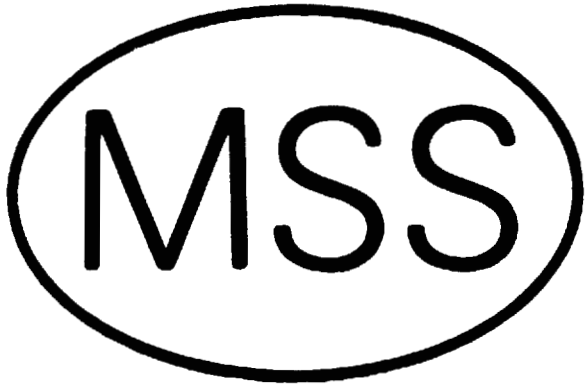

STANDARD PRACTICE **SP-67**

1995
Edition

BUTTERFLY VALVES

Developed and Approved
by the
Manufacturers Standardization Society
of the
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U.S. customary units in this SP are the standard; the metric units are for reference only.

Substantive changes in this 1995 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.

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BUTTERFLY VALVES

1. SCOPE

1.1 This Standard Practice covers dimensions, design, testing and marking requirements for butterfly valves. Further reference should be made to the MSS Standard Practice for High Pressure - Offset Seat Butterfly Valves, SP-68.

1.2 This Standard Practice covers two types of butterfly valves:

Type I - Valves for tight shut-off (tested per subsection 11.2.1).

Type II - Valves permitting seat leakage (see subsection 11.2.2).

1.3 This Standard Practice covers flangeless (wafer-type), single flange (lug-type), and flanged end valves in sizes 1½ NPS thru 72 NPS, grooved end valves, and shouldered end valves with pressure ratings in accordance with the requirements of Sections 4 and 5.

2. REFERENCED STANDARDS

ANSI/ASME:

B36.10M-1985	Welded and Seamless Wrought Steel Pipe

ANSI/AWWA:

C115/A21.15-88	Flanged Ductile-Iron Pipe with Threaded Flanges
C151/A21.51-91	Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
C207-94	Steel Pipe Flanges for Waterworks Service - Sizes 4 in. Through 144 in. (100mm through 360mm)
C504-94	Rubber-Seated Butterfly Valves
C606-87	Grooved and Shouldered Joints

ASME:

B1.1-1989	Unified Inch Screw Threads
B16.24-1991	Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900, 1500 and 2500, and Flanged Fittings, Class 150 and 300
B16.47-1990	Large Diameter Steel Flanges, NPS 26 Through NPS 60
Boiler and Pressure Vessel Code - 1992	Sections I and VIII

ASME/ANSI:

B16.1-1989	Cast Iron Pipe Flanges and Flanged Fittings
B16.5-1988	Pipe Flanges and Flanged Fittings
B16.34-1988	Valves - Flanged, Threaded and Welding End
B16.42-1987	Ductile-Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300

MSS:

SP-25-1993	Standard Marking System for Valves, Fittings, Flanges and Unions
SP-68-1988	High Pressure-Offset Seat Butterfly Valves
SP-91-1992	Guidelines for Manual Operation of Valves

3. DEFINITIONS

3.1 Face-to-Face of Valve Before Installation — This is the dimension of the valve face-to-face before it is installed in the pipe line. It does not include the thickness of gaskets if separate gaskets are used. It does include the thickness of gaskets or seals that are an integral part of the valve and this dimension is before these gaskets or seals are compressed.

3.2 Face-to-Face of Valve Installed — This is the dimension of the valve face-to-face after it is installed in the pipe line. It does not include the thickness of gaskets if separate gaskets are used. It does include the thickness of gaskets or seals that are an integral part of the valve, however this dimension is established with the gaskets or seals compressed. See Fig. 1A, 1B, 1C and Table 3.

3.3 Face-to-Face of Valve and Gaskets Installed — This is the dimension of the valve face-to-face including separate gaskets when installed in the pipe line. This dimension must be established using the thickness of the valve face-to-face dimension and the compressed thickness of the gaskets to be used in such installations.

3.4 CWP - Cold Working Pressure (PSIG) — The pressure rating for the pressure containing components of the valve at temperatures up to and including 100° F.

3.5 System Pressure — Maximum specified operating pressure for the application.

3.6 Differential Pressure — The difference in pressure between two points located on opposite sides of the valve disc.

3.7 Shut-Off Pressure — The maximum differential pressure with the valve in the fully closed position.

4. STANDARD ENDS

4.1 Flanged Ends - Valves shall be compatible for use with flanges to ASME/ANSI B16.1 Class 25 or 125, ASME/ANSI B16.5 Class 150, ASME B16.47 Class 150 Series A, ASME B16.24 Class 150, ASME/ANSI B16.42 Class 150 or ANSI/AWWA C-207. Figure 2 illustrates bolting options.

4.2 Single Flange (Lug Type) - Valves shall be compatible for use with flanges to ASME/ANSI B16.1 Class 25 or 125, ASME/ANSI B16.5 Class 150, ASME B16.24 Class 150, ASME/ANSI B16.42 Class 150, or ANSI/AWWA C-207. Figure 3 illustrates bolting options.

4.3 Flangeless (Wafer Type) - Valves shall be compatible for use with flanges to ASME/ANSI B16.1 Class 25 or 125, ASME/ANSI B16.5 Class 150, ASME B16.24 Class 150, ASME/ANSI B16.42 Class 150, or ANSI/AWWA C-207. Figure 4 illustrates bolting options.

