Check Valves: Flanged, Lug, Wafer, and Butt-welding

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1 Scope

This standard covers the design, materials, face-to-face dimensions, pressure-temperature ratings, inspection, examination, and testing requirements for two types of check valves.

Type “A” check valves have short face-to-face dimensions per this standard.

— The body pattern may be wafer, wafer with lugs, or double flanged.

— The obturator may be single or dual plate, swing disc, or pivoting disc.

— Body materials include gray and ductile irons, and materials included in ASME B16.34.

— See typical illustrations in Annex C, Figures C.1, C.2, C.3, C.4, and C.5.

Type “B” check valves are long pattern or short pattern with face-to-face/end-to-end dimensions per ASME B16.10.

— The body may be flanged or have butt-welding ends.

— The obturator may be swing disc or pivoting disc.

— Body materials are included in ASME B16.34.

— See typical illustrations in Annex C, Figure C.5.

Other types of check valves, such as axial disc or body/stem guided disc (center spring type) valves, nozzle-type check valves, or lift-type check valves, are not included in this standard.

This standard covers valves of the nominal pipe sizes DN:

— 50, 65, 80, 100, 125, 150, 200, 250, 300, 350, 400, 450, 500, 600, 650, 700, 750, 800, 850, 900, 950, 1000, 1050, and 1200

corresponding to nominal pipe sizes NPS:

— 2, 2½, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, and 48.

Pressure class designations include:

— 150, 300, 600, 900, 1500, and 2500 per ASME B16.34;

— 125 and 250 per ASME B16.1;

— 150 and 300 per ASME B16.42.

Information to be specified by the purchaser is shown in Annex B.

The standard nomenclature for valve parts are identified in Figures C.1 through C.5 in Annex C. These figures show typical designs only and are not to be construed as precluding other available designs that conform to the requirements of this standard.

The construction of a valve is acceptable only if it conforms to this standard in all respects.

This edition of API 594 states values in both metric (SI) and U.S. Customary units of measurement. These systems of units are to be regarded separately. The values stated in each system are not exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems constitutes nonconformance with this standard.

2 Normative References

The following referenced documents are indispensable for the application of this document. Unless otherwise cited by specific revision or date, the latest edition of the referenced documents (including any amendments) applies.

ANSI/NACE MR0103/*ISO 17945, Petroleum, petrochemical and natural gas industries — Metallic materials resistant to sulfide stress cracking in corrosive petroleum refining environments*

ANSI/NACE MR0175/*ISO 15156-1, Petroleum, petrochemical, and natural gas industries — Materials for use in H_2S-containing environments in oil and gas production*

API Standard 598, *Valve Inspection and Testing*

ASME B1.1,[1] *Unified Inch Screw Threads (UN and UNR Thread Form)*

ASME B1.13M, *Metric Screw Threads: M Profile*

ASME B16.1, *Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250*

ASME B16.5, *Pipe Flanges and Flanged Fittings*

ASME B16.10, *Face-to-Face and End-to-End Dimensions of Valves*

ASME B16.11, *Forged Fittings, Socket-Welding and Threaded*

ASME B16.14, *Ferrous Pipe Plugs, Bushings, and Locknuts with Pipe Threads*

ASME B16.25, *Buttwelding Ends*

ASME B16.34, *Valves—Flanged, Threaded, and Welding End*

ASME B16.42, *Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300*

ASME B16.47, *Large Diameter Steel Flanges; NPS 26 Through NPS 60 Metric/Inch Standard*

ASME B18.2.1, *Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)*

ASME B18.2.2, *Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)*

ASME B18.2.4.6M, *Metric Heavy Hex nuts*

ASME B18.15, *Forged Eyebolts*

ASME *BPVC, Section VIII*

ASME *BPVC, Section IX*

[1] ASME International, 2 Park Avenue, New York, New York 10016–5990, www.asme.org.

DIN 580, *Lifting eye bolts*

ISO 3266,[2] *Forged steel eyebolts grade 4 for general lifting purposes*

MSS-SP-6,[3] *Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings*

MSS-SP-25, *Standard Marking System for Valves, Fittings, Flanges, and Unions*

MSS-SP-144, *Pressure-Seal Bonnet Valves*

3 Terms and Definitions

For the purposes of this document, the following definitions apply.

3.1
class
An alphanumeric designation that is used for reference purposes relating to valve pressure-temperature capability, considering valve material mechanical properties and valve dimensional characteristics. It comprises "Class" followed by a dimensionless whole number. The number following "Class" does not represent a measurable value and is not used for calculation purposes unless specified in this standard. The allowable pressure for a valve with a class number depends on the valve material and its application temperature, and is to be found in tables of pressure-temperature ratings.

3.2
DN
An alphanumeric designation of size that is common for components used in a piping system and that is used for reference purposes. It comprises the letters "DN" followed by a dimensionless number indirectly related to the physical size of the bore or outside diameter of the end connection as appropriate. The dimensionless number following "DN" does not represent a measurable value and is not used for calculation purposes unless specified.

3.3
NPS
An alphanumeric designation of size that is common for components used in a piping system and that is used for reference purposes. It comprises the letters "NPS" followed by a dimensionless number indirectly related to the physical size of the bore or outside diameter of the end connection as appropriate. The dimensionless number may be used as a valve size identifier without the prefix "NPS." The dimensionless size identification number does not represent a measurable value and is not used for calculation purposes.

3.4
pressure-containing part
A part whose failure to function as intended results in a release of contained fluid into the environment and, at a minimum, includes bodies, end connections, bonnets/covers, and stems.

4 Pressure-temperature Ratings

4.1 Valve Rating

The pressure-temperature rating of the valve for various body materials shall be as follows:

4.1.1 Type "A" valves only:

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[2] International Organization for Standardization, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, www.iso.org.

[3] Manufacturers Standardization Society of the Valve and Fittings Industry, Inc., 127 Park Street, NE, Vienna, Virginia 22180–4602, www.mss-hq.com.

a) gray iron: the pressure-temperature rating for the applicable flange Class 125 and Class 250 as specified in ASME B16.1;

b) ductile iron: the pressure-temperature rating for the applicable flange Class 150 and Class 300 as specified in ASME B16.42;

4.1.2 Type “A” and Type “B” valves.

a) ASME B16.34, Table 1, Group 1, 2, or 3 materials: The pressure-temperature rating shall be in accordance with standard class ratings of ASME B16.34, Table 2;

b) Special materials: The pressure-temperature rating for materials not covered by ASME B16.34 shall be determined by agreement between purchaser and manufacturer.

4.2 Temperature Restrictions

4.2.1 Restrictions of temperature and concurrent pressure, or pressure and concurrent temperature (e.g., those imposed by special soft seals or special trim materials), shall be marked on the valve nameplate (see Section 8).

4.2.2 The temperature for a corresponding pressure rating is the maximum temperature of the pressure-containing body of the valve. In general, this temperature is the same as that of the contained fluid. The use of a pressure rating corresponding to a temperature other than that of the contained fluid is the responsibility of the user.

4.2.3 For temperatures below the lowest temperature listed in the pressure-temperature tables, the service pressure shall be no greater than the pressure for the lowest listed temperature. The use of valves at lower temperatures is the responsibility of the user. Consideration should be given to the loss of ductility and impact strength of many materials at low temperature.

