

Bypass and Drain Connections

Standard Practice
Developed and Approved by the
Manufacturers Standardization Society of the
Valve and Fittings Industry, Inc.
127 Park Street, NE
Vienna, Virginia 22180
Phone: (703) 281-6613
Fax: (703) 281-6671
e-mail: info@mss.hq.com



www.mss-hq.com

This MSS Standard Practice was developed under the consensus of the MSS Technical Committee 106 and the MSS Coordinating Committee. The content of this Standard Practice is the result of the efforts of competent and concerned volunteers to provide an effective, clear, and non-exclusive specification that will benefit the industry as a whole. This MSS Standard Practice is intended as a basis for common practice by the manufacturer, the user, and the general public. The existence of an MSS Standard Practice does not in itself preclude the manufacture, sale, or use of products not conforming to the Standard Practice. Mandatory conformance is established only by reference in a code, specification, sales contract, or public law, as applicable.

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

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.

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

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FOREWARD

The 1953 edition of MSS SP-45-1953 Bypass and Drain Connection Standard Practice was a combination of two former MSS Standard Practices; MSS SP-5-1944 By-Pass Size Standard Practice and MSS-SP-28-1943 Drain Tapping Standard Practice. As the subject matter of these two Standard Practices is so closely related they were combined as a convenience to the user.

MSS SP-5 was originally adopted in 1924 and applied to steel gate valves only. Bosses on steel castings of that period presented a more complex problem than castings of other metals and the diversification of requests in regard to size, location, and number of bosses on the part of users prompted the MSS to initiate a standardization program on the subject. The original Standard Practice established the number of bosses, minimum O.D. of boss, and the pipe thread size for steel gate valves in sizes 3 to 24 inch inclusive. The bosses were intended to be used for both bypass and drain connections.

In 1937 a new edition of SP-5 was adopted. This edition was greatly expanded over the original and included both cast iron and steel valves in the gate, globe and angle patterns. The subject matter was confined to by-passes only and standard locations were established for the bypass on each type of valve. Two sets of bypass sizes were established; one for the purpose of warming up main lines before opening the main valve and one for the purpose of balancing the pressure on both sides of the main valve to facilitate its operation. The edition has been reaffirmed periodically up to the promulgation of the new MSS SP-45.

MSS SP-28 was originally adopted in 1937 and was also prompted by the variety of user requests for connections on valves and fittings at odd locations and varying sizes, with and without bosses. SP-28 established standard drain sizes for each size valve and fitting, standard maximum sizes for unbossed tappings and standard locations with standard symbols to designate the location. MSS SP-28 was revised in 1945 at which time a standard method of designating openings of reducing fittings was added. This Standard Practice was also periodically reaffirmed.

The 1953 edition of MSS SP-45 combined these two Standard Practices so that the user has all information pertaining to bypass and drain connections in a single document. In this edition the newer methods of making attachments, such as butt-weld have been recognized.

The 1971 edition expanded the coverage of the document by including coverage of ball valves. In preparing this edition, the entire Standard Practice was reviewed and up-dated to keep pace with the expanding technology.

The 1976 edition expanded the coverage of the bypass sizes to include valves through NPS 48 and the document has been metricized.

The 1982 edition expanded the coverage of the document to include plug valves.

The 1987 edition was a reaffirmation of the 1982 edition with no substantive change.

The 1992 edition changed the title, removed metric units, and made several editorial changes.

The 1998 edition added metric units and made several editorial and format changes.

The 2003 edition was issued with only editorial changes.

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1 SCOPE.....	1
2 LOCATION AND SYMBOLS.....	1
3 STANDARD DRAIN SIZES.....	1
4 STANDARD BYPASS SIZES.....	1
5 BYPASS LOCATIONS.....	2
6 DRAIN & BYPASS CONNECTION DIMENSIONS.....	3
7 BOSSES.....	3
8 REDUCING FITTINGS.....	3
 TABLE 1 Standard Drain Sizes.....	1
2 Bypass Sizes.....	2
3 Connection Dimensions.....	4
 FIGURE 1 Minimum Thread Length.....	3
2 Welding Socket Dimensions.....	3
3 Butt-Weld.....	4
4 Bosses.....	4
5 Method of Designating Location of Opening for Drains & Bypasses.....	5
6 Method of Designating Location of Opening for Drains.....	6
 ANNEX A Referenced Standards and Applicable Dates.....	7

BYPASS AND DRAIN CONNECTIONS

1. SCOPE

1.1 This Standard Practice establishes requirements for connections to valves and fittings to accommodate drains and bypasses in all pressure classes.