4.4 Grooved Ends — Valve ends shall conform to ANSI/AWWA C-606.

4.5 Shouldered Ends — Valve ends shall conform to ANSI/AWWA C-606.

5. DESIGN REQUIREMENTS

5.1 Wall Thickness — The design requirements of this section apply only to the valve body. The disc and shaft are specifically excluded.

5.1.1 Steel, Nickel Alloy and other Special Alloy Valves

5.1.1.1 Valves that conform to the applicable requirements of ASME/ANSI B16.34 shall have body pressure-temperature ratings in accordance with that standard. For valves that do not conform to the applicable requirements of ASME/ANSI B16.34, 5.1.1.2 or 5.1.1.3 shall be used to determine the minimum required wall thickness.

5.1.1.2 Valves that do not conform to the applicable requirements of ASME/ANSI B16.34 shall have their minimum wall thickness determined using the following equation:

$$t = 1.5 \frac{Pd}{2S - 1.2P}$$

Where P = Pressure rating at temperature under consideration, psi

d = Inside diameter of valve body (or shaft bore in body for the body neck of flangeless valves), in

S = Allowable stress, psi

The allowable stress shall be taken from the ASME Boiler and Pressure Vessel Code, Section I (or if not listed, use Section VIII, Division 1). If the material is not listed in either of these Code sections then the allowable stress shall be determined using the method of Appendix P of Section VIII. For cast materials use the appropriate casting quality factor from UG-24 of Section VIII.

5.1.1.3 As an alternative to 5.1.1.2, valves that do not conform to the applicable requirements of ASME/ANSI B16.34 shall have the maximum allowable pressure determined using a proof test in accordance with UG-101 of ASME Section VIII.

5.1.2 Bronze and Bronze Alloy Valves

5.1.2.1 Valves that conform to the applicable requirements of ASME B16.24 shall have body pressure-temperature ratings in accordance with that standard. For valves that do not conform to the applicable requirements of ASME B16.24, 5.1.2.2 or 5.1.2.3 shall be used to determine the minimum required wall thickness.

5.1.2.2 Valves that do not conform to the applicable requirements of ASME B16.24 shall have the minimum wall thickness determined using methods that result in designs that are as conservative as those used in that standard.

5.1.2.3 As an alternative to 5.1.2.2, valves that do not conform to the applicable requirements of ASME B16.24 shall have the maximum allowable pressure determined using a proof test in accordance with UG-101 of ASME Section VIII.

5.1.3 Cast Iron Valves

5.1.3.1 Valves that conform to the applicable requirements of ASME/ANSI B16.1 or ANSI/AWWA C504 shall conform to the body pressure-temperature requirements in accordance with the respective standard. For valves which do not conform to the applicable requirements of ASME/ANSI B16.1 or ANSI/AWWA C504, Sections 5.1.3.2 or 5.1.3.3 shall be used to determine the minimum required wall thickness.

5.1.3.2 Valves that do not conform to the applicable requirements of ASME/ANSI B16.1 or ANSI/AWWA C504 shall have the minimum wall thickness determined using methods that result in designs that are as conservative as those used in these standards.

5.1.3.3 As an alternative to 5.1.3.2, valves that do not conform to the applicable requirements of ASME/ANSI B16.1 or ANSI/AWWA C504 shall have the maximum allowable pressure determined using a proof test in accordance with UCI-101 of ASME Section VIII.

5.1.4 Ductile Iron Valves

5.1.4.1 Valves that conform to the applicable requirements of ASME/ANSI B16.42 or ANSI/AWWA C504 shall conform to the body pressure-temperature requirements in accordance with the respective standard. For valves which do not conform to the applicable requirements of ASME/ANSI B16.42 or ANSI/AWWA C504, Sections 5.1.4.2 or 5.1.4.3 shall be used to determine the minimum required wall thickness.

5.1.4.2 Valves that do not conform to the applicable requirements of ASME/ANSI B16.42 or ANSI/AWWA C504 shall have the minimum wall thickness determined using methods that result in designs that are as conservative as those used in these standards. Reference Annex C of ASME/ANSI B16.42.

5.1.4.3 As an alternative to 5.1.4.2, valves that do not conform to the applicable requirements of ASME/ANSI B16.42 or ANSI/AWWA C504 shall have the maximum allowable pressure determined using a proof test in accordance with UCD-101 of ASME Section VIII.

5.1.5 Reduced Body Wall Thickness

5.1.5.1 The body material thickness between the shaft bore in the body and adjacent bolt holes shall not be less than 25% of the required wall thickness of the body neck.

5.2 Flange Thickness — If materials other than those listed in the flange standards in Section 2 are used for flanged end valves, the minimum flange thickness shall be determined using methods that are as conservative as those used in the standard appropriate for the material of construction. In no case shall the minimum flange thickness be less than that listed in the standard for the flange rating under consideration.

5.3 Pressure Rating — Valves may be designed for shut-off pressure rating or differential pressures lower than the body pressure rating. This pressure rating shall be so marked in accordance with Section 12 of this Standard Practice. Flange ratings other than those listed in the flange standards in Section 2 are outside the scope of this Standard Practice.

5.4 Flange Bolting

5.4.1 Cast iron, ductile iron and non-ferrous valves with threaded body flange bolt holes shall have these holes drilled and tapped in accordance with ASME B1.1 Coarse Thread Series Class 2B.

5.4.2 Steel valves, all classes, with threaded body flange bolt holes intended for use with alloy steel bolting shall be drilled and tapped in accordance with ASME B1.1 Coarse Thread Series Class 2B for bolts 1" and smaller and

shall be tapped to the 8 Thread Series Class 2B for bolts 1-1/8" and larger.

