MSS SP-61-1999

Pressure Testing Of Steel Valves

Standard Practice
Developed and Approved by the
Manufacturers Standardization Society of the
Valve and Fittings Industry, Inc.
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MSS

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Unless otherwise specifically noted in this MSS SP, any standard referred to herein is identified by the date of issue that was applicable to the referenced standard(s) at the date of issue of this MSS SP. (See Annex A.)

In this Standard Practice all notes, annexes, tables, and figures are construed to be essential to the understanding of the message of the standard, and are considered part of the text unless noted as "supplemental". All appendices appearing in this document are construed as "supplemental". "Supplemental" information does not include mandatory requirements.

U.S. customary units in this SP are the standard; the metric units are for reference only.

Substantive changes in this 1999 edition are "flagged" by parallel bars as shown on the margins of this paragraph. The specific detail of the change may be determined by comparing the material flagged with that in the previous edition.

Non-toleranced Dimensions in this Standard Practice are nominal, and, unless otherwise specified, shall be considered "for reference only."

Originally Approved February, 1961

FOREWORD

The MSS SP-61 Standard for Pressure Testing of Steel Valves was originally adopted in 1961. It was developed for the purpose of providing a uniform means of testing steel valves commonly used in the "full open" and "full closed" type of service. It is not intended for use with control valves. Refer to standards ISA-S75.19-1995 and ANSI/FCI 70-2-1991 for Control Valves.

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PRESSURE TESTING OF STEEL VALVES

1. SCOPE

This Standard Practice covers requirements and acceptance criteria for shell and seat closure pressure testing of steel valves.

2. DEFINITIONS

2.1 Production Pressure Test:
Pressure tests which include closure member and shell tests performed on production units manufactured for sale to verify the pressure containing capability of production units.

2.2 Shell Test:
An internal pressure test of the pressure containing envelope to demonstrate pressure containing capability of the external pressure boundary .

2.3 Seat and Closure Member Test:
An internal pressure test of flow regulating elements (seats, seals and closure member such as gate, disc, ball or plug). To demonstrate static performance within allowable leakage tolerances.

2.4 No Visible Leakage:

2.4.1 The term "no visible leakage" applied to a hydrostatic test liquid is defined as a leak rate which will produce no visible weeping or formation of drops at the test pressure and for the duration of test.

2.4.2 The term "no visible leakage" applied to air or gas testing is defined as a leak rate which will produce no visible formation of bubbles in a water immersion test or after application of leak detection fluid at the test pressure and for the duration of test.

2.4.3 For automatic leak detection methods, this definition shall be considered equivalent to a leak rate no greater then 4.1 x 10^{-5} in^3/sec[(1)] (6.7 x 10^{-4} ml/sec) with a pressure differential of 80 to 100 psi (5.5 to 6.9 bar) for application to valves of 8NPS (DN 200) and smaller.

(1) This leakage rate is based on the measured leakage of nitrogen gas from a needle valve with a 0.167" O.D. x 0.091" I.D. tube discharged submerged in water to a depth of 1". The tube end was cut square and smooth with no chamfers or burrs and the tube axis was parallel to the surface of the water. Leakage was adjusted to a level equal to 40 bubbles in 10 minutes at 90 psi. The 40 bubbles equaled 1.6 ml or, 1 bubble = 0.04 SCC. Using these data, a leak rate equivalent to 1 bubble every minute is found to be 4.1 x 10^{-5} in^3/sec (6.7 x 10^{-4} ml/sec).

3. GENERAL REQUIREMENTS

3.1 The manufacturer shall be responsible for the performance of tests specified herein.

3.2 Fluid for shell and seat closure tests shall be air, inert gas, or liquid, such as water (which may contain a corrosion inhibitor), kerosene, or other fluid with viscosity not greater than that of water. Temperature of the test fluid shall not exceed 125 °F (52 °C).

3.3 Valves shall be substantially relieved of air or gas when tested with liquid.

3.4 Seat closure tests for NPS 4 (DN 100) and larger valves shall be conducted after an acceptable shell test. Seat closure tests for smaller valves may be conducted before or after the shell test at the manufacturer's option. However, when valves conform to ASME B16.34, the requirements of paragraph 7.2 of ASME B16.34 shall apply.

3.5 Valves shall be shell tested prior to painting Corrosion protection treatment such as phosphatizing and linings may be applied prior to shell testing. If pressure tests in the presence of purchaser's representative are specified, valves that were painted following successful pressure testing may be retested without removal of paint.