5 Design

5.1 Body and Cover

5.1.1 The minimum body wall thickness for various materials shall be as follows:

a) Type “A” valves only:

   1) gray iron: as shown in Table 1 for Class 125 and Class 250 only;

   2) ductile iron: as shown in Table 1 for Class 150 and Class 300 only.

b) Type “A” and Type “B” valves:

   1) For materials per ASME B16.34-Table 1-Group 1, the minimum wall thickness shall be as per API 594-Table 1.

   2) For materials per ASME B16.34-Table 1-Group 2 or Group 3, the minimum wall thickness shall be as per the requirements of ASME B16.34. Other wall thicknesses exceeding these minimum wall values shall be as agreed between purchaser and manufacturer.

   3) For materials not covered by ASME B16.34, minimum wall thickness shall be as agreed between the purchaser and manufacturer.

5.1.2 The face-to-face dimensions shall be as follows:

a) Type “A” valves (including valves with ring-joint facings) shall conform to Table 2 or Table 3. Table 3 shall be used as an alternative to Table 2 for double-flanged valves if required to allow clearance for fastener assembly. The face-to-face dimensional tolerances in Table 2 shall be as specified in ASME B16.10 for sizes through DN 600 (NPS 24) and shall be ±3 mm (0.125 in.) for sizes larger than DN 600 (NPS 24).Face-to-face dimensions not provided in Table 2 or Table 3 shall be manufacturer's standard or by agreement between the purchaser and manufacturer.

b) Type “B” valves shall conform to ASME B16.10 long pattern, including stated dimensional tolerances.

c) For Type “A” or Type “B” valves, special lengths are only permitted by agreement between the purchaser and manufacturer.

Table 1—Minimum Body-wall Thickness by Class Designation

Valve Size DN (NPS)	Class							
	125	250	150	300	600	900	1500	2500
50 (2)	6.9 (0.27)	9.9 (0.39)	8.6 (0.34)	9.7 (0.38)	11.2 (0.44)	19.1 (0.75)	19.1 (0.75)	22.4 (0.88)
65 ($2^1/_2$)	6.9 (0.27)	10.9 (0.43)	9.7 (0.38)	11.2 (0.44)	11.9 (0.47)	22.4 (0.88)	22.4 (0.88)	25.4 (1.00)
80 (3)	8.4 (0.33)	12.4 (0.49)	10.4 (0.41)	11.9 (0.47)	12.7 0.50)	19.1 (0.75)	23.9 (0.94)	30.2 (1.19)
100 (4)	10.9 (0.43)	13.7 (0.54)	11.2 (0.44)	12.7 (0.50)	16.0 (0.63)	21.3 (0.84)	28.7 (1.13)	35.8 (1.41)
125 (5)	10.9 (0.43)	15.2 (0.60)	—	—	—	—	—	—
150 (6)	12.4 (0.49)	16.5 (0.65)	11.9 (0.47)	16.0 (0.63)	19.1 (0.75)	26.2 (1.03)	38.1 (1.50)	48.5 (1.91)
200 (8)	13.7 (0.54)	18.0 (0.71)	12.7 (0.50)	17.5 (0.69)	25.4 (1.00)	31.8 (1.25)	47.8 (1.88)	62.0 (2.44)
250 (10)	16.5 (0.65)	20.8 (0.82)	14.2 (0.56)	19.1 (0.75)	28.7 (1.13)	36.6 (1.44)	57.2 (2.25)	67.6 (2.66)
300 (12)	18.0 (0.71)	22.4 0.88)	16.0 (0.63)	20.6 (0.81)	31.8 (1.25)	42.2 (1.66)	66.8 (2.63)	86.6 (3.41)
350 (14)	19.6 (0.77)	24.9 (0.98)	16.8 (0.66)	22.4 (0.88)	35.1 (1.38)	46.0 (1.81)	69.9 (2.75)	—
400 (16)	22.4 (0.88)	27.7 (1.09)	17.5 (0.69)	23.9 (0.94)	38.1 (1.50)	52.3 (2.06)	79.5 (3.13)	—
450 (18)	23.6 (0.93)	30.7 (1.21)	18.3 (0.72)	25.4 (1.00)	41.4 (1.63)	57.2 (2.25)	88.9 (3.50)	—
500 (20)	24.9 (0.98)	33.3 (1.31)	19.1 (0.75)	26.9 (1.06)	44.5 (1.75)	63.5 (2.50)	98.6 (3.88)	—
600 (24)	27.7 (1.09)	36.1 (1.42)	20.6 (0.81)	30.2 (1.19)	50.8 (2.00)	73.2 (2.88)	114.3 (4.50)	—
650 (26)	—	—	21.4 (0.84)	31.6 (1.24)	—	—	—	—
700 (28)	—	—	22.2 (0.87)	33.3 (1.31)	—	—	—	—
750 (30)	32.0 (1.26)	44.5 (1.75)	23.0 (0.91)	34.9 (1.37)	60.5 (2.38)	—	—	—
800 (32)	—	—	23.8 (0.94)	36.0 (1.41)	—	—	—	—

Table 1—Minimum Body-wall Thickness by Class Designation (Continued)

Valve Size DN (NPS)	Class							
	125	250	150	300	600	900	1500	2500
850 (34)	—	—	24.6 (0.97)	38.1 (1.50	—	—	—	—
900 (36)	36.1 (1.42)	52.8 (2.08)	25.4 (1.00)	39.96 (1.56)	70.4 (2.77)	—	—	—
950 (38)	—	—	26.1 (1.03)	41.3 (1.63)	—	—	—	—
1000 (40)	—	—	27.0 (1.06)	43.0 (1.69)	—	—	—	—
1050 (42)	40.1 (1.58)	61.2 (2.41)	27.7 (1.09)	44.4 (1.75)	80.0 (3.15)	—	—	—
1200 (48)	44.4 (1.75)	69.3 (2.73)	30.2 (1.19)	49.5 (1.95)	—	—	—	—

NOTE 1 The wall thickness shown for Class 125 and Class 250 conform to those in ASME B16.1, except for DN 900, 1050, and 1200 (NPS 36, 42, and 48), Class 250, which have been extrapolated. The wall thicknesses shown for Class 150 to Class 2500 for sizes through DN 1050 (NPS 42) conform to those in API Standard 600. The wall thickness for DN 1200 (NPS 48) is extrapolated from API Standard 600.
NOTE 2 Dimensions in mm (in.)