5.4.3 Steel valves limited by use of organic materials of construction to service temperatures below 500°F (260°C) where carbon steel bolting can be used, may be tapped in accordance with ASME B1.1 Coarse Thread Series 2B for all bolt sizes.

6. VALVE DISC CLEARANCE

6.1 Butterfly valve discs may upon rotation project beyond the body flange faces, and therefore, caution should be exercised by the user to insure there is no interference between the butterfly valve disc and adjacent components, such as lined piping, strainers, check valves, and other valving. Also mating pipe flanges must be aligned prior to tightening of flange bolts.

6.2 All valves shall be designed for suitable clearance according to the pipe inside diameters shown in Table 1, and in accordance with Annex A and Figure 7.

7. TRIM

Trim materials shall be suitable for the service conditions and shall be at the manufacturer's option unless specified. Trim shall be defined as comprising shafts, bushings, body seating surfaces, discs or disc seating surfaces, internal keys, pins, and screws in contact with the line fluid. Seats in the body and on the disc may be separate or integral. Seat facings may be applied to bodies and/or discs.

8. FACE-TO-FACE DIMENSIONS

8.1 Flanged End Valves — Face-to-Face dimensions and tolerances for flanged end valves are listed in Table 2.

8.2 Flangeless (Wafer Type) Valves — Face-to-Face dimensions and tolerances for flangeless valves are listed in Table 3. Figures 1A and 1B illustrate valves with integral seals or gaskets. Figure 1C illustrates valves that require separate gaskets.

8.3 Single Flange (Lug Type) Valves — Face-to-Face dimensions and tolerances for single flange valves are listed in Table 3. Figures 1A and 1B illustrate valves with integral seals or gaskets. Figure 1C illustrates valves that require separate gaskets.

8.4 Grooved End Valves — Grooved end valve configuration is shown in Figure 5.

8.5 Shouldered End Valves — Shouldered end valve configuration is shown in Figure 6.

9. ACTUATORS

9.1 Actuators used with these valves shall be self locking or have provisions to prevent unwanted disc movement during normal operating conditions.

9.2 Many factors such as flow media, operating pressures, fluid velocities and location in the pipe line affect the operating torque of the valve. These conditions must be considered when sizing the actuator. See MSS SP-91 for guidelines in selecting manual actuators.

10. PURCHASING INFORMATION

In order to enable the manufacturer to properly supply valves for the application, the purchaser shall furnish the following information:

a) Standard to be used.

b) Size of valve.

c) Type of valve (see Section 1).

d) Type of end connection (see Section 4).
If flanged end, specify narrow or wide from Table 2.
If single flanged (lug type) or flangeless (wafer type), specify narrow, wide, or extra wide from Table 3.

e) Connecting pipe material (see Table 1).

f) Body line pressure.

g) Shut-off pressure (see Subsection 5.3).

h) Type and temperature of line fluid to be handled.

i) Flow conditions:

1. For on-off service, maximum flow.
2. For regulating service; maximum flow at maximum pressure drop; minimum flow at maximum pressure drop; maximum flow at minimum pressure drop.
3. Whether valve is in closed system or subject to free discharge.

j) Type of actuator.

k) Method of operation:

1. Frequency
2. Opening Time
3. Closing Time

l) For manual operation-Direction of closing.

m) Stem orientation (horizontal/vertical, etc.).

n) Buried or submerged service (if applicable).

o) Allowable leakage for Type II valves (see Subsection 11.2.2).

11. PRODUCTION TESTING

11.1 Shell Test — Each assembled valve shall be subjected to a pressure test at a minimum of one and one half times the body design cold working pressure for the duration specified. The test shall be made with water which may contain a corrosion inhibitor, with kerosene, or other suitable liquid provided its viscosity is no greater than that of water. The manufacturer at his option may use air or inert gas as the test medium. This shell test shall be conducted at ambient temperature with the disc in the partially open position. As an alternative, the body may be tested prior to assembly. No visible leakage through the body wall shall be allowed. Leakage through the shaft seal shall not be cause for rejection.

The duration of the shell test shall be no less than:

VALVE SIZE (NPS)	TIME (SECONDS) Fig. 1B and 5	Fig. 1A, 1C, 2, 3 and 4
2 and Smaller	15	15
2½ - 8	30	60
10 and Larger	60	180

11.2 Seat Test

11.2.1 Type I Valves — Each valve that is furnished for tight shut-off service shall be tested in the closed position to a pressure equal to at least the rated system pressure for the duration specified below. The test shall be made with water which may contain a corrosion inhibitor, with kerosene, or other suitable liquid provided its viscosity is no greater than that of water. The manufacturer at his option may use air or inert gas as the test medium. The test shall be conducted in a manner that will test the tightness of the seat in the direction of flow as indicated on the valve. For valves designed to close against pressure from either direction, the pressure shall be applied across the valve disc in the direction producing the most adverse seating condition. This test shall be made at ambient temperature with the seats clean and free of oil, grease, or any sealant.

If the test fluid is a liquid, there shall be no visible evidence of drops or wetting through the disc nor leakage past the seat. When air or inert gas is the test medium, there shall be no visible formation of bubbles when the closure is either covered with water or coated with a soap or similar solution.

The duration of the seat test shall be no less than:

VALVE SIZE (NPS)	TIME (SECONDS)
12 and Smaller	15
14 - 24	30
Larger than 24	60

11.2.2 Type II Valves — Valves that permit seat leakage shall not be subjected to a seat test unless specified by the purchaser. When so specified, valves shall be tested as agreed upon by the purchaser and the manufacturer.