1.2 Specific requirements are:

- a) Standard symbols and locations of openings for drains and bypasses.
- b) Standard size of drains and bypass openings.
- c) Minimum thread lengths in drain and bypass tappings.
- d) Minimum diameter and depth of socketweld connection for drain and bypass.
- e) Butt-welding connection for drain and bypass.
- f) Bosses for drain and bypass connection.
- g) Method for designating outlets of reducing fittings.

2. LOCATION AND SYMBOLS

2.1 Figures 5 and 6 illustrate the application of standard symbols for the locations of openings for drain and bypass connections recognized as standard. These symbols should be regularly employed on drawings, specifications requisitions, and other instruments used in the transactions of business.

2.2 When a tap is required at some other location, it is recommended that the manufacturer be consulted as to their practicability, and both the inquiry and the order should be accompanied by a sketch indicating the location upon the fitting or valve body.

3. STANDARD DRAIN SIZES

3.1 When fittings and valves require drain openings, they are regularly furnished with the size shown in Table 1 unless otherwise specified by purchaser.

TABLE 1 - Standard Drain Sizes

Valve or Fitting Size		Drain Size	
NPS	DN	NPS	DN
2-4	50-100	1/2	15
5-8	125-200	3/4	20
10-24	250-600	1	25

4. STANDARD BYPASS SIZES

4.1 When valves are ordered with bypass attached, the size of bypass shall be as shown in Table 2, except where unusual service conditions warrant consideration of a special oversize bypass, then the installation of the bypass around the main valve is recommended wherever possible.

TABLE 2 - Bypass Sizes

Main Valve NPS (DN)	Bypass NPS (DN)	
	Series A ^(a)	Series B ^(b)
2 to 4 (50 to 100)	1/2 (15)	1 (25)
5 (125)	3/4 (20)	1 1/4 (32)
6 (150)	3/4 (20)	1 1/4 (32)
8 (250)	3/4 (20)	1 1/2 (32)
10 (250)	1 (25)	1 1/2 (32)
12 (300)	1 (25)	2 (50)
14 (350)	1 (25)	2 (50)
16 (400)	1 (25)	3 (80)
18 (450)	1 (25)	3 (80)
20 (500)	1 (25)	3 (80)
24 (600)	1 (25)	4 (100)
30 (750)	1 (25)	4 (100)
36 (900)	1 (25)	6 (150)
42 (1100)	1 (25)	6 (150)
48 (1200)	1 (25)	8 (200)
Notes: ^(a) Series A is for preheating the piping system (normally with steam) before opening main valve and for balancing pressures where lines are of limited volume. ^(b) Series B is for lines conveying gases or liquids where bypassing may facilitate the operation of the main valve by balancing the pressure on both sides of the disc or discs. These larger sizes may be of the bolted on type.		

5. BYPASS LOCATIONS

5.1 Gate Valves When gate valves are ordered with bypass attached, it shall be standard practice to attach the bypass at the side of the main valve with the stems of both valves pointing upward. The more common of the "Special" attached locations is on the center of the flow line, at the bottom of the main valve, (see Figure 5 locations C & D) with the stem of the bypass valve at right angles to the main valve stem. This is designated as the "bottom attachment," or defined as "bypass at the bottom." When any other "special attached location" or other position of the bypass valve stem is desired, a sketch should be sent to the manufacturer.

5.2 Globe Valves When globe valves are ordered with bypass attached, it shall be regular practice to attach bypass at the right-hand side of the main valve, (see Figure 5 locations E & F) with the stems of both valves parallel, pointing vertically upward. When bypass may be "specially" required attached at the left-hand side, (see Figure 5 locations A & B) the designation shall be "left-hand attachment." Right-hand side of a globe valve is the side at the right, when facing the flow port which leads to the under-side of the disc.