Table 2—Face-to-Face Dimensions by Class Designation for Type "A" Wafer and Lug Valves

Valve Size DN (NPS)	Class							
	125	250	150	300	600	900	1500	2500
50 (2)	54 (2.12)	54 (2.12)	60 (2.38)	60 (2.38)	60 (2.38)	70 (2.75)	70 (2.75)	70 (2.75)
65 ($2^1/_2$)	60 (2.38)	60 (2.38)	67 (2.62)	67 (2.62)	67 (2.62)	83 (3.25)	83 (3.25)	83 (3.25)
80 (3)	67 (2.62)	67 (2.62)	73 (2.88)	73 (2.88)	73 (2.88)	83 (3.25)	83 (3.25)	86(3.38)
100 (4)	67 (2.62)	67 (2.62)	73 (2.88)	73 (2.88)	79 (3.12)	102 (4.00)	102 (4.00)	105 (4.12)
125 (5)	83 (3.25)	83 (3.25)	—	—	—	—	—	—
150 (6)	95 (3.75)	95 (3.75)	98 (3.88)	98 (3.88)	136 (5.38)	159 (6.25)	159 (6.25)	159 (6.25)
200 (8)	127 (5.00)	127 (5.00)	127 (5.00)	127 (5.00)	165 (6.50)	206 (8.12)	206 (8.12)	206 (8.12)
250 (10)	140 (5.50)	140 (5.50)	146 (5.75)	146 (5.75)	213 (8.38)	241 (9.50)	248 (9.75)	254 (10.00)
300 (12)	181 (7.12)	181 (7.12)	181 (7.12)	181 (7.12)	229 (9.00)	292 (11.50)	305 (12.00)	305 (12.00)
350 (14)	184 (7.25)	222 (8.75)	184 (7.25)	222 (8.75)	273 (10.75)	356 (14.00)	356 (14.00)	—
400 (16)	191 (7.50)	232 (9.12)	191 (7.50)	232 (9.12)	305 (12.00)	384 (15.12)	384 (15.12)	—
450 (18)	203 (8.00)	264 (10.38)	203 (8.00)	264 (10.38)	362 (14.25)	451 (17.75)	468 (18.44)	—
500 (20)	213 (8.38)	292 (11.50)	219 (8.62)	292 (11.50)	368 (14.50)	451 (17.75)	533 (21.00)	—
600 (24)	222 (8.75)	318 (12.50)	222 (8.75)	318 (12.50)	438 (17.25)	495 (19.50)	559 (22.00)	—

Table 2—Face-to-Face Dimensions by Class Designation for Type "A" Wafer and Lug Valves (Continued)

Valve Size DN (NPS)	Class							
	125	250	150	300	600	900	1500	2500
650 (26)	222 (8.75)	-—	222 (8.75)	318 (12.50)	—	—	—	—
700 (28)	—	—	305 (12.00)	368 (14.50)	—	—	—	—
750 (30)	305 (12.00)	368 (14.50)	305 (12.00)	368 (14.50)	505 (19.88)	635 (25)—	—	—
800 (32)	—	—	356 (14.00)	368 (14.50)	—	—	—	—
850 (34)	—	—	—	—	—	—	—	—
900 (36)	368 (14.50)	483 (19.00)	368 (14.50)	483 (19.00)	635 (25.00)	—	—	—
950 (38)	—	—	—	—	—	—	—	—
1000 (40)	—	—	432 (17.00)	546 (21.50)	—	—	—	—
1050 (42)	432 (17.00)	568 (22.38)	432 (17.00)	568 (22.38)	702 (27.62)	—	—	—
1200 (48)	524 (20.62)	629 (24.75)	524 (20.62	629 (24.75)	—		—	—

NOTE 1 Face-to-face dimensions that are not provided in Table 2 shall be the manufacturer's standard or by agreement between the purchaser and manufacturer.
NOTE 2 Dimensions in mm (in.)

Table 3—Alternative Face-to-Face Dimensions by Class Designation for Type "A" Double-flanged Valves

Valve Size DN (NPS)	Class					
	150	300	600	900	1500	2500
50 (2)	114 (4.50)	114 (4.50)	121 (4.75)	165 (6.50)	165 (6.50)	225 (8.87)
80 (3)	121 (4.75)	121 (4.75)	143 (5.63)	165 (6.50)	207 (8.12)	280 (11.00)
100 (4)	121 (4.75)	121 (4.75)	165 (6.50)	197 (7.75)	225 (8.87)	330 (13.00)
150 (6)	130 (5.12)	130 (5.12)	194 (7.63)	219 (8.63)	292 (11.37)	454 (17.87)
200 (8)	[a]	152 (6.00)	219 (8.63)	254 (10.00)	340 (13.37)	489 (19.25)
250 (10)	[a]	178 (7.00)	244 (9.63)	267 (10.50)	387 (15.25)	622 (24.50)
300 (12)	[a]	[a]	[a]	[a]	435 (17.12)	686 (27.00)
350 (14)	[a]	[a]	[a]	[a]	476 (18.75)	—
400 (16)	[a]	[a]	[a]	[a]	537 (21.15)	—

Table 3—Alternative Face-to-Face Dimensions by Class Designation for Type "A" Double-flanged Valves (Continued)

Valve Size DN (NPS)	Class					
	150	300	600	900	1500	2500
450 (18)	[a]	[a]	[a]	[a]	565 (22.25)	—
500 (20)	[a]	[a]	[a]	[a]	629 (24.75)	—
600 (24)	[a]	[a]	[a]	[a]	733 (28.87)	—

NOTE 1 Table 3 provides face-to-face dimensions that shall be used as an alternative to Table 2 for double-flanged valves if required to allow clearance for fastener assembly.
NOTE 2 Face-to-face dimensions that are not provided in Table 3 shall be the manufacturer's standard or by agreement between the purchaser and manufacturer.
NOTE 3 Dimensions in mm (in.)

[a] Dimensions are the same as wafer and lug designs in Table 2.

5.1.3 For Type "A" valves, the purchase order shall specify whether the body type shall be wafer, lug, or double flanged; for Type "B" valves, the purchase order shall specify whether the body type shall be flanged or butt-welding.

5.1.3.1 End and cover flanges shall be integrally cast or forged with the body.

5.1.3.2 Flanges may be attached by full penetration butt-welding if agreed to by the purchaser, in which case flanges shall conform to ASME B16.5 or ASME B16.47 and have butt-welding ends for use without backing rings.

5.1.3.3 Flanges for iron valves shall only be the integral type.

5.1.3.4 Welding a flange to a valve body shall be by full penetration butt-welding. The welding procedure and the welder or welding operator shall be qualified in accordance with ASME BPVC, Section IX. Valves that have flanges attached by welding shall meet the requirements of paragraph 2.1.6 of ASME B16.34.

5.1.3.5 Integral or other alignment rings (centering backing rings) used to facilitate welding shall be completely removed after the weld is completed.

5.1.4 Type "A" valves larger than DN 600 (NPS 24) in classes 150, 300, and 600 shall have body-flange bolt patterns suitable for the lug or double-flanged type, outside diameters suitable for the wafer type, and gasket surface dimensions compatible with the flange standards specified in the purchase order.

5.1.5 Flange faces with ring-joint grooves shall conform to the dimensions shown in either ASME B16.5 or ASME B16.47 Series "A", as applicable.

5.1.6 Flange-facing finishes shall be:

a) Type "A" valves only: Gray iron and ductile iron valves shall be finished as specified in MSS SP-6.

b) Type "A" and Type "B" valves: ASME B16.34, Table 1, Group 1, 2, or 3 valves shall be finished as specified in ASME B16.5 or ASME B16.47 Series "A", as applicable.