11.3 Shaft Seal Test — Each valve shall not be required to pass a shaft seal test, however the manufacturer shall be able to demonstrate that the shaft seal is capable of sealing at 1.1 times the rated cold working pressure.

12. MARKING

Valves shall be marked as applicable in accordance with ASME/ANSI B16.34 or MSS SP-25 except that in the case where the maximum differential shut-off pressure and/or temperature is less than the body pressure and temperature rating, such limitations must be shown on the valve. If necessary, this information may be on an identification plate attached to the valve.

TABLE 1. PIPE MINIMUM DIAMETERS FOR DISC CLEARANCE

Nominal Valve Size(a)	Minimum Pipe Inside Diameters(d)									
	Unlined Gray Iron Pipe(b)(d)		Unlined Steel Pipe (c)(d)		Unlined Ductile Iron Pipe (d)(e)(f)(g)(h)					
					Minimum Pressure Class		Pressure Class 350		Special Class 53	
Inches	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm
1½			1.61	40.9						
2			2.07	52.6						
2½			2.47	62.7						
3	3.26	82.8	3.07	78.0	3.40	86.4	3.40	86.4	3.28	83.3
4	3.26	102.6	4.03	102.4	4.24	107.7	4.24	107.7	4.10	104.1
5			5.05	128.3						
6	6.08	154.4	6.07	154.2	6.34	161.0	6.34	161.0	6.16	156.5
8	8.11	206.0	7.98	202.7	8.49	215.6	8.49	215.6	8.27	210.1
10	10.00	254.0	10.2	254.5	10.52	267.2	10.52	267.2	10.28	261.1
12	12.02	305.3	11.94	303.3	12.58	319.5	12.58	319.5	12.34	313.4
14	13.94	354.1	13.25	336.6	14.66	372.4	14.60	370.8	14.38	365.3
16	15.86	402.8	15.25	387.4	16.72	424.7	16.64	422.7	16.46	418.1
18	17.84	453.1	17.25	438.2	18.80	477.5	18.70	475.0	18.54	470.9
20	19.84	503.9	19.25	489.0	20.86	529.8	20.76	527.3	20.62	523.7
24	23.88	606.6	23.25	590.6	25.06	636.5	24.86	631.4	24.78	629.4
30	29.90	759.5	29.25	743.0	31.26	794.0	30.96	786.4	30.92	785.4
36	35.90	911.9	35.25	895.4	37.48	952.0	37.12	942.8	37.08	941.8
42	41.90	1064.3	41.24	1047.5	43.62	1107.9	43.18	1096.8	43.14	1095.8
48	47.90	1216.7	47.25	1200.2	49.82	1265.4	49.34	1253.2	49.30	1252.2
54	53.90	1369.1			56.44	1433.6	55.88	1419.4	55.84	1418.3
60	59.90	1521.5			60.43	1534.9	59.85	1520.2		
64					64.45	1637.0	63.83	1621.3		
66	65.90	1673.9								
72	71.90	1826.3								

a) For valve sizes not covered by pipe data in Table 1, caution must be exercised as required in Section 6 to insure there is no interference between piping I.D. and valve disc.

b) Diameters for the valves sizes 3 NPS through 24 NPS were calculated from Tables 6.4 and 6.5 of ANSI A21.6 (withdrawn in 1993) with allowance for the specified tolerances to get the smallest I.D. as follows:

Size 3 NPS - 6 NPS thickness class 22
8 NPS thickness class 23
Size 10 NPS - 12 NPS thickness class 24
14 NPS thickness class 25
Size 16 NPS - 24 NPS thickness class 26

Diameters for valve sizes 30 NPS through 60 NPS are calculated from ANSI A21.2 with allowances for the specified tolerances to get the smallest I.D. Diameters for valves sizes 66 NPS through 72 NPS are extrapolated based on the consistency of size 30 NPS and larger.

c) Diameters are calculated subtracting twice the nominal wall thickness from the outside diameter as specified for standard pipe in Table 2 of ANSI/ASME B36.10M.

d) Pipe dimensional data in Table 1 is for *unlined* pipe. The majority of Gray Iron A21.6 and Ductile Iron Pipe ANSI/AWWA C151/A21.51 include a cement mortar lining. For valve installations with lined pipelines, caution must be exercised as required in Section 6 to insure there is no interference between the piping and the valve disc.

e) Ductile iron pipe diameters are calculated by subtracting the ANSI/AWWA C151/A21.51 negative OD tolerance and twice the nominal wall thickness from the nominal OD.

f) The minimum nominal wall thickness of ductile iron pipe flanged in accordance with ANSI/AWWA C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Threaded Flanges, is Special Class 53 for 3-54 inch nominal pipe sizes and Pressure Class 350 for 60 and 64 inch pipe sizes.

g) 64 inch ductile iron pipe flanged in accordance with ANSI/AWWA C115/A21.15 have 66 inch NPS flanges. If a 66 inch NPS butterfly valve is used with this pipe, careful consideration should be given to disc clearance.

h) Ductile iron pipe are available in classes other than those listed in Table 1. When using other classes, consult the valve/pipe manufacturers for clearance requirements.