3.6 Valve test fixture loads applied to valve ends shall be limited to those required to effectively seal the valve ends.

3.7 Leakage detection devices, e.g. pressure decay devices, may be used for detecting leakage provided that they perform at the pressures specified in paragraphs 4 and 5. The valve manufacture shall be able to demonstrate that, when these devices are used, the test results are equivalent to the requirements of this Standard Practice.

4. SHELL TESTS

4.1 Each valve shall be given a shell test at a gage pressure no less than 1.5 times the 100 °F (38 °C). rating, rounded off to the next higher 25 psi (1 bar) increment.

4.2 Shell tests shall be conducted with the valve in the partially open position and with the valve ends closed. Pressure retaining parts of valves may be tested separately when the valves have internal components, such as diaphragms in diaphragm valves, which are not designed to withstand required shell test pressures. The manufacturer's nameplate data shall contain reference to this limitation.

4.3 Visually detectable leakage through the pressure boundary walls is not acceptable. Stem seal leakage during shell test shall not be cause for rejection. Stem seals shall be capable of retaining pressure at least equal to the 100 °F (38 °C) rating without visible leakage.

4.4 The duration of the shell test shall be not less than shown below:

VALVE SIZE		TEST TIME
NPS	DN	(SECONDS)
2 and Smaller	50 and Smaller	15
21/2 - 8	65 - 200	60
10 and Larger	250 and Larger	180

5. SEAT CLOSURE TESTS

5.1 Each valve designed for shutoff or isolation service, such as stop valves and check valves, shall be given a fluid seat closure tightness test.

5.1.1 The seat closure test shall be performed at a fluid (liquid or gas) pressure no less than 1.1 times the 100 °F (38 °C) rating rounded to the next 5 psi (0.5 bar). At the manufacturer's option, a gas pressure of no less than 80 psi (5.6 bar) may be substituted for the valve sizes and pressure classes listed in Table 1

TABLE 1 - ALTERNATE GAS TEST

Valve Size	Pressure Class
NPS (DN)	CLASS (PN)
12 (300) and Smaller	400 (70) and Lower
4 (100) and Smaller	All

5.1.2 Seat closure testing shall be performed with seat surfaces free of materials that aid in sealing except as provided for in 5.1.3 and 5.1.4

5.1.3 When necessary to prevent damage during valve actuation, a light oil of viscosity no greater than that of kerosene may be applied to seating surfaces.

5.1.4 When valve primary seat design is based on the presence of a sealant material, e.g. lubricated plug valves, the sealant material may be in place. When it is intended that sealants act as secondary or back-up seat seals, the sealant material shall not be in place during the closure test.

5.1.5 When lubricants are used for assembly operations, it is not required that these be removed prior to testing if their presence has no influence on the test results.

5.2 For valves of the double seating type such as many gate, plug, and ball valves, the test pressure shall be applied successively to each end of the closed valve and leakage to the opposite end checked.

5.2.1 As alternate methods for valves with independent double seating (such as double disc or split wedge gate valves), at the option of the manufacturer, the pressure may be applied inside the bonnet (or body) of the closed valve and each seat checked for leakage at the valve ports, or the pressure may be applied to the valve ports and the sum of seat leakage checked at the bonnet (or body). These alternate methods may be used at option of the manufacturer for valves with single discs (such as solid or flexible wedge gate valves) provided a supplementary closure member test across the disc is performed.

5.3 For other valve types, the test pressure shall be applied across the closure member in the direction producing the most adverse seating condition. For example, a globe valve shall be tested with pressure under the disc. A check valve, or other valve type designed, sold and marked as a one-way valve, requires a closure test only in the appropriate direction. A stop check valve requires both tests.

5.4 Valves conforming to this standard in all respects, except that they are designed for operating conditions that have pressure differential across the closure member limited to values less than the 100 °F (38 °C) pressure rating and having closure members and/or actuating devices (direct, mechanical, fluid, or electrical) that would be subject to damage at high differential pressures, shall be tested as described above except that the closure test requirement may be reduced to 1.1 times the maximum specified closed position differential pressure. This exception may be exercised upon agreement between the user and manufacturer. The manufacturer's name plate data shall include reference to any such limitations.

5.5 Valves of single or symmetrical seat design, capable of seating in two directions, e.g., butterfly or weir type diaphragm valves, require seat testing in only one direction.