5.1.7 Auxiliary connections are required only when specified by the purchaser:

a) Type "A" gray iron and ductile iron valves: The size, type, and location of auxiliary connections shall be the manufacturer's standard unless otherwise agreed by the manufacturer and the purchaser.

b) Type "A" ASME B16.34, Table 1, Group 1, 2, or 3 valves: Auxiliary connections shall conform to the requirements of ASME B16.34. The location and designation of auxiliary connections shall be the manufacturer's standard.

c) Type "B" valves: For ASME B16.34, Table 1, Group 1, 2, or 3 valves, auxiliary connections shall conform to the requirements of ASME B16.34. The location and designation of auxiliary connections shall be per ASME B16.34.

5.1.8 The valve may have either an integral or a removable seat ring. Sealing compounds or greases shall not be used when assembling seat rings; however, a light lubricant that has a viscosity no greater than kerosene may be used to prevent galling of mating threaded surfaces. Separate seats shall be secured against loosening.

5.1.9 Tapped test openings are permitted only if specified in the purchase order. The tap shall not be larger than DN 15 (NPS $^1/_2$) if a tap is made in the body for testing the valve. After testing, the tapped hole shall be fitted with an ASME B16.11 or ASME B16.14 threaded solid round or hex-head plug. The test tap shall conform with ASME B16.34.

5.1.10 For Type "A" and Type "B" valves, a tapped blind hole shall be provided in the body, cover, or cap of valves that are either DN 250 (NPS 10) or larger, or weigh more than 23 kg (50 lb), for attachment of an eye bolt or equivalent lifting device. The hole shall be tapped with a coarse (UNC) class 2B thread, conforming to ASME B1.1 class 2B (U.S. customary) or ASME B1.13M class 6g (metric). Eyebolts specified in the purchase order shall conform to ASME B18.15 (U.S. customary) or either ISO 3266 or DIN 580 (metric).

5.1.11 Unless otherwise specified in the purchase order, for Type "A" valves, the lugs of lug-type valves and flanges of double-flanged type valves shall be provided with non-threaded (drilled) bolt clearance holes. If the manufacturer determines there is inadequate clearance for holes through the lug due to the proximity of the hinge pin or other internal component, tapped blind holes may be supplied at these locations only. Tapped holes in the lugs shall comply with the following:

a) Tapped lug holes for bolts 1 in. or less in diameter shall be drilled and tapped in accordance with ASME B1.1, coarse-thread series, class 2B. For bolts $1^1/_8$ in. or more in diameter, such holes shall be drilled and tapped in accordance with ASME B1.1, eight-thread series, class 2B.

b) Each hole shall be fully tapped, using at least three tapping steps, including taper, plug, and bottoming taps.

c) The finished threaded bolt holes shall have full undamaged threads to a depth at least equal to the nominal bolt diameter.

d) The manufacturer shall specify the minimum depth of full undamaged threads.

5.1.12 Type "B" valves shall have a bolted flat or dished cover design that meets the requirements of ASME BPVC, Section VIII, Division1.

Gasket contact surfaces shall be free of sealing compounds. A light coating of a lubricant, no heavier than kerosene, may be applied if needed to assist in proper gasket assembly.

5.1.13 If a valve design utilizes a stem that extends beyond the pressure boundary, stem retention shall be in accordance with ASME B16.34. The design shall not rely on actuation components (e.g., gear operators, actuators, levers, etc.) to prevent ejection.

5.1.14 Type "B" swing check valves shall be equipped with a single-contact stop point to prevent the possibility of the disc getting stuck in the open position.

5.1.15 Type "B" valves: Cover and cover flanges shall be circular, except for DN 50 and DN 65 (NPS 2 and NPS $2^1/_2$), which may be of noncircular design.

5.2 Bonnet-to-body Joint

5.2.1 The body-to-cover joint shall be a flange and gasket type.

5.2.2 For Class 150 valves, the bonnet-to-body joint shall be one of the following types illustrated in ASME B16.5 and ASME B16.47:

— flat face;

— raised face;

— tongue and groove;

— spigot and recess (i.e., male and female);

— ring joint.

5.2.3 Except for Class 150, the gasket shall not extend beyond the inner edge of the bolt holes.

5.2.4 The body-to-cover joint of Type “B” valves shall have at least four through-type bolts of the following minimum sizes:

a) M10 or $^{3}/_{8}$ in. when 50 ≤ DN ≤ 65 (2 ≤ NPS ≤ $2^{1}/2$);

b) M12 or $^{1}/_{2}$ in. when 80 ≤ DN ≤ 200 (3 ≤ NPS ≤ 8);

c) M16 or $^{5}/_{8}$ in. when DN ≥ 250 (NPS ≥ 10).

The total cross-sectional area of the bolts shall be in accordance with the requirements of ASME B16.34.

5.2.5 If pressure seal bonnet design is specified, 5.2.1 through 5.2.4 are not applicable. In addition, the bonnet joint construction shall be in accordance with MSS SP-144 Style B unless otherwise specified by the purchaser.

5.3 End Connections

5.3.1 Type “A” valves:

a) gray iron: flanges in classes 125 and 250 as specified in ASME B16.1;

b) ductile iron: flanges in classes 150 and 300 as specified in ASME B16.42;

c) ASME B16.34, Table 1, Group 1, 2, or 3 materials:

   — Class 150 through Class 1500 in sizes DN 50 (NPS 2) up to and including DN 600 (NPS 24), and Class 2500 in sizes DN 50 (NPS 2) up to and including DN 300 (NPS 12), shall be as specified in ASME B16.5.

   — Class 150 through Class 900 for sizes DN 650 (NPS 26) and larger shall be as specified in ASME B16.47 Series “A”. ASME B16.47 Series “B” is acceptable with agreement by the purchaser.

5.3.2 Type “B” valves:

a) ASME B16.34, Table 1, Group 1, 2, or 3 materials:

   — Class 150 through 2500 in sizes up to and including DN 600 (NPS 24) shall be as specified in ASME B16.5.

— Class 150 through Class 900 for sizes DN 650 (NPS 26) and larger shall be as specified in ASME B16.47 Series “A”.

— Butt-welding ends shall be as specified in ASME B16.25.

5.3.3 Butt-welding ends shall conform to the requirements of ASME B16.25 for the bore specified for use without backing rings.

5.3.4 Conversion of a flanged end to a butt-welding end is not permitted, except by agreement between the purchaser and manufacturer.

5.4 Plates and Discs

5.4.1 Valves are classified as follows:

a) A single-plate valve has a plate or disc that closes the valve when flow reversal or gravity forces the plate or disc against the valve-body seat. This closure may be aided using springs or other devices. The single plate or disc may have a swinging action, mounted at a pivot point, or a linear action, where the plate or disc is guided. Springs may also be used to assist closure.

b) A dual-plate valve has plates that close the valve with the assistance of one or more springs if flow reversal forces the plates against the valve-body seat.

5.4.2 For Type “A” single-plate valves and Type “B” valves, if a nut is used to assemble the disc or plate to the hinge arm, the nut shall be positively secured to prevent separation of the connecting parts; the use of a fillet weld, lock washer, or lock nut are not acceptable means for positively securing the nut.

5.4.3 The closure assembly materials and design shall not limit the overall corrosion resistance of the valve.

5.4.4 The disc assembly design shall limit disc rotation to less than 360 degrees.

5.5 Seating Surfaces

5.5.1 The body and plate or disc seating surfaces may be of the following construction:

— integral;

— deposited weld material with a minimum finished thickness of 1.6 mm (0.060 in.);

— high-velocity oxygen fuel deposited coating;

— mechanically retained metal;

— resilient material.