TABLE 2. FACE—TO-FACE DIMENSIONS—FLANGED END VALVES

Nominal Valve Size	Narrow Face-to-Face		Wide Face-to-Face		TOLERANCE	
	in.	mm	in.	mm	in.	mm
1½	—	—	—	—		
2	—	—	—	—		
2½	—	—	—	—		
3	5.00	127.0	5.00	127.0	±0.06	±1.5
4	5.00	127.0	7.00	177.8		
5	5.00	127.0	7.50	190.5		
6	5.00	127.0	8.00	203.2		
8	6.00	152.4	8.50	215.9		
10	8.00	203.2	15.00	381.0		
12	8.00	203.2	15.00	381.0		
14	8.00	203.2	16.00	406.4		
16	8.00	203.2	16.00	406.4		
18	8.00	203.2	16.00	406.4		
20	8.00	203.2	18.00	457.2	±0.13	±3.3
24	8.00	203.2	18.00	457.2		
30	12.00	304.8	22.00	558.8		
36	12.00	304.8	22.00	558.8		
42	12.00	304.8	24.00	609.6		
48	15.00	381.0	26.00	660.4		
54	15.00	381.0	28.00	711.2		
60	15.00	381.0	30.00	762.0		
66	18.00	457.2	34.00	863.6		
72	18.00	457.2	36.00	914.4		

TABLE 3. FACE-TO-FACE DIMENSIONS, SINGLE FLANGE AND FLANGELESS VALVES

Nominal Valve Size	Face-to-Face of Valve Installed (See Figure 1A, 1B, 1C)							
	W-1 Narrow Body		W-2 Wide Body		W-3 Extra Wide Body		Tolerance	
	in.	mm	in.	mm	in.	mm	in.	mm
1½	1.31	33.3	1.44	36.6	1.50	38.1		
2	1.69	42.9	1.75	44.5	1.81	46.0		
2½	1.81	46.0	1.94	49.3	2.00	50.8		
3	1.81	46.0	1.94	49.3	2.00	50.8	± .06	± 1.5
4	2.06	52.3	2.19	55.6	2.25	57.2		
5	2.19	55.6	2.50	63.5	2.56	65.0		
6	2.19	55.6	2.75	69.9	2.81	71.4		
8	2.38	60.5	2.81	71.4	2.94	74.7		
10	2.69	68.3	3.00	76.2	3.12	79.2		
12	3.06	77.7	3.25	82.6	3.38	85.9		
14	3.06	77.7	3.62	91.9	3.75	95.3		
16	3.12	79.2	4.00	101.6	4.12	104.6	± .13	± 3.3
18	4.00	101.6	4.50	114.3	4.62	117.3		
20	4.38	111.2	5.00	127.0	5.12	130.0		
24			6.06	153.9	6.19	157.2		
30			6.50	165.1				
36			7.88	201.2				
42			9.88	251.0			± .25	± 6.3
48			10.88	276.4				

Face-to-Face of valve installed is defined in subsection 3.2.

TABLE 4. END TO END DIMENSIONS, GROOVED END VALVES

Nominal Valve Size	End-to-End		Tolerance	
	in.	mm	in.	mm
1½	3.38	85.9	± 0.6	± 1.5
2	3.19	81.0		
2½	3.81	96.8		
3	3.81	96.8		
4	4.56	115.8		
5	5.81	147.6		
6	5.81	147.6		
8	5.25	133.4	± .13	± 3.3
10	6.25	158.8		
12	6.50	165.1		
14	7.00	177.8		
16	7.00	177.8		
18	8.00	203.2		
20	8.50	215.9		
24	10.00	254.0		

