MSS SP-72

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MSS SP-72-1999

Ball Valves with Flanged or Butt-Welding Ends for General Service

Standard Practice
Developed and Approved by the
Manufacturers Standardization Society of the
Valve and Fittings Industry, Inc.
127 Park Street, N.E.
Vienna, Virginia 22180
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MSS

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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.

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

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.)

Originally Approved February, 1970

FOREWORD

The 1999 Edition of MSS SP-72 has been updated from the 1992 Edition by revising material names in Section 1.4, 2.1.5., 2.1.6, and 4.1. Metric data (DN) and (PN) was added to Section 1.3, 3.1.1, 5.2.2.1, 7.1.3, 7.1.4, 7.2.2, 7.2.3, and Table 1. The formulas in paragraph 7.1.4 and 7.2.2 have been revised to agree with MSS I.S. 9 format. The reference to NPS was corrected in all applicable paragraphs. Annex A listing all referenced documents has been added.

CONTENTS

BALL VALVES WITH FLANGED OR BUTT-WELDING ENDS FOR GENERAL SERVICE

1. SCOPE

1.1 This Standard Practice covers flanged or butt-weld end ball valves having in general, but not restricted to, round openings which may be full port, regular port, or reduced port types. The following characteristics shall be considered standard practice unless otherwise specified by agreement between manufacturer and purchaser.

1.2 Valves covered by this Standard Practice are suitable for use in general liquid and gas service. Their service pressures and temperatures generally conform to standards cited in Paragraph 2, but may be restricted by the materials used for their seats and seals, or by other special considerations.

1.3 The size range covered by this Standard Practice is NPS 1/2 (DN 15) through NPS 36 (DN 900).

1.4 This Standard Practice covers ball valves of the following materials:

carbon steel
alloy steels
stainless steels
ductile iron
gray iron
copper alloy

1.5 Names of common valve body types are given in Figure 1. When variations or other body types are used, they may be named by the manufacturer. The names of basic valve parts are given in Figure 2. Other parts may be named by the manufacturer. Body types and valve parts may also be identified by applicable MSS or other terminology standards.

2. SERVICE PRESSURE RATINGS

2.1 The pressure-temperature rating of flanged and butt-welding end ball valves shall conform to those set forth in the Standards listed below, except as they are limited by their seat and seal materials.

2.1.1	Carbon Steel	ASME B16.5-1996 & ASME B16.34-1996
2.1.2	Alloy Steel	ASME B16.5-1996 & ASME B16.34-1996
2.1.3	Stainless Steel	ASME B16.5-1996 & ASME B16.34-1996
2.1.4	Ductile Iron	ASME B16.42-1987
2.1.5	Gray Iron	ASME B16.1-1989
2.1.6	Copper Alloy	ASME B16.24-1991

2.2 Cold Working Pressure (CWP). The cold working pressure rating of the valve shell and components is the rated pressure at 100° F (38° C) for carbon steel, alloy steel, stainless steel, and ductile iron, and 150° F (66° C) for copper alloy. The maximum working pressure at any other temperature shall not exceed this rated pressure.

3. VALVE PORT SIZES

3.1 Ball valves may be furnished as either full port, regular port or reduced port.

3.1.1 Full Port valves are defined as having minimum bore diameters as specified in Annex A of ASME B16.34 for valves up to NPS 30 (DN 750). A tolerance of -.06 inches (1.52 mm) is allowed on NPS 12 (DN 300) and smaller valves. A tolerance of -0.12 inches (3.05 mm) is allowed on NPS 14 (DN 350) and larger valves. Oversize tolerance is not specified. For valves above NPS 30 (DN 750), bore diameter shall be as agreed upon between purchaser and manufacturer.

3.1.2 Regular port and reduced port valves have bore diameters smaller than full bore and shall be as listed in Table 1.

4. MATERIALS

4.1 Valve Shell Parts and Bolting – The valve shell parts are defined as those which contain pressure within the piping but do not include the ball, seats, seals, and other parts. This standard covers only pressure retention bolting. Mechanical connections and bolting for end flanges are not included.

Recommended materials for valve shell parts and bolting are those which are in conformance to the specifications listed in 2.1.1 through 2.1.6. When alternate materials are used, the manufacturer shall

be prepared to certify, based on documentation from producer or recognized distributor of these alternate materials, that the products are at least equally suitable for the intended use.