5.5.2 On Type “A” single-plate valves and Type “B” valves, a resilient seal ring may be fitted either to the body or plate or disc seat as specified by the purchaser. The body and plate or disc seating surfaces shall be designed to give a full metal-to-metal seal even if the resilient seal is completely missing.

5.5.3 Welding is not permitted on gray iron or ductile iron.

5.5.4 Brazing is permitted on gray iron and ductile iron only for attaching seating surfaces to the body or the plate, and only if agreed to by the purchaser and the manufacturer. Furnace brazing is the only type of brazing permitted and may be used only if the parts are heated under closely controlled conditions in a uniform manner, and to a temperature no higher than the lower critical temperature of the base material. Cooling shall be in the furnace or in still air.

5.6 External Bolts and Threaded Holes

5.6.1 Bolting shall be standard inch-series bolting unless the purchaser specifies metric-series bolting. Bolts and threaded holes with a diameter of 1 in. or smaller shall have coarse (UNC) threads or the most nearly corresponding metric threads. Those larger than 1 in. in diameter shall be of the eight-thread series (8 UN) or the most nearly corresponding metric threads. Bolt threads shall be Class 2A, and nut threads shall be Class 2B. Unified inch threads shall conform to ASME B1.1 and metric threads to ASME B1.13M.

5.6.2 For Type "B" valves, cover flange bolts shall be continuously threaded stud bolts with heavy, semifinished hexagon nuts conforming to the requirements of ASME B18.2.2 or ASME B18.2.4.6M. Hex bolts or cap screws conforming to ASME B18.2.1 may also be used for DN 65 (NPS $2^{1}/_{2}$) and smaller valves. Hex bolts and cap screws shall be suitable for external wrenching only.

5.6.3 Bolting and other valve components shall not be cadmium plated.

5.7 Flow Indication

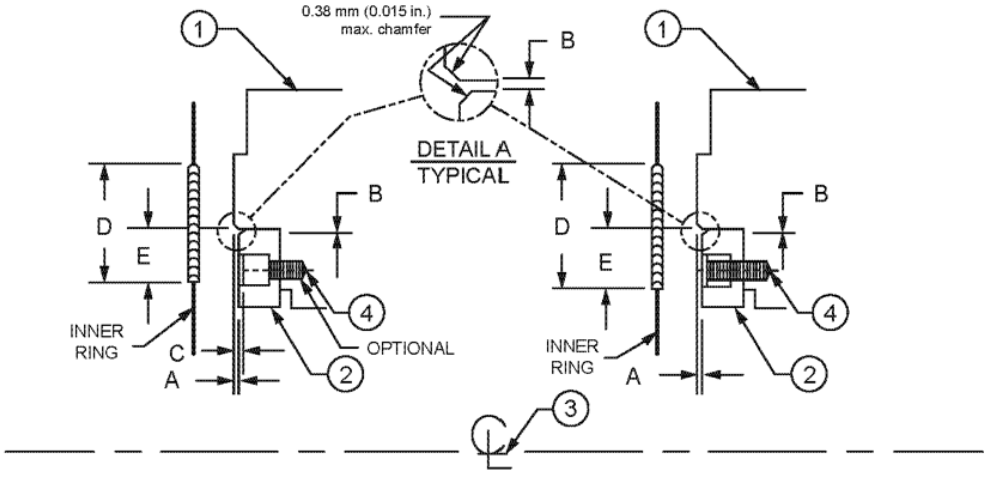
The valve body shall have a clearly visible cast, forged, machined-in, or die-stamped arrow to indicate the direction of flow through the valve.

5.8 Gasket Surface

5.8.1 Gasket Seating Surface Interruptions

Fasteners in the flange seating surface shall be recessed to or below the flange gasket level. Interruptions in the seating area of a centered ASME B16.20 spiral-wound gasket for valve sizes DN 150 (NPS 6) and larger shall not exceed the limitations given in Figure 1. The permissible surface interruptions on smaller-size valves shall be as agreed between purchaser and manufacturer, but shall not exceed 50 % of the gasket seating width.

NOTE The degree of interruption may affect the sealing ability of a spiral-wound gasket.



(A) HALF MOON RETAINER DESIGN (B) 360° RETAINER RING DESIGN

Dimension	Definition	Range, mm	Range, in.
A	Protrusion of seat retainer plate above valve body face (after being compressed by mating flange). Negative value denotes insert below valve body face.	+0.00 to –0.25	+0.000 to –0.010
B	Radial width of annular gap between valve body and seat retainer plate (exclusive of chamfer).	0.76 max.	0.030 max.
C	Distance of screw head below face of seat retainer plate.	0.00 to 1.27	0.000 to 0.050
D	Width of sealing area of spiral-wound gasket for valve's size and rating.	—	—
E	Distance gasket sealing area overlaps fastener opening in face of seat retainer plate (may occur at the ID or OD of the gasket).	35 % of D maximum	

Figure 1—Limitations for Flange Face Interruptions That Fall Within the Gasket Seating Area

6 Material

6.1 Body and Cover

The body of Type “A” valves and the body and cover of Type “B” valves shall be made of a material conforming to a purchaser-selected material specification listed in the applicable ASME standard as referenced in 4.1.

6.2 Plate and Disc

6.2.1 The plate or disc material shall have a corrosion resistance at least equal to that of the body material.

6.2.2 The plates shall be renewable.

6.3 Cover Gasket (Type “B” Valves)

6.3.1 The cover flange gasket shall be:

a) solid metal, corrugated or grooved (profiled) metal gasket with graphite facing;

b) metal ring joint;

c) spiral-wound metal gasket with filler and a centering/compression ring;

d) spiral-wound metal gasket with filler, to be used in a body to cover joint design that provides gasket compression control.

For Class 150, the following are also acceptable:

a) corrugated metal insert with graphite facings;

b) if approved by the purchaser, a flexible graphite sheet, reinforced with a metal insert in the flat, perforated, tanged, or corrugated configuration;

c) if approved by the purchaser, other suitable facings may be used.

6.3.2 The metallic portion of the gasket exposed to the service environment shall be made of a material that has corrosion resistance at least equal to the body.

6.3.3 Unless otherwise specified in the purchase order, the gasket shall be suitable for the pressure rating of the valve within a valve design temperature range from –29 °C (–20 °F) to 427 °C (800 °F).

6.4 Trim

6.4.1 The trim includes the following:

a) body or seat ring seating surfaces;

b) plate or disc seating surfaces;

c) hinge pin (contained within the pressure boundary).

6.4.2 Metallic seating surface material shall be the manufacturer’s standard; that may be the same as the body material. If specific trim is requested, it shall be as shown in Table 4. The typical specifications in Table 4 represent some acceptable grades. Ni-Cr materials (Trim 5A) shall have the manufacturer’s standard hard facing.

6.4.3 The base material of the valve disc shall be of a nominal material composition equal to the body, except for disc material made of solid trim material.

6.4.4 Resilient seat material, if required, shall be specified by the purchaser, and if located in the body, an overlay in the seat area is not required unless otherwise specified in the purchase order.