5.6 Butterfly valves of the offset stem-seat design may be closure tested in only one direction. The manufacturer shall be able to demonstrate that the direction selected is that least likely to attain effective tightness.

5.7 Allowable leakage rates, except for the conditions of 5.7.2 and 5.7.3 shall be as in 5.7.1.

5.7.1 The maximum sllowable leakage of each seat closure shall be 10 ml/hr of liquid or 0.1 standard cu ft/hr of gas per unit of NPS (0.4 ml/hr of liquid or 120 standard ml/hr of gas per unit of DN) under the specified test condition.

5.7.2 In the case of valves having pressure or flow reversal actuated closure, e.g., check valves, the permissible leakage rate may be increased by a factor of 4.

5.7.3 In the case of valves having a seat closure member that uses a compliant material, e.g., plastic or elastomer, for fluid sealing at closure, there shall be no visible leakage for the duration of the seat test.

5.8 The duration of each seat closure test shall not be less than shown below:

VALVE SIZE		TEST TIME
NPS	DN	(SECONDS)
2 and Smaller	50 and Smaller	15
21/2 - 8	65 - 200	30
10-18	250-450	60
20 and Larger	500 and Larger	120

ANNEX A
REFERENCE STANDARDS AND APPLICABLE DATES

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

Standard Name or Designation

ASME, ANSI/ASME, ANSI, ASME/ANSI

B16.34-1996	Valves - Flanged, Threaded and Welding End

FCI

70-2-1991	Quality Control Standard for Control Valve Seat Leakage

ISA

S75.19-1995	Hydrostatic Testing of Control/Valves

Publications of the following organizations appear in the above list.

ANSI	American National Standard Institute, Inc. 11 West 42nd Street, 13th Floor, New York, NY 10036
ASME	The American Society of Mechanical Engineers 3 Park Ave, New York, NY, 10016-5990
ISA	International Society for Measurement and Control 67 Alexander Drive, Research Triangle Park, NC 27709
FCI	Fluid Controls Institute 31 South Street Morristown, NJ 07914

List of MSS Standard Practices
(Price List Available Upon Request)