5.3 Angle Valves When angle valves are ordered with bypass attached, it shall be regular practice to attach bypass at the back of the main valve, (see Figure 5 locations E & F) with the stems of both parallel, pointing vertically upward. When bypass may be "specially" required attached at the right-hand or left-hand side, (see Figure 5 locations C & D and A & B respectively) the designation shall be "right-hand attachment" or "left-hand attachment." Right-hand side of an angle valve is at the right, when facing the back of the valve.

5.4 Check Valves When check valves are ordered with bypass attached, it is standard practice to attach the bypass at the side of the check valve so that the bypass valve stem and the check valve cap both point upward. If location of bypass is important its location should be specified according to Figure 5.

5.5 Ball Valves When ball valves are ordered with bypass attached, it shall be standard practice to attach the bypass at the side of the main valve with the stems of both valves pointing upward. If location of bypass is important its location should be specified according to Figure 5.

5.6 Plug Valves When plug valves are ordered with bypass attached, it shall be standard practice to attach the bypass at the side of the main valve with the stems of both valves pointing upward. If the main valve should have a handwheel on the side of the valve, the bypass, where possible, should be located on the handwheel side. If any other location is required, position should be specified according to Figure 5.

6. DRAIN & BYPASS CONNECTION DIMENSIONS

6.1 Pipe Threads Pipe threads shall be tapered pipe threads in accordance with ASME B1.20.1. Metal thickness shall be sufficient to allow the effective thread length specified in Table 3. These lengths are equal to the effective thread lengths of tapered external pipe threads, ASME B1.20.1. Where wall thickness is insufficient or the tapped hole needs reinforcement, a boss is required.

6.2 Sockets Sockets (socket-welding) may be provided in the wall of a fitting or valve if the metal thickness is sufficient to allow the depth of socket specified in Table 3. Where the wall thickness is insufficient, or the size of socket requires opening reinforcement, a boss is required.

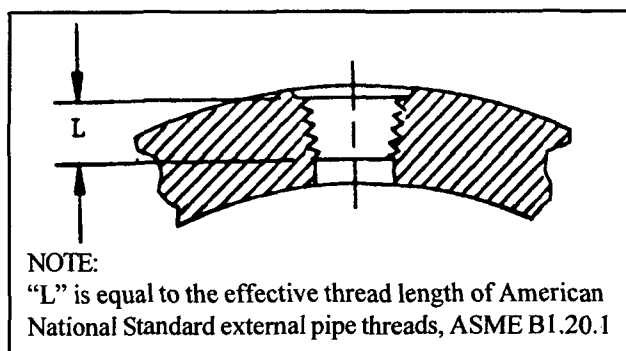


Figure 1
Minimum Thread Length

6.3 Butt Welds Connections may be made by butt-welding directly to the wall of the fitting or valve, see Table 3.

7. BOSSES

7.1 When a boss is required to meet the thicknesses in Table 3, the diameter shall be not less than those shown in Figure 4.

8. REDUCING FITTINGS

8.1 When a drain opening is required on the side of a reducing fitting whose side is tapered, the axis of the drain opening should be at right angles to the centerline of the fitting.

8.2 The size of the drain opening on a reducing fitting shall be governed by the size of the adjacent outlet.

8.3 When a tap is required on a reducing fitting at a point centrally located, such as "G" on a reducer, its size shall be governed by the average of the drain openings which would be used for the largest and smallest outlet, using the drain opening size which is standard, or the next smaller size as shown in Table 1.