Table 4—Seating-surface and Hinge Pin Nominal Trim Material

Trim No.	Nominal Trim	Seat Surface Material Type	Seat Surface Typical Specification Grade			Hinge Pin	
			Cast	Forged	Welded	Material Type	Typical Specification Type
1	F6	13 Cr	ASTM A217 (CA15)	ASTM A182 (F6)	AWS A5.9 (ER410)	13 Cr	ASTM A276-T410
2	304	18 Cr-8 Ni	ASTM A351 (CF8)	ASTM A182 (F304)	AWS A5.9 (ER308)	18 Cr-8Ni	ASTM A276-T304
5	Hard-faced	Co-Cr-A	N/A	N/A	AWS A5.13 (E or R Co-Cr-A)	13 Cr	ASTM A276-T410
5A	Hard-faced	Ni-Cr	N/A	N/A	Manufacturer's standard	13 Cr	ASTM A276-T410
8	F6 and hard-faced	13 Cr Co-Cr-A	ASTM A217 (CA15) N/A	ASTM A182 (F6) N/A	AWS A5.9 (ER410) AWS A5.13 (E or R Co-Cr-A)	13 Cr	ASTM A276-T410
9	Monel	Ni-Cu alloy	ASTM A494 (M-35–1)	ASTM B564 (UNS N04400)	Manufacturer's standard	Ni-Cu alloy	Manufacturer's standard
10	316	18 Cr-8 Ni-Mo	ASTM A351 (CF8M)	ASTM A182 (F316)	AWS A5.9 (ER316)	18 Cr-8 Ni-Mo	ASTM A276-T316
12	316 and hard-faced	18 Cr-8 Ni-Mo Trim 5 or 5A	ASTM A351 (CF8M)	ASTM A182 (F316)	AWS A5,9 (ER316) Trim 5 or 5A	18 Cr-8 Ni-Mo	ASTM A276-T316
13	Alloy 20	19 Cr-29 Ni	ASTM A351 (CN7M)	ASTM B473	AWS A5.9 (ER320)	19 Cr-29 Ni	ASTM B473
14	Alloy 20 and hard-faced	19 Cr-29 Ni Trim 5 or 5A	ASTM A351 (CN7M)	ASTM B473	AWS A5.9 (ER320) Trim 5 or 5A	19 Cr-29 Ni	ASTM B473
16	Hard-faced	Co-Cr-A[a]	NA	NA	AWS A5.13 ECoCr-A or AWS A5.21 ERCoCr-A	18Cr-8NiMo	ASTM A276-T316
AA	Bronze	Bronze		Manufacturer's standard	—	—	—

NOTE 1 AWS A5.13 ECoCr-A or AWS A5.21 ERCoCr-A: This classification includes such trademark materials as Stellite 6™ *, Stoody 6™ * and Wallex 6™ *. For plasma transfer arc welding (PTAW), process powder with the metallurgy equivalent to UNS R30006 can also be used. CoCr-E (Stellite 21™ * or equal) may be used only with purchaser approval. Typical CoCr-E alloys include AWS A5.13 ECoCr-E or AWS A5.21 ERCoCr-E. Trademarks are examples only and do not constitute an endorsement of this product by API.
NOTE 2 Monel is used strictly as an example of any nickel-copper alloy 400 matching UNS N04400 specifications. It does not constitute any endorsement of any specific product or company by API.

6.5 Springs

Unless otherwise specified in the purchase order, the spring material shall be as follows:

a) For valves rated for temperatures of 315 °C (600 °F) and above, spring material shall be nickel-chromium alloy UNS N07750.

b) For valves rated for temperatures below 315 °C (600 °F), the spring material shall be the manufacturer's standard.

6.6 Other Internal Wetted Parts

The material specifications of internal wetted parts not otherwise specified in this standard shall have nominal chemical composition and corrosion-resistance properties similar or superior to those of the body. This applies to internal parts (e.g., hinges, hinge arms, bolts, and bearings) that, by design, encounter the process fluid in their normal function.

6.7 Removable Parts

6.7.1 Separate removable valve parts shall be positively secured against loosening.

6.7.2 Spring tension pins shall not be used.

6.8 Pipe Plugs and Pin Retainers

6.8.1 Any pipe plug and pin retainers shall be solid, be compatible with the valve body, and be made from a material with corrosion resistance equivalent to or better than the body material.

6.8.2 Materials for internal retaining components shall be made from a material with corrosion resistance equivalent to or better than the hinge pin material.

6.8.3 Threaded pipe plugs used as pin retainers on Type "B" valves shall be seal welded. The material used for seal welding shall provide the same corrosion resistance as the valve body material.

6.8.4 Welding on threaded pipe plugs used as pin retainers on Type "B" valves, including any associated post-weld heat treatment, shall be performed using qualified welders and established procedures in accordance with ASME Section IX and the principles of Part D of ASME Section II, Appendix A.

6.9 AAMP (Association for Materials Protection and Performance) Compliance

6.9.1 If specified in the purchase order, the body, cover, trim, and other internal wetted parts shall comply with ANSI/NACE MR0103/ISO 17945 or ANSI/NACE MR0175/ISO 15156–1.

6.10 Nameplate

The nameplate shall be austenitic stainless steel or nickel alloy, and shall be attached to the valve body by pins or welding. The pin material used for attachment shall be similar to the nameplate.

7 Inspection, Examination, Testing, and Repair

7.1 Inspection and Examination

7.1.1 The valve manufacturer shall examine each valve to assure compliance to this standard.

7.1.2 Inspection and examination shall be in accordance with API 598.

7.2 Pressure Tests

Each valve shall be pressure tested in accordance with API 598.

7.3 Repair of Defects

7.3.1 Defects in the body and cover of a cast or forged ASME B16.34 Group 1, 2 or 3 materials valve may be repaired as permitted by the most nearly applicable ASTM cast or forged material specification listed in ASME B16.34.

7.3.2 The repair of defects in gray iron or ductile iron castings, by methods such as welding, brazing, plugging, or impregnation, is not permitted.

8 Marking

Nameplates (see 6.10) of valves made that conform to this standard shall be marked “API 594” and shall also be marked as follows:

a) For a valve in accordance with ASME B16.34, marking shall be in accordance with that standard.

b) For a valve made of other materials, marking shall be in accordance with MSS SP-25.

c) If valve rating is limited by construction details or material considerations as described in 4.2, such limited rating shall be marked on the nameplate.

9 Shipment

9.1 Coatings

9.1.1 For ASME B16.34, Table 1, Group 1 materials, un-machined exterior body surfaces shall be painted using the manufacturer’s standard rust preventative paint.

9.1.2 For ASME B16.34, Table 1, Group 2 and Group 3 materials, external painting of the body is not required unless specified by the purchaser.

9.1.3 Machined or threaded surfaces of materials that are not rust-resistant shall be coated with easily removable rust preventative.

9.1.4 All coatings and/or paints shall not contain lead.[4]

9.2 Valve Openings

9.2.1 Valve ends shall be protected to prevent damage to the gasket surfaces and valve internals during shipment and storage. The valve shall be individually packaged or supplied with protective covers. Protective covers shall be wood, wood fiber, plastic, or metal, and securely attached to the valve ends. The covers shall be designed to fully protect the sealing surfaces and in a way that the valves cannot be installed without complete removal of the covers.