4.2 Other Parts – Parts such as stems, glands, gland bushings, balls, handwheels, gearing and motor drive, and seats or seals, shall be of materials suitable for the service. Non-metallic seats or seals, when employed, shall be designed by the manufacturer with suitable material selected for compatibility with the temperature, pressure and line fluids for which the valves are recommended.

5. DESIGN

5.1 The design of the valve shell be such as to provide against any detrimental distortion under hydrostatic test conditions, assembly stresses, closing stresses, pipe reaction stresses or when rated pressure is applied across a closed valve.

5.2 End Connections and End Preparation

5.2.1 End flange dimensions shall conform to those set forth in the applicable standards listed in Par. 2.1.1 to 2.1.6, or MSS SP-44.

5.2.2 Butt Welding Ends

5.2.2.1 Sizes NPS 6 (DN 150) and smaller of carbon steel, Class 150 through 900 (PN 20 through 150)
Unless otherwise specified, butt-welding ends shall conform to ASME B16.34 and valve ends shall be bored to match Schedule 40 Pipe for Class 150 and 300 (PN 20 and 50), and Schedule 80 Pipe for Class 400 through 900 (PN 68 through 150).

5.2.2.2 Sizes NPS 2 and smaller of stainless steel, Class 150 and 300 (PN 20 and 50)
Unless otherwise specified, butt-welding ends shall be bored to match Schedule 10S Pipe.

5.2.2.3 For all other butt welding end valves covered by this Standard Practice, the purchaser shall specify the bore of the valve ends. Unless otherwise specified by the purchaser, the welding end preparation shall be optional with the manufacturer.

5.3 Valve Length

5.3.1. Face-to-Face dimensions of flanged ball valves shall conform to ASME B16.10 (Note Full port or top opening valves may not be available within the short pattern lengths shown in ASME B16.10. These valves may have face-to-face dimensions as agreed upon by the purchaser and manufacturer.)

5.3.2 End-to-end dimensions of butt-welding end ball valves shall conform to ASME B16.10, or such other dimensions as shall be agreed upon by the purchaser and manufacturer.

5.4 Auxiliary Connections

5.4.1 When connections are provided, they shall be in accordance with ASME B16.34. The number and location shall be optional with the manufacturer or by agreement between the manufacturer and the purchaser.

5.5 Operation – Valves shall be furnished with a means of operation, such as a lever or actuator, adequately sized to actuate the valve with reasonable effort by the operator under the rated working pressure.

5.6 Position Indication – Stems, stem extensions, adapters and actuators shall be provided with positive means for indicating port position.

6. MARKING

6.1 Ball valves shall be marked in accordance with MSS SP-25.

7. TESTING

7.1 Shell Test

7.1.1 Ball valves shall be given a hydrostatic shell test at 1-1/2 times the rated cold working pressure of the valve.

7.1.2 The ball shall be partially open during the shell test unless other means are provided for assuring equalization of pressure throughout the shell.

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

Valve Size		Test Time
NPS	DN	Seconds
2 and smaller	50 and smaller	15
2-1/2 - 8	65 - 200	60
10 and larger	250 and larger	120

Time duration is the period of inspection after the valve is fully prepared and under test pressure.

7.1.4 For valves of Class 150 (PN 20) and Class 300 (PN 50), in sizes NPS 3 (DN 80) and smaller, a minimum of 80 psig (6 Bar) gas test with a minimum 15 second duration may be substituted. However, if this option is exercised, the manufacturer shall be able to certify that a production sample of the size valve so-tested was subjected to a hydrostatic shell test of F times cold working pressure of valve

where

$F = 2\ [AYS^1/MYS^1]$
or
$F = 2\ [AYS^2/MYS^2]$
or
$F = 2\ [AYS^3/MYS^3]$

whichever is larger, with no detrimental distortion

and where

AYS^1 = Actual Yield Strength of Body
MYS^1 = Minimum Specified Yield Strength of Bonnet
AYS^2 = Average Yield Strength of Bonnet
MYS^2 = Minimum Specified Yield Strength of Bonnet
AYS^3 = Average Yield Strength of Bonnet Bolting
MYS^3 = Minimum Specified Yield Strength of Bonnet Bolting.

7.1.5 Visually detectable leakage through pressure boundary walls is not acceptable. Leakage through the stem packing shell not be cause for rejection. The stem packing shall be capable of retaining pressure at least equal to the rated cold working pressure of the valve without visible leakage.