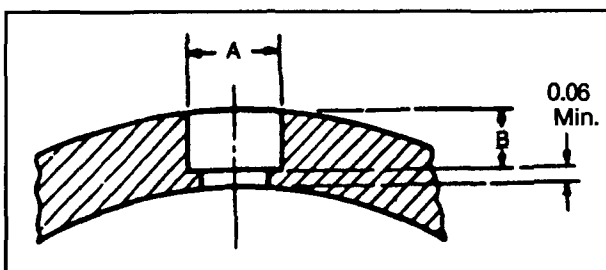
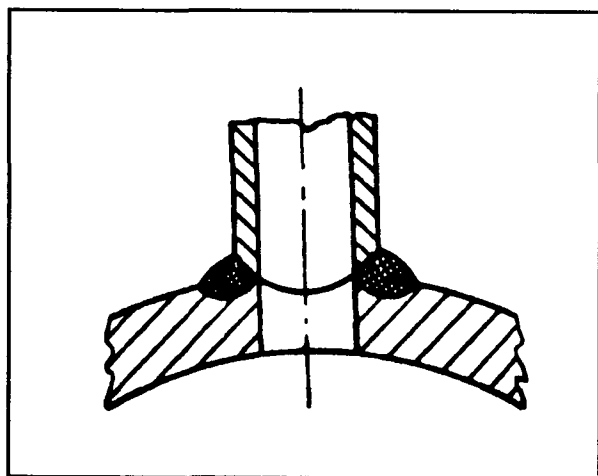
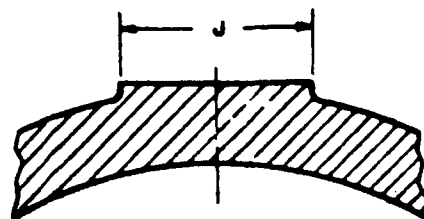


Figure 2
Welding Socket Dimensions

TABLE 3 - Connection Dimensions

Connection Size		Thread Length L minimum Figure 1		Welding Socket, Figure 2			
				Diameter A, min		Depth B, min	
NPS	DN	inches	mm	inches	mm	inches	mm
3/8	10	0.41	11	0.690	17.5	0.19	5
1/2	15	0.53	14	0.855	22	0.19	5
3/4	20	0.55	14	1.065	27	0.25	6.5
1	25	0.68	18	1.330	34	0.25	6.5
1 1/4	32	0.71	18	1.675	43	0.25	6.5
1 1/2	40	0.72	19	1.915	49	0.25	6.5
2	50	0.76	20	2.406	61	0.31	8

**Figure 3
Butt Weld**

Connection Size		Boss Diameter "J"	
NPS	DN	inches	mm
3/8	10	1.25	32
1/2	15	1.50	38
3/4	20	1.75	44
1	25	2.13	54
1 1/4	32	2.50	64
1 1/2	40	2.75	70
2	50	3.38	86