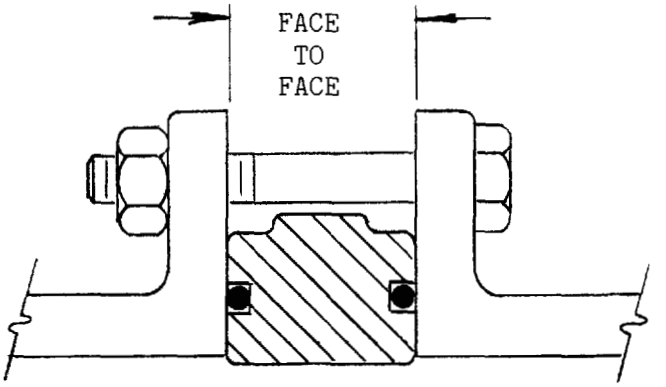

FIGURE 1A

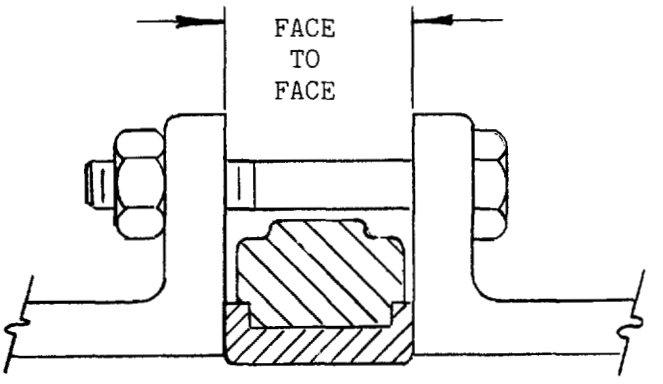

FIGURE 1B

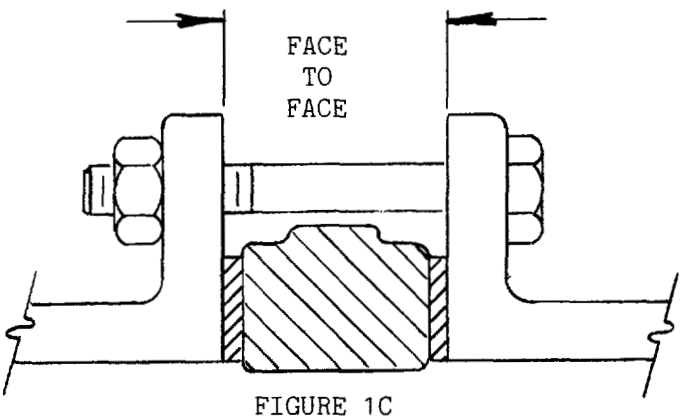

FIGURE 1C

FIGURE 1. FACE-TO-FACE, FLANGELESS AND SINGLE FLANGE VALVES

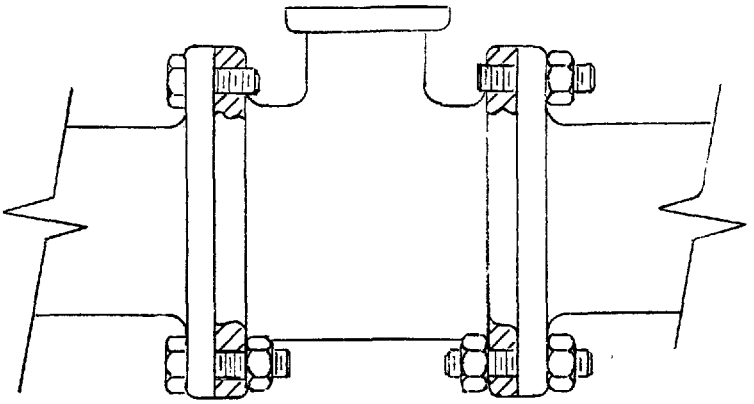

FIGURE 2. FLANGED ENDS, BOLTING OPTIONS

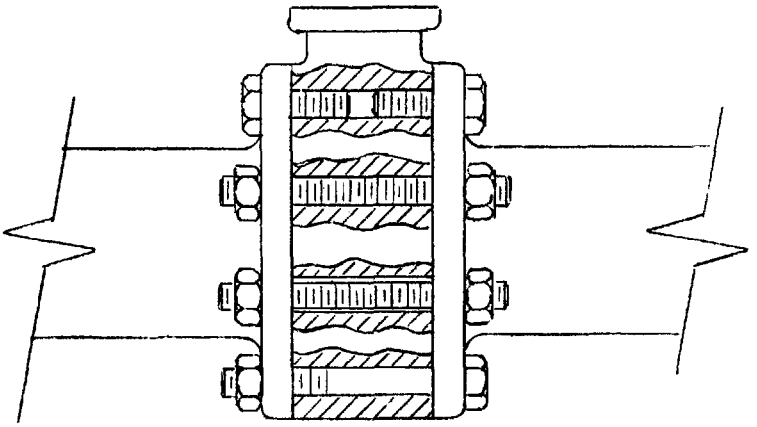

FIGURE 3. SINGLE FLANGED, BOLTING OPTIONS

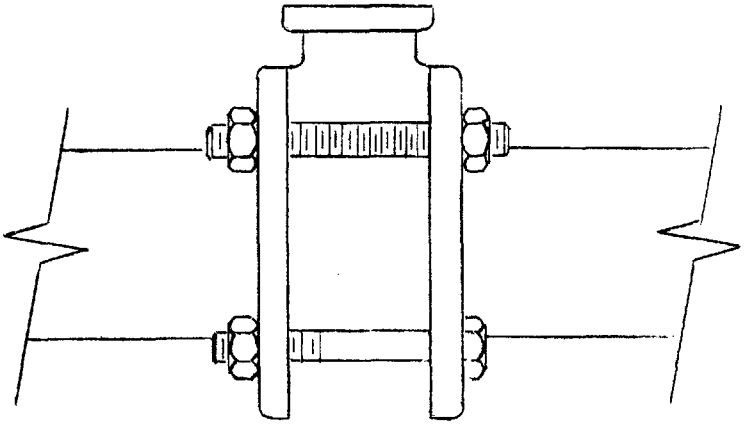

FIGURE 4. FLANGELESS, BOLTING OPTIONS

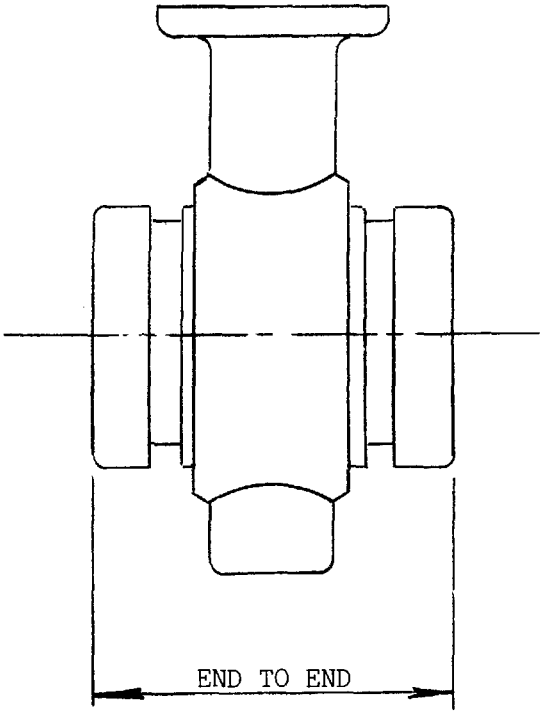

FIGURE 5. END TO END, GROOVED END VALVES

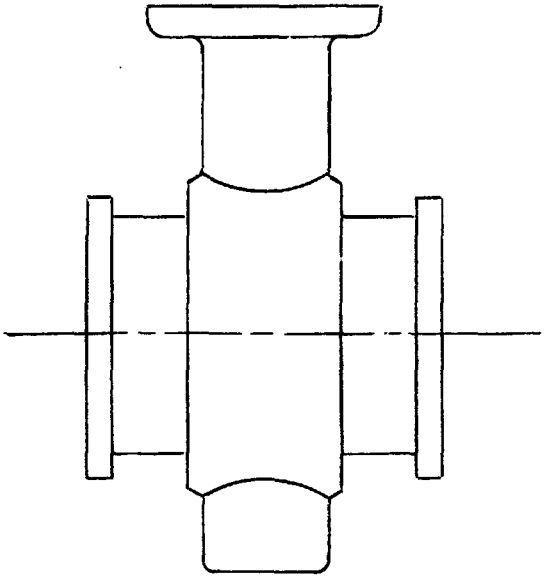

FIGURE 6. SHOULDERED END VALVES

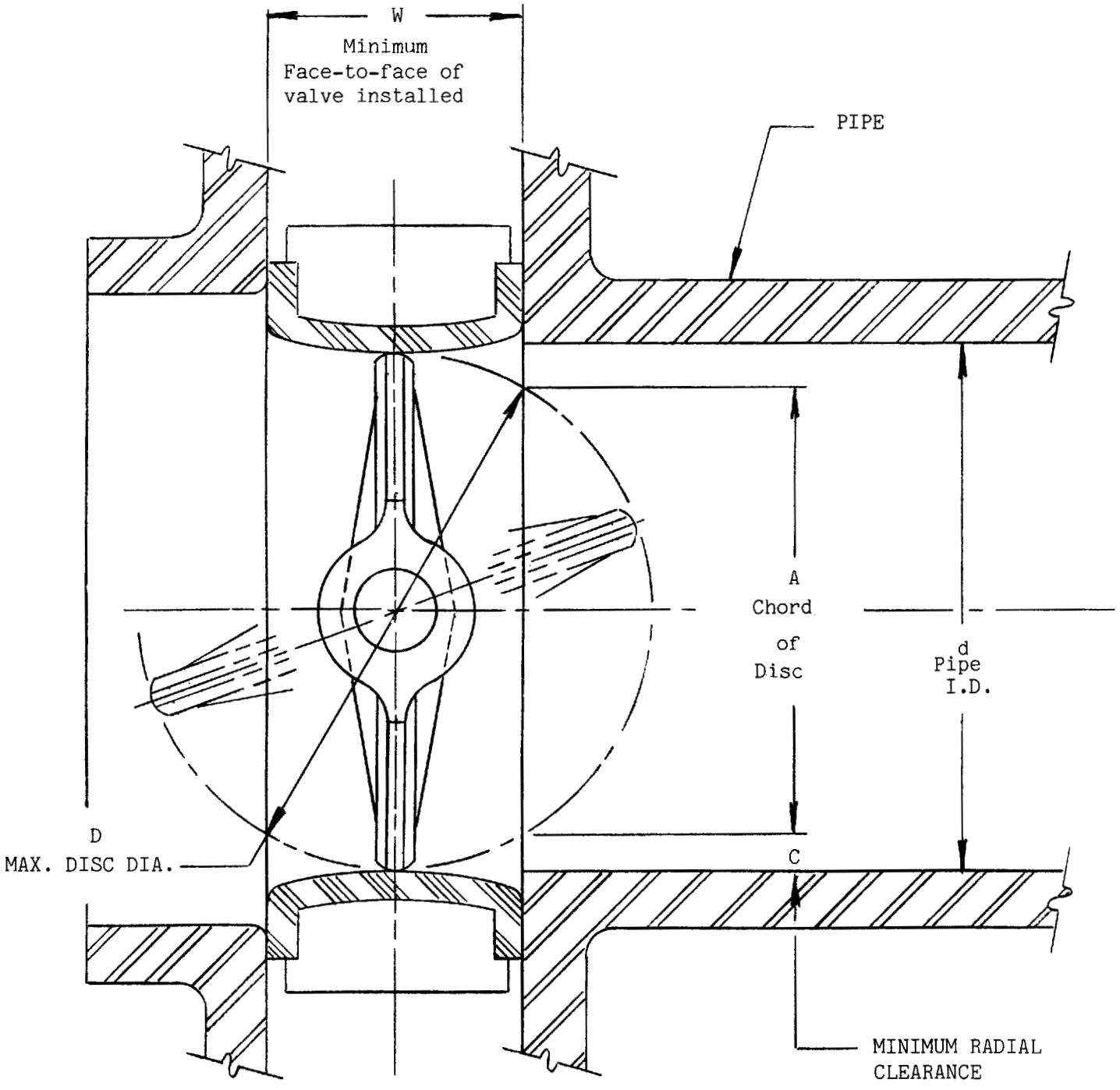

FIGURE 7. DISC TO PIPE MINIMUM CLEARANCE TYPICAL CONCENTRIC TYPE CONSTRUCTION

ANNEX A

DISC TO PIPE CLEARANCE

In accordance with paragraph 6.2 of this Standard Practice, butterfly valves shall be designed to have clearance with the inside diameters of adjacent pipe. Generally this consideration is most important with valves having single flange-lug type, flangeless-span or wafer type bodies where the face-to-face dimension of the valve body is relatively short.

Minimum clearances are shown in Table A1 of this annex.

The following equations illustrate how to calculate the clearance between a concentric type valve and adjacent pipe. See Figure A1.