Number	
SP-6-1996	Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings
SP-9-1997	Spot Facing for Bronze, Iron and Steel Flanges
SP-25-1998	Standard Marking System For Valves, Fittings, Flanges and Unions
SP-42-1999	(R 95) Class 150 Corrosion Resistant Gate, Glove, Angle and Check Valves with Flanged and Butt Weld Ends
SP-43-1991	(R 96) Wrought Stainless Steel Butt-Welding Fittings
SP-44-1996	Steel Pipeline Flanges
SP-45-1998	Bypass and Drain Connections
SP-51-1991	(R 95) Class 150LW Corrosion Resistant Cast Flanges and Flanged Fittings
SP-53-1999	Quality Standard for Steel Castings and Forgings for Valves, Flanges and Fittings and Other Piping Components - Magnetic Particle Examination Method
SP-54-1999	Quality Standard for Steel Castings for Valves, Flanges, and Fittings and Other Piping Components - Radiographic Examination Method
SP-55-1996	Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components - Visual Method for Eval. of Surface Irregularities
SP-58-1993	Pipe Hangers and Supports - Materials, Design and Manufacture
SP-60-1999	Connecting Flange Joint Between Tapping Sleeves and Tapping Valves
SP-61-1999	Pressure Testing of Steel Valves
SP-65-1999	High Pressure Chemical Industry Flanges and Threaded Stubs for Use with Lens Gaskets
SP-67-1995	Butterfly Valves
SP-68-1997	High Pressure Butterfly Valves with Offset Design
SP-69-1996	Pipe Hangers and Supports - Selection and Application
SP-70-1998	Cast Iron Gate Valves, Flanged and Threaded Ends
SP-71-1997	Gray Iron Swing Check Valves, Flanged and Threaded Ends
SP-72-1999	Ball Valves with Flanged or Butt-Welding Ends for General Service
SP-73-1991	(R 96) Brazing Joints for Wrought and Cast Copper Alloy Solder Joint Pressure Fittings
SP-75-1998	Specification for High Test Wrought Butt Welding Fittings
SP-77-1995	Guidelines for Pipe Support Contractual Relationships
SP-78-1998	(R 92) Cast Iron Plug Valves, Flanged and Threaded Ends
SP-79-1999a	Socket-Welding Reducer Inserts
SP-80-1997	Bronze Gate, Globe, Angle and Check Valves
SP-81-1995	Stainless Steel, Bonnetless, Flanged, Knife Gate Valves
SP-82-1992	Valve Pressure Testing Methods
SP-83-1995	Class 3000 Steel Pipe Unions, Socket-Welding and Threaded
SP-85-1994	Cast Iron Globe & Angle Valves, Flanged and Threaded Ends
SP-86-1997	Guidelines for Metric Data in Standards for Valves, Flanges, Fittings and Actuators
SP-87-1991	(R 96) Factory-Made Butt-Welding Fittings for Class 1 Nuclear Piping Applications
SP-88-1993	Diaphragm Type Valves
SP-89-1998	Pipe Hangers and Supports - Fabrication and Installation Practices
SP-90-1986	(R 91) Guidelines on Terminology for Pipe Hangers and Supports
SP-91-1992	(R 96) Guidelines for Manual Operation of Valves
SP-92-1999	(R 92) MSS Valve User Guide
SP-93-1999	(R 92) Quality Standard for Steel Castings and Forgings for Valves, Flanges, and Fittings and Other Piping Components - Liquid Penetrant Examination Method
SP-94-1999	Quality Std for Ferritic and Martensitic Steel Castings for Valves, Flanges, and Fittings and Other Piping Components - Ultrasonic Examination Method
SP-95-1999	(R 91) Swage (d) Nipples and Bull Plugs
SP-96-1996	Guidelines on Terminology for Valves and Fittings
SP-97-1995	Integrally Reinforced Forged Branch Outlet Fittings - Socket Welding, Threaded and Buttwelding Ends
SP-98-1996	Protective Coatings for the Interior of Valves, Hydrants, and Fittings
SP-99-1994	Instrument Valves
SP-100-1997	Qualification Requirements for Elastomer Diaphragms for Nuclear Service Diaphragm Type Valves
SP-101-1989	Part-Turn Valve Actuator Attachment - Flange and Driving Component Dimensions and Performance Characteristics
SP-102-1989	Multi-Turn Valve Actuator Attachment - Flange and Driving Component Dimensions and Performance Characteristics
SP-103-1995	Wrought Copper and Copper Alloy Insert Fittings for Polybutylene Systems
SP-104-1995	Wrought Copper Solder Joint Pressure Fittings
SP-105-1996	Instrument Valves for Code Applications
SP-106-1990	(R 96) Cast Copper Alloy Flanges and Flanged Fittings, Class 125, 150 and 300
SP-107-1991	Transition Union Fittings for Joining Metal and Plastic Products
SP-108-1996	Resilient-Seated Cast Iron-Eccentric Plug Valves
SP-109-1996	Welded Fabricated Copper Solder Joint Pressure Fittings
SP-110-1996	Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
SP-111-1996	Gray-Iron and Ductile-Iron Tapping Sleeves
SP-112-1999	Quality Standard for Evaluation of Cast Surface Finishes - Visual and Tactile Method. This SP must be sold with a 10-surface, three-dimensional Cast Surface Comparator, which is a necessary part of the Standard. Additional Comparators may be sold separately at $19.00 each. Same quantity discounts apply on total order.
SP-113-1999	Connecting Joint between Tapping Machines and Tapping Valves
SP-114-1995	Corrosion Resistant Pipe Fittings Threaded and Socket Welding, Class 150 and 1000
SP-115-1999	Excess Flow Valves for Natural Gas Service
SP-116-1996	Service Line Valves and Fittings for Drinking Water Systems
SP-117-1996	Bellows Seals for Globe and Gate Valves
SP-118-1996	Compact Steel Globe & Check Valves - Flanged, Flangeless, Threaded & Welding Ends (Chemical & Petroleum Refinery Service)
SP-119-1996	Belled End Socket Welding Fittings, Stainless Steel and Copper Nickel
SP-120-1997	Flexible Graphite Packing System for Rising Stem Steel Valves (Design Requirements)
SP-121-1997	Qualification Testing Methods for Stem Packing for Rising Stem Steel Valves
SP-122-1997	Plastic Industrial Ball Valves
SP-123-1998	Non-Ferrous Threaded and Solder-Joint Unions for Use With Copper Water Tube

(R-YEAR) Indicates year standard reaffirmed without substantive changes

A large number of former MSS Practices have been approved by the ANSI or ANSI Standards, published by others. In order to maintain a single source of authoritative information, the MSS withdraws its Standard Practices in such cases.

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