**Figure 4
Bosses**

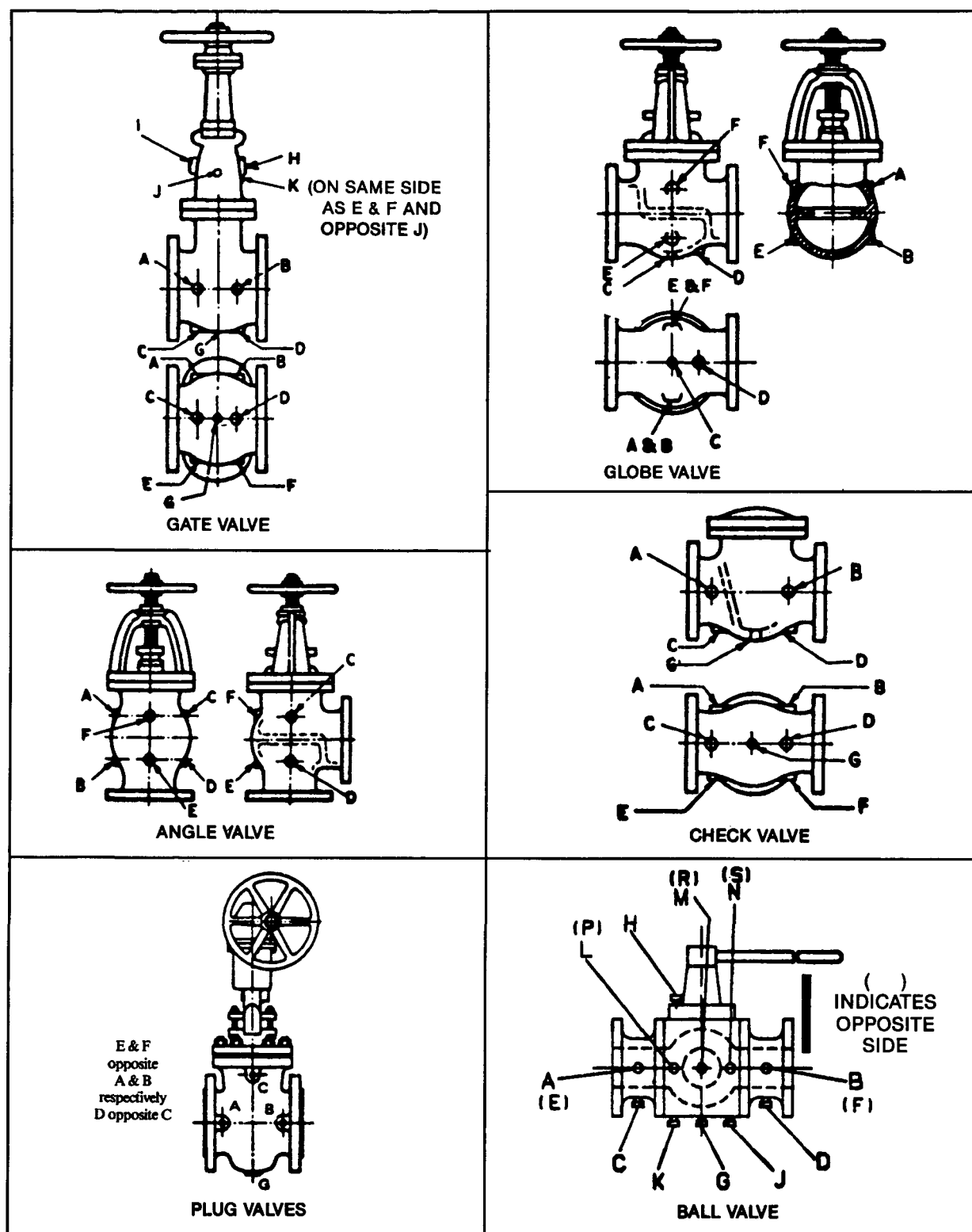


Figure 5
Method of Designating Location of Openings for Drains & Bypasses

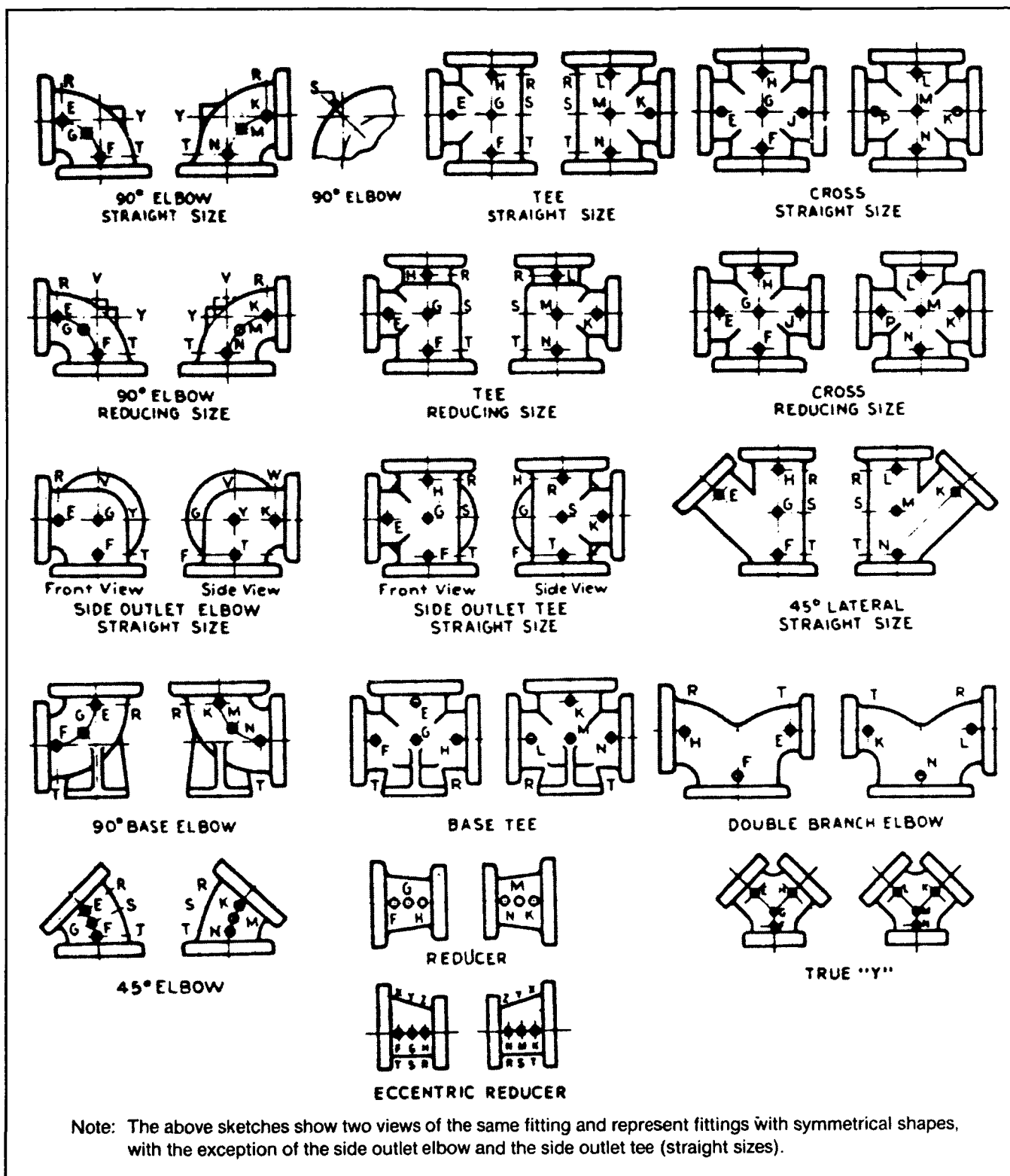


Figure 6
Method of Designating Location of Openings for Drains

ANNEX A
Referenced 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 Description:

ASME, ANSI/ASME, ANSI, ASME/ANSI

B1.20.1-1983 (R2001) Pipe Threads, General Purpose (Inch)

Publications of the following organization appear in the above list:

ASME	The American Society of Mechanical Engineers Three Park Avenue, New York, NY 10016-5990
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List of MSS Standard Practices (Price List Available Upon Request)