7.2 Seat Tests

7.2.1 Ball valves shall be given a seat test in a manner which will test the tightness of the seat in the direction of flow as indicted on the valve, or in both directions, when flow direction is not indicated on valve. The method of seat leakage testing on each seat shall be such that no seat leakage can escape detection because of gradual pressurization or filling of cavity between two seats. Also the method of testing shall apply the pressure differential on the tested seat in the same direction as pressure is applied on this seat in service.

7.2.2 Ball valves shall be given a hydrostatic seat test at the rated cold working pressure of the valve. On valves NPS 12 (DN 300) and smaller, an 80 psig (6 Bar) gas seat test may be substituted for the hydrostatic seat test. However, if this option is exercised, the manufacture shall be able to certify that a production sample of the size so tested was subjected to a hydrostatic seat test of F times cold working pressure of valve.

where

$F = 2\ [AYS^4/MYS^4]$
or
$F = 2\ [AYS^5/MYS^5]$
or
$F = 2\ [AYS^6/MYS^6]$

whichever is larger, with no detrimental distortion of ball, stem, or trunnion

and where

AYS^4 = Actual Yield Strength of Ball
MYS^4 = Minimum Specified Yield Strength of Ball
AYS^5 = Average Yield Strength of Stem
MYS^5 = Minimum Specified Yield Strength of Stem
AYS^6 = Average Yield Strength of Trunnion
MYS^6 = Minimum Specified Yield Strength of Trunnion.

At the manufacturer's option, as an alternate method for the 80 psig (6 Bar) gas test, the pressure may be applied inside the body cavity with the ball closed and both sides open for inspection.

7.2.3 The duration of the seat test shall not be less than shown below.

Valve Size		Test Time
NPS	DN	Seconds
2 and smaller	50 and smaller	15
2-1/2 - 8	65 - 200	30
10 - 18	250 - 450	60
20 - 36	500 - 900	120

Time duration is the period of inspection after the valve is fully prepared and under test pressure.

7.2.4 There shall be no visible leakage, as defined by MSS SP-82, past the seat for the duration of the test for valve with resilient (polymeric or elastomeric) seats.

7.2.5 The maximum allowable leakage rate on each seat or nonresilient seated, except metal-seated, valves for the duration of the test shall be 2/10 of a standard cubic foot of gas per hour (6 liters per hour) per inch of nominal valve size or a maximum of 1.22 cubic inches (20 ml per hour) of hydrostatic media per hour per inch of nominal valve size, at the test pressure specified in 7.2.2.

7.2.6 The maximum allowable leakage rate on each seat of metal-seated valves for the duration of the test shall be 4/10 of a standard cubic foot of gas per hour (12 liters per hour) per inch of nominal valve size, or a maximum of 2.44 cubic inches (40 ml per hour) of hydrostatic test media per hour per inch of nominal valve size at the test pressure specified in 7.2.2.

7.2.7 When volumetric loss testing devices are used, the valve manufacturer must demonstrate that leakage sensitivity of the device produces results that are equivalent to or better than those which are acceptable when visual examination methods showing no leakage are employed.

7.3 System Hydrostatic Tests – If valves conforming to this standard practice are subject to hydrostatic testing of systems with the valve in the closed position at a pressure greater than the CWP rating, such testing shall be the responsibility of the user.

TABLE 1

PORT SIZES FOR LESS THAN FULL PORT BALL VALVES

Valve Size		COLUMN A Regular Port		COLUMN B Reduced Port	
NPS	DN	Inches	(mm)	Inches	(mm)
1/2	15	0.31	(7.9)	0.31	(7.9)
3/4	20	0.49	(12.4)	0.49	(12.4)
1	25	0.75	(19.0)	0.62	(15.7)
1 1/4	32	0.93	(23.6)	0.80	(20.3)
1 1/2	40	1.12	(28.4)	0.97	(24.6)
2	50	1.50	(38.1)	1.18	(30.0)
3	80	2.25	(57.1)	1.80	(45.7)
4	100	3.00	(76.2)	2.50	(63.5)
6	150	4.00	(101.6)	3.00	(76.2)
8	200	6.00	(152.4)	4.00	(101.6)
10	250	7.37	(187.2)	6.00	(152.4)
12	300	9.00	(228.6)	8.00	(203.2)
14	350	10.50	(266.7)	8.62	(218.9)
16	400	12.00	(304.8)	10.00	(254.0)
18	450	13.25	(336.6)	11.25	(285.7)
20	500	15.25	(387.3)	12.50	(317.5)
22	550	17.25	(438.1)	14.00	(355.6)
24	600	19.25	(488.9)	15.25	(387.3)

For valves above NPS 24 (DN 600) up to NPS 36 (DN 900), port size shall be as agreed upon between purchaser and manufacturer

Tolerance = -0.06 (1.52 mm) for NPS 12 (DN 300) and smaller.