9.2.2 All threaded connections in the valve body shall be supplied with solid, fully tightened plugs conforming to ASME B16.11 or ASME B16.14. Gray iron or malleable iron plugs shall only be used on gray iron or ductile iron valves, respectively.

9.2.3 Non-spring-assisted check valves shall be shipped with the disc secured or supported during transport. A warning label shall be attached to the protective cover with instructions to remove, prior to installation, material from inside the valve that secures or supports the disc.

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[4] “Lead-free” is defined by the Consumer Product Safety Act, CPSA 15 USC 2057–8, 1978, as less than 0.06 % (600 ppm by dry weight).

9.3 Packaging

9.3.1 If export packaging is not specified in the purchase order, valves may be shipped loose, palletized, or packed in a box or crate. Valves shall be packaged to prevent damage during shipment.

9.3.2 If the purchase order specifies export packaging, valves shall be shipped in wooden boxes or crates, individually or collectively, and packed to prevent them from shifting within the package (the shipping agent representing the purchaser will normally provide detailed instructions).

Annex A
(informative)

API Monogram Program Use of the API Monogram by Licensees

The information in this annex has been intentionally removed.

See API Specification Q1 (Annex A) or the API website for information pertaining to the API Monogram Program and use of the API Monogram on applicable products.

Annex B
(informative)

Information to be Specified by the Purchaser

NOTE Numbers in brackets are references to clauses or subsections of this standard.

1) Supplemental requirements of this standard shall be specifically stated in the purchase order.

2) If no supplemental requirements are to be taken to this standard, the purchase order only needs to refer to API 594 and to specify the items in the following list that are marked with an asterisk (*). The items listed below without an asterisk are options that may also be specified:

   a) valve size * [Section 1, (Scope)];

   b) pressure class * [Section 1, (Scope)];

   c) for valve sizes DN 650 (NPS 26) and over, specify ASME B16.47 Series “A” or “B” (5.3);

   d) wafer, lug, double flange, flanged, or butt-welding body type * (5.1.3);

   e) material of the valve body * (6.1);

   f) seating surface material* (6.4.2);

   g) nominal trim material * (6.4.1);

   h) type “A,” single plate, or dual plate * (5.4);

   i) facing requirements, flanged, ring joint, or butt-weld * (5.1.6);

   j) design temperature for proper spring selection * (6.5);

   k) auxiliary connections and openings (5.1.7);

   l) tapped test openings (5.1.9);

   m) cover gasket and/or cover flange facing [6.3];

   n) lifting eyebolts (5.1.10);

   o) integral seating or removable seat ring (5.1.8);

   p) flange bolt holes threaded (5.1.11);

   q) any required exceptions to the manufacturer’s permissible options (e.g., NACE MR 0103, NACE MR 0175/ISO 15156);

   r) welded plug, pin retainers (6.8);

   s) inspection by purchaser (7.1.2);

   t) color and coatings (9.1);

   u) recommended spare parts list;

v) supplementary examination and testing (Section 7);

w) export packaging (9.3);

3) Items where agreement with the manufacturer is required:

a) gasket surface interruptions, for 50 ≤DN ≤ 125 (2 ≤ NPS ≤ 5) (5.8);

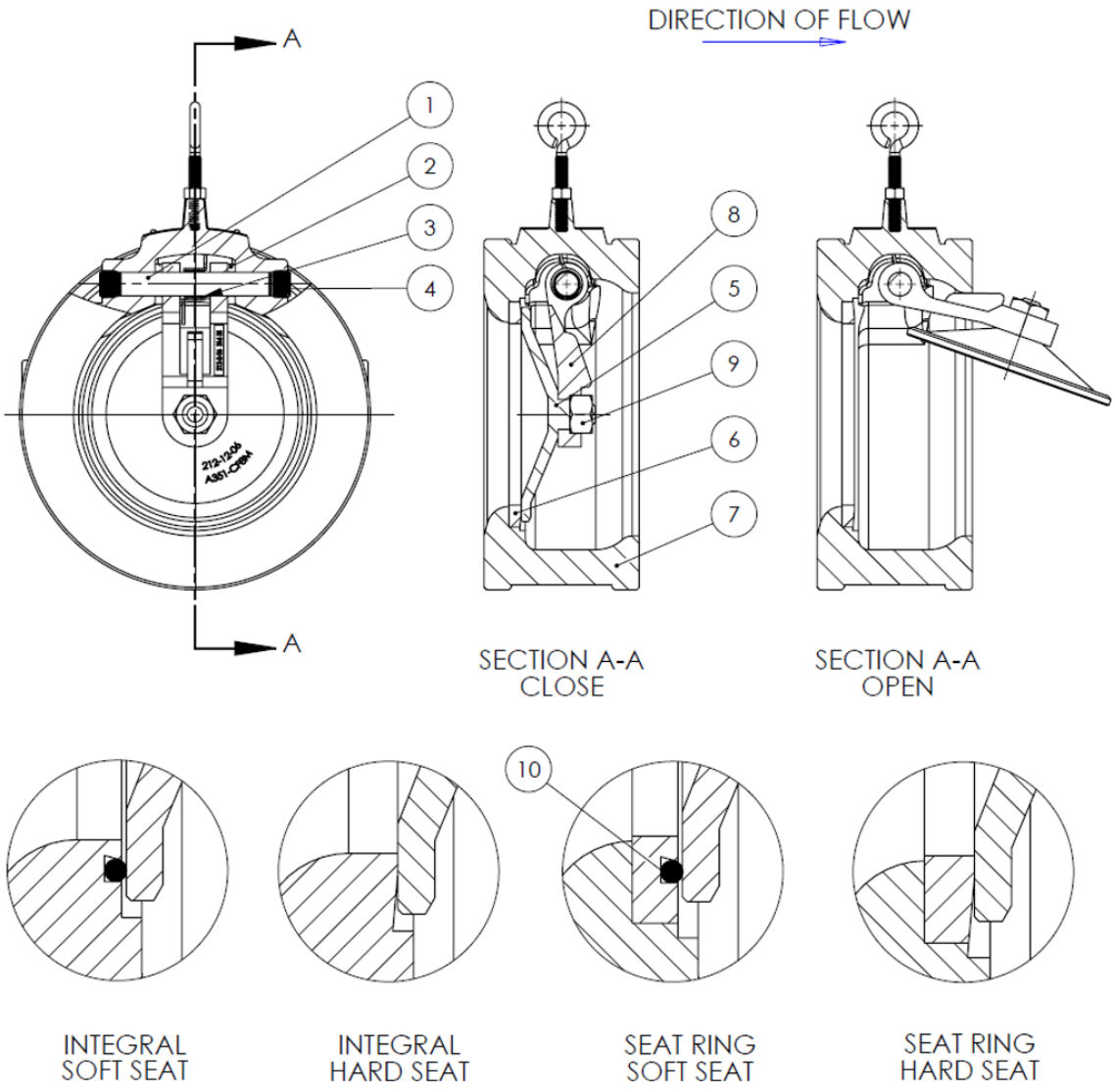
b) welded flanges (5.1.3.1);

c) special materials (4.1.1, 5.1.1);

d) short pattern or special length (5.1.2).