Number	
SP-6-2001	Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings
SP-9-2001	Spot Facing for Bronze, Iron and Steel Flanges
SP-25-1998	Standard Marking System For Valves, Fittings, Flanges and Unions
SP-42-1999	Class 150 Corrosion Resistant Gate, Globe, Angle and Check Valves with Flanged and Butt Weld Ends
SP-43-1991	(R 01) Wrought Stainless Steel Butt-Welding Fittings
SP-44-1996	(R 01) Steel Pipeline Flanges
SP-45-2003	Bypass and Drain Connections
SP-51-2003	Class 150LW Corrosion Resistant Flanges and Cast Flanged Fittings
SP-53-1999	(R 02) Quality Standard for Steel Castings and Forgings for Valves, Flanges, and Fittings and Other Piping Components - Magnetic Particle Examination Method
SP-54-1999	(R 02) Quality Standard for Steel Castings for Valves, Flanges, and Fittings and Other Piping Components - Radiographic Examination Method
SP-55-2001	Quality Standard for Steel Castings for Valves, Flanges, Fittings, and Other Piping Components - Visual Method for Evaluation of Surface Irregularities
SP-58-2002	Pipe Hangers and Supports - Materials, Design, and Manufacture
SP-60-1999	Connecting Flange Joint Between Tapping Sleeves and Tapping Valves
SP-61-2003	Pressure Testing of Steel Valves
SP-65-1999	High Pressure Chemical Industry Flanges and Threaded Stubs for Use with Lens Gaskets
SP-67-2002	Butterfly Valves
SP-68-1997	High Pressure Butterfly Valves with Offset Design
SP-69-2002	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-73-2003	Brazing Joints for Copper and Copper Alloy Pressure Fittings
SP-75-1998	Specification for High Test Wrought Butt Welding Fittings
SP-77-1995	(R 00) Guidelines for Pipe Support Contractual Relationships
SP-78-1998	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-81-2001	Stainless Steel, Bonnetless, Flanged Knife Gate Valves
SP-82-1992	Valve Pressure Testing Methods
SP-83-2001	Class 3000 Steel Pipe Unions, Socket Welding and Threaded
SP-85-2002	Gray Iron Globe & Angle Valves, Flanged and Threaded Ends
SP-86-2002	Guidelines for Metric Data in Standards for Valves, Flanges, Fittings, and Actuators
SP-88-1993	(R 01) Diaphragm Valves
SP-89-1998	Pipe Hangers and Supports - Fabrication and Installation Practices
SP-90-2000	Guidelines on Terminology for Pipe Hangers and Supports
SP-91-1992	(R 96) Guidelines for Manual Operations of Valves
SP-92-1999	MSS Valve User Guide
SP-93-1999	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-95-2000	Swage(d) Nipples and Bull Plugs
SP-96-2001	Guidelines on Terminology for Valves and Fittings
SP-97-2001	Integrally Reinforced Forged Branch Outlet Fittings-Socket Welding, Threaded, and Buttwelding Ends
SP-98-2001	Protective Coatings for the Interior of Valves, Hydrants, and Fittings
SP-99-1994	(R 01) Instrument Valves
SP-100-2002	Qualification Requirements for Elastomer Diaphragms for Nuclear Service Diaphragm Valves
SP-101-1989	(R 01) Part-Turn Valve Actuator Attachment-Flange and Driving Component Dimensions and Performance Characteristics
SP-102-1989	(R 01) Multi-Turn Valve Actuator Attachment - Flange and Driving Component Dimensions and Performance Characteristics
SP-103-1995	(R 00) Wrought Copper and Copper Alloy Insert Fittings for Polybutylene Systems
SP-104-1995	Wrought Copper Solder Joint Pressure Fittings
SP-105-1996	(R 01) 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	(R 00) Transition Union Fittings for Joining Metal and Plastic Products
SP-108-2002	Resilient-Seated Cast-Iron Eccentric Plug Valves
SP-109-1997	Welded Fabricated Copper Solder Joint Pressure Fittings
SP-110-1996	Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
SP-111-2001	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 \$25.00 each. Same quantity discounts apply on total order.
SP-113-2001	Connecting Joint between Tapping Machines and Tapping Valves
SP-114-2001	Corrosion Resistant Pipe Fittings Threaded and Socket Welding, Class 150 and 1000
SP-115-1999	Excess Flow Valves 1 1/4 NPS and Smaller, for Fuel Gas Service
SP-116-2003	Service-Line Valves and Fittings for Drinking Water Systems
SP-117-2002	Bellows Seals for Globe and Gate Valves
SP-118-2002	Compact Steel Globe & Check Valves - Flanged, Flangeless, Threaded, & Welding Ends (Chemical & Petroleum Refinery Service)
SP-119-2003	Factory-Made Wrought Belled End Socket-Welding Fittings
SP-120-2002	Flexible Graphite Packing System for Rising Stem Steel Valves (Design Requirements)
SP-121-1997	(R 02) 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
SP-124-2001	Fabricated Tapping Sleeves
SP-125-2000	Gray Iron and Ductile Iron In-Line, Spring-Loaded, Center-Guided Check Valves
SP-126-2000	Steel In-Line Spring-Assisted Center Guided Check Valves
SP-127-2001	Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application
SP-129-2003	Copper-Nickel Socket-Welding Fittings and Unions
(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 Practice in such cases.

Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.
127 Park Street, N.E., Vienna, VA 22180-4620 • (703) 281-6613 Fax # (703) 281-6671