= -0.12 (3.05 mm) for NPS 14 (DN 350) and larger.

Oversize tolerances not specified.

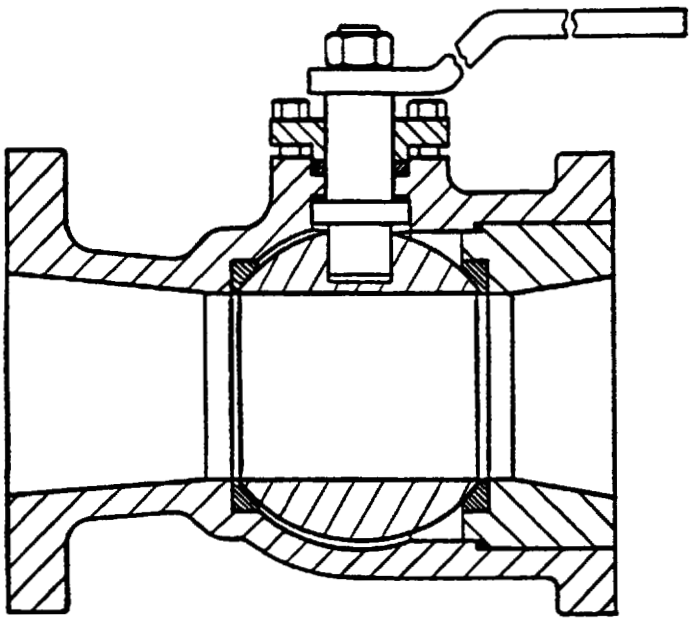


FIGURE 1A — ONE PIECE BODY

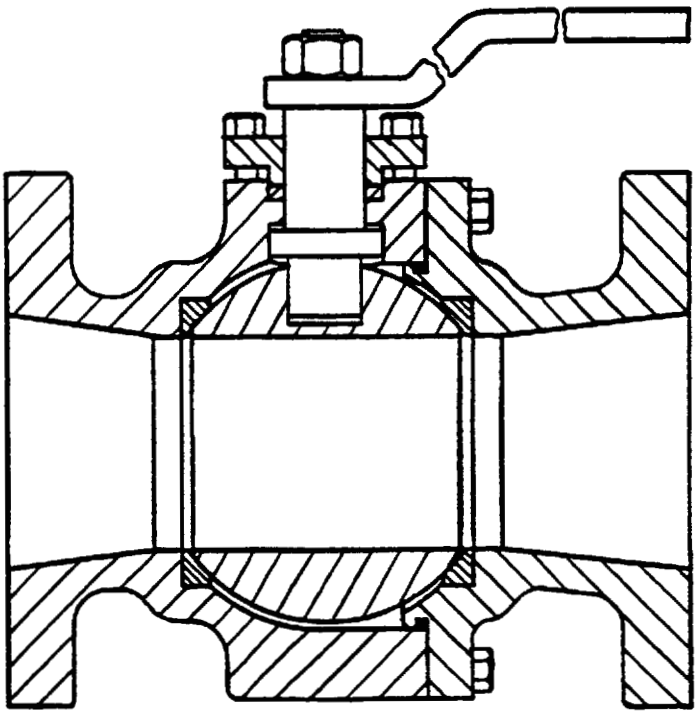


FIGURE 1B — SPLIT BODY

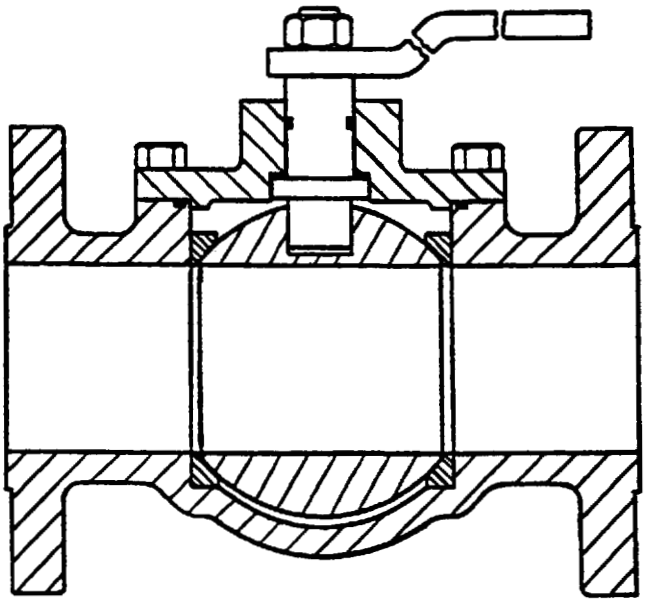


FIGURE 1C — TOP ENTRY