$a = d - 2c$

$D = \sqrt{w^2 + a^2}$

Where:

a = Chord of disc in full open position as determined by intersection of a plane through the installed face of the valve body, in. (mm).

c = Minimum radial clearance with pipe when perfectly centered with valve (See Table A1 below), in. (mm).

d = Inside diameter of connecting pipe (Reference — Table 1), in. (mm).

D = Maximum disc diameter, in. (mm).

w = Minimum installed face-to-face, in. (mm).

Notes:

1. Above calculation assumes concentric location of disc in body. The design shall provide for the minimum radial clearance, c, for eccentric constructions.
2. Larger discs may be used for designs that provide for alignment of the pipe with the disc and it can be demonstrated by worst case calculations that the pipe will not interfere with disc rotation.
3. See Figure 7 for typical illustration of concentric type construction.

TABLE A1. DISC TO PIPE MINIMUM CLEARANCES

Valve Size (NPS)	Minimum Clearance (c) with Valve Perfectly Centered with Pipe
1½ - 6	0.06 in. (1.5 mm)
8 - 20	0.12 in. (3.0 mm)
24 - 72	0.25 in. (6.4 mm)

LIST OF MSS STANDARD PRACTICES

NUMBER	
SP- 6-1990	Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings
SP- 9-1992	Spot Facing for Bronze, Iron and Steel Flanges
SP-25-1993	Standard Marking System for Valves, Fittings, Flanges and Unions
SP-42-1990 (R 1995)	Class 150 Corrosion Resistant Gate, Globe, Angle and Check Valves with Flanged and Butt Weld Ends
SP-43-1991	Wrought Stainless Steel Butt-Welding Fittings
SP-44-1991	Steel Pipe Line Flanges
SP-45-1992	Bypass and Drain Connections
SP-51-1991 (R 1995)	Class 150 LW 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-55-1985 (R 1990)	Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components — Visual Method
SP-58-1993	Pipe Hangers and Supports — Materials, Design and Manufacture
SP-60-1991	Connecting Flange Joint Between Tapping Sleeves and Tapping Valves
SP-61-1992	Pressure Testing of Steel Valves
SP-65-1994	High Pressure Chemical Industry Flanges and Threaded Stubs for Use with Lens Gaskets
SP-67-1995	Butterfly Valves
SP-68-1988	High Pressure-Offset Seat Butterfly Valves
SP-69-1991	Pipe Hangers and Supports — Selection and Application
SP-70-1990	Cast Iron Gate Valves, Flanged and Threaded Ends
SP-71-1990	Cast Iron Swing Check Valves, Flanged and Threaded Ends
SP-72-1992	Ball Valves with Flanged or Butt-Welding Ends for General Service
SP-73-1991	Brazing Joints for Wrought and Cast Copper Alloy Solder Joint Pressure Fittings
SP-75-1993	Specifications for High Test Wrought Butt Welding Fittings
SP-77-1984 (R 1990)	Guidelines for Pipe Support Contractual Relationships
SP-78-1987 (R 1992)	Cast Iron Plug Valves, Flanged and Threaded Ends
SP-79-1992	Socket-Welding Reducer Inserts
SP-80-1987	Bronze Gate, Globe, Angle and Check Valves
SP-81-1981 (R 1986, 91)	Stainless Steel, Bonnetless, Flanged Knife Gate Valves
SP-82-1992	Valve Pressure Testing Methods
SP-83-1995	Steel Pipe Unions, Socket-Welding and Threaded
SP-84-1990	Valves — Socket-Welding and Threaded Ends
SP-85-1994	Cast Iron Globe & Angle Valves, Flanged and Threaded Ends
SP-86-1987 (R 1992)	Guidelines for Metric Data in Standards for Valves, Flanges, Fittings and Actuators
SP-87-1991	Factory-Made Butt-Welding Fittings for Class I Nuclear Piping Applications
SP-88-1993	Diaphragm Type Valves
SP-89-1991	Pipe Hangers and Supports — Fabrication and Installation Practices
SP-90-1986 (R 1991)	Guidelines on Terminology for Pipe Hangers and Supports
SP-91-1992	Guidelines for Manual Operation of Valves
SP-92-1987 (R 1992)	MSS Valve User Guide
SP-93-1987 (R 1992)	Quality Standard for Steel Castings and Forgings for Valves, Flanges, and Fittings and Other Piping Components — Liquid Penetrant Examination Method
SP-94-1992	Quality Standard for Ferritic and Martensitic Steel Castings for Valves, Flanges, and Fittings and Other Piping Components — Ultrasonic Examination Method
SP-95-1986 (R 1991)	Swage(d) Nipples and Bull Plugs
SP-96-1991	Guidelines on Terminology for Valves and Fittings
SP-97-1995	Integrally Reinforced Forged Branch Outlet Fittings — Socket Welding, Threaded and Buttwelding Ends
SP-98-1992	Protective Coatings for the Interior of Valves and Hydrants
SP-99-1994	Instrument Valves
SP-100-1988	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-105-1990	Instrument Valves for Code Applications
SP-106-1990	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-108-1991	Resilient Seated-Eccentric Cast Iron Plug Valves
SP-109-1991	Welded Fabricated Copper Solder Joint Pressure Fittings
SP-110-1992	Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
SP-111-1992	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-surfac, three-dimensional Cast Surface Comparator, which is a necessary part of the Standard. Additional comparators may be sold separately.
SP-113-1994	Connecting Joint between Tapping Machines and Tapping Valves

R-Year — Indicates year standard reaffirmed without substantive change. **Prices available upon request.**

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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