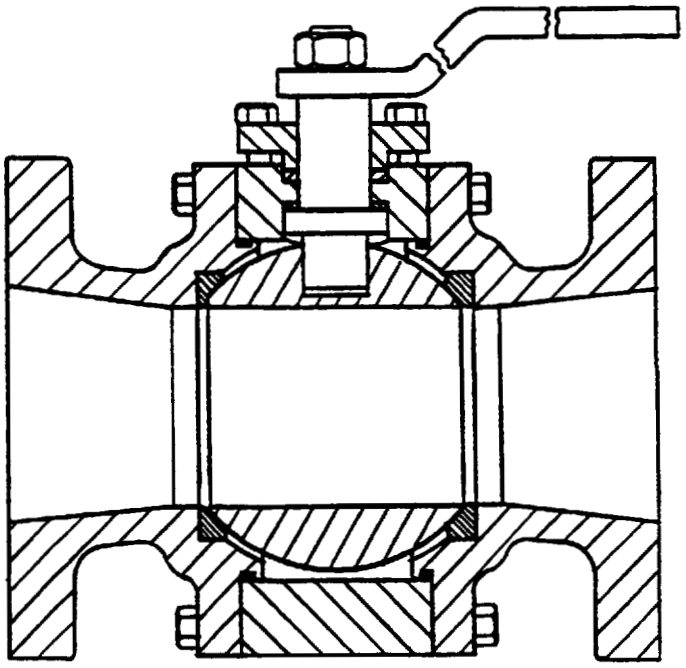
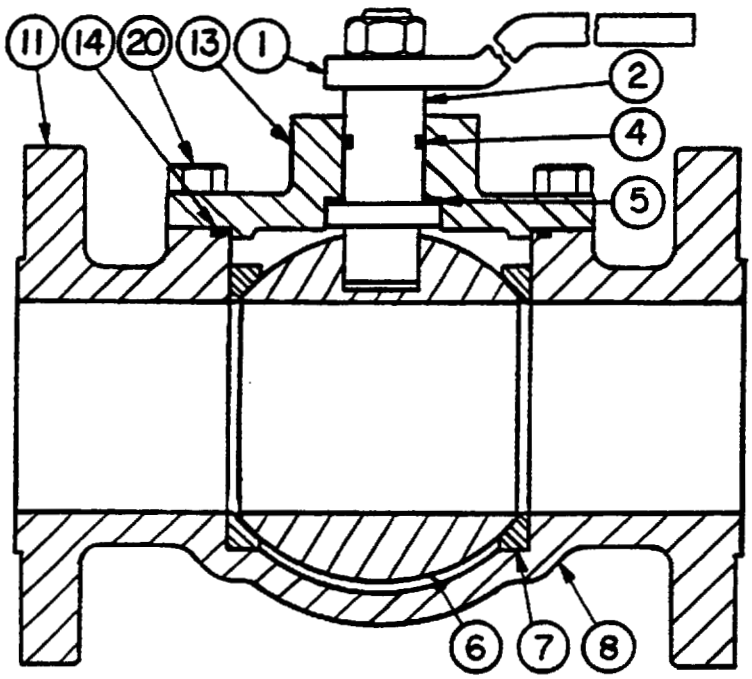


FIGURE 1D — THREE PIECE BODY

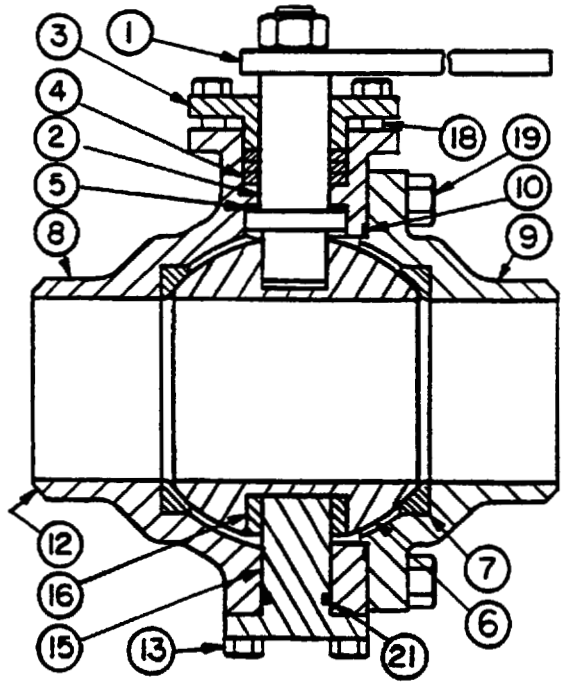
FIGURE 1 — EXAMPLES OF BODY CONSTRUCTION

These illustrations are not intended to limit design, nor to indicate any preferred design.

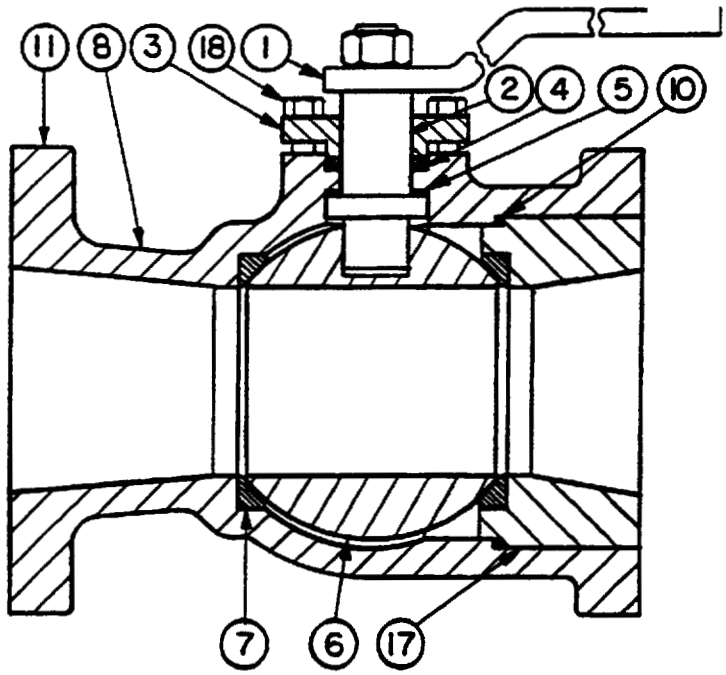


TOP ENTRY FLANGED CONNECTIONS

1. HANDLE
2. STEM
3. GLAND
4. STEM SEAL
5. THRUST WASHER
6. BALL
7. SEAT
8. BODY
9. BODY END
10. BODY SEAL
11. FLANGED CONNECTION
12. BUTT WELD CONNECTION
13. BONNET
14. BONNET SEAL
15. TRUNNION
16. TRUNNION BUSHING
17. BODY INSERT
18. GLAND OR BONNET BOLTING
19. BODY BOLTING
20. BONNET BOLTING
21. TRUNNION SEAL



SPLIT BODY BUTT WELD CONNECTIONS



ONE PIECE BODY FLANGED CONNECTIONS

FIGURE 2 — NOMENCLATURE FOR BALL VALVE PARTS, TYPICAL Basic valve parts have been named. These illustrations are not intended to limit design nor to indicate any preferred design.

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 Publications

ASME B16.1 - 1998	Cat Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
ASME B16.5 - 1996 (A 1998)	Pipe Flanges and Flanged Fittings
ASME B16.10 - 1992	Face-to-Face and End-to-End Dimensions of Valves
ASME B16.24 - 1991 (R 1998)	Cast Copper Alloy Pipe Flanges and Flanged Fittings
ASME B16.34 - 1996 (A 1998)	Valves - Flanged, Threaded, and Welding End
ASME B16.42 - 1998	Ductile Iron Pipe Flanges and Flanged Fittings

MSS Publication

MSS SP - 25 - 1998	Standard Marking System for Valves, Fittings, Flanges, and Unions
MSS SP - 44 - 1996	Steel Pipeline Flanges
MSS SP - 82 - 1992	Valve Pressure Testing Methods

Publications of the following organizations appear on the above list:

ASME	The American Society of Mechanical Engineer Three Park Avenue, New York, NY 10016-5990
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. 127 Park Street, N.E., Vienna, VA 22180

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-53-1995	Quality Standard for Steel Castings and Forgings for Valves, Flanges and Fittings and Other Piping Components - Magnetic Particle Examination Method
SP-54-1995	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-61-1992	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-79-1999	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-92-1987	(R 92) MSS Valve User Guide
SP-93-1987	(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-112-1993	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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