Annex C
(informative)

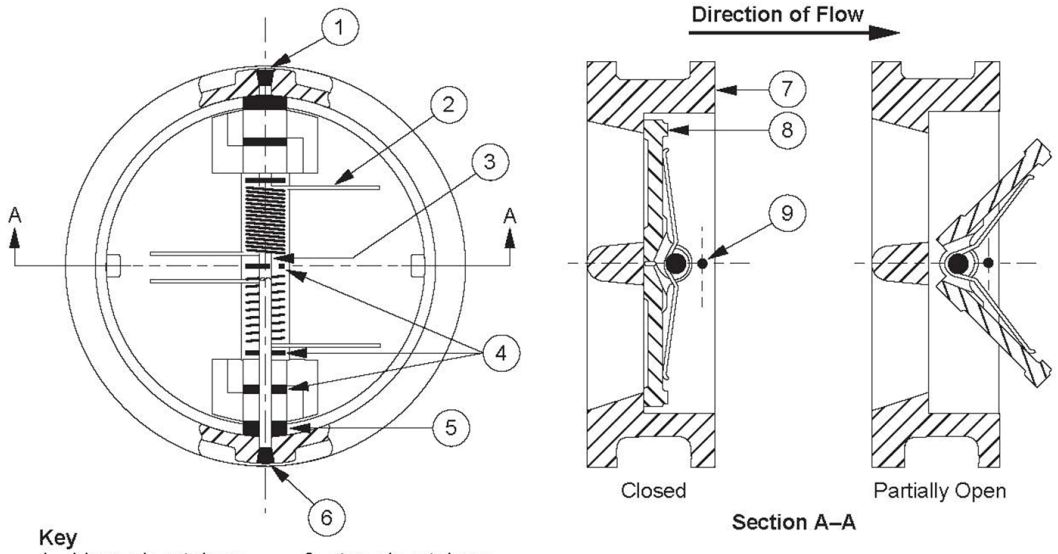
Standard Nomenclature for Valve Parts



NOTE The optional configuration of a full flange or lug flange (like that shown in Figure C.3) and of a double-flanged type (like that of Figure C.4) will be the manufacturer's standard unless otherwise specified in the purchase order. All notes on Figure C.3 and Figure C.4 apply.

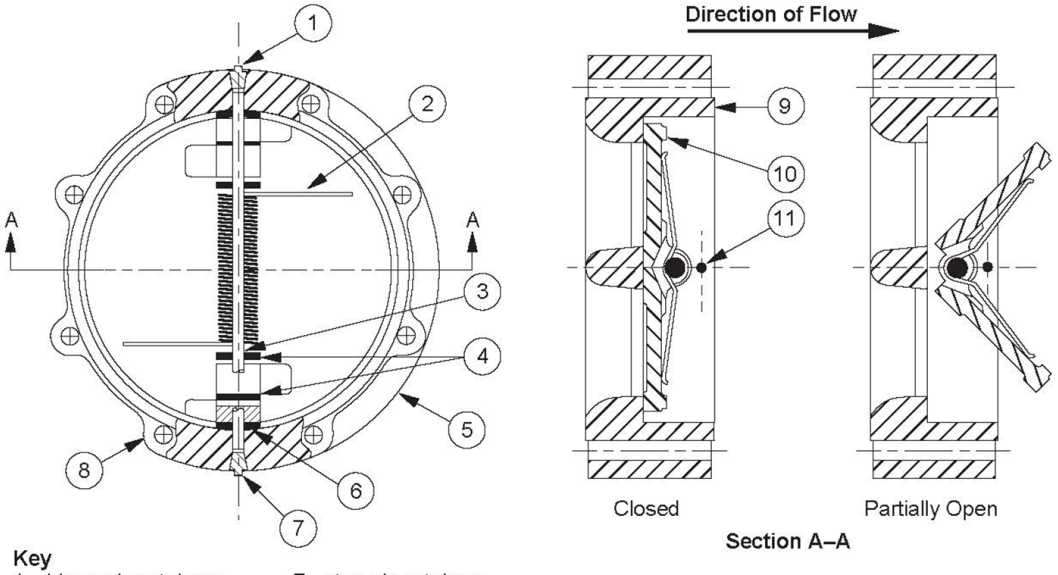
Key			
1 hinge pin	4 hinge pin retainers	7 body	10 resilient "o" ring
2 bearing spacers	5 disc or plate	8 arm	
3 spring	6 seat ring	9 disc nut	

Figure C.1—Single-plate Wafer Check Valve



Key
1 hinge pin retainers
2 spring
3 hinge pin
4 plate lug bearings
5 body lug bearings
6 stop pin retainers
7 body
8 plates
9 stop pin

Figure C.2—Dual-plate Wafer Check Valve

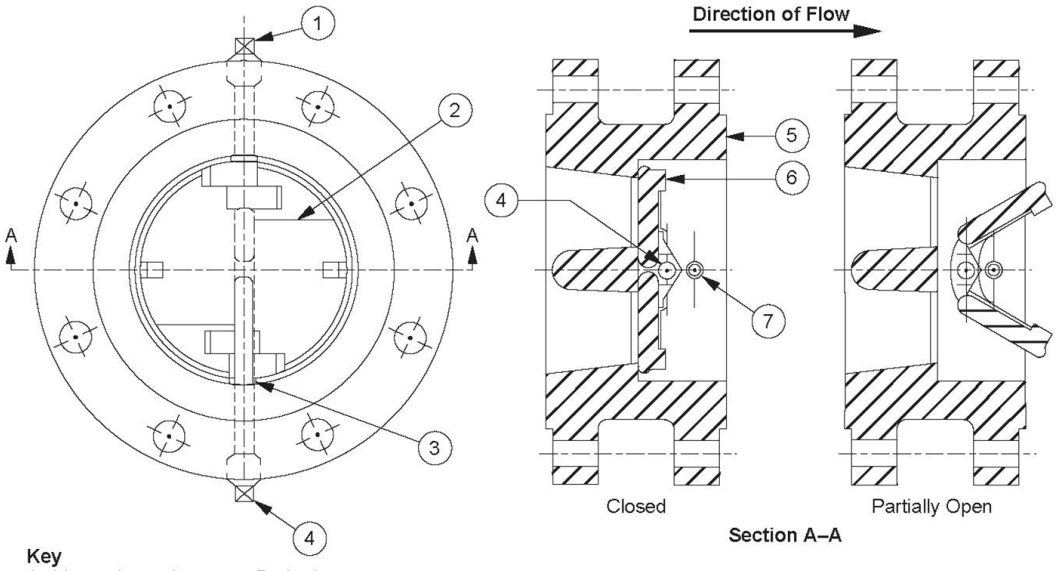


Key
1 hinge pin retainers
2 spring
3 hinge pin
4 plate lug
5 full flange
6 body lug bearings
7 stop pin retainers
8 lug flange
9 body
10 plates
11 stop pin

NOTE 1 The optional configuration of a full flange or lug flange shall be the manufacturer's standard unless otherwise specified by the purchaser.

NOTE 2 Unless otherwise specified in the purchase order, the bolt holes will be through-drilled.

Figure C.3—Dual-plate Lug Check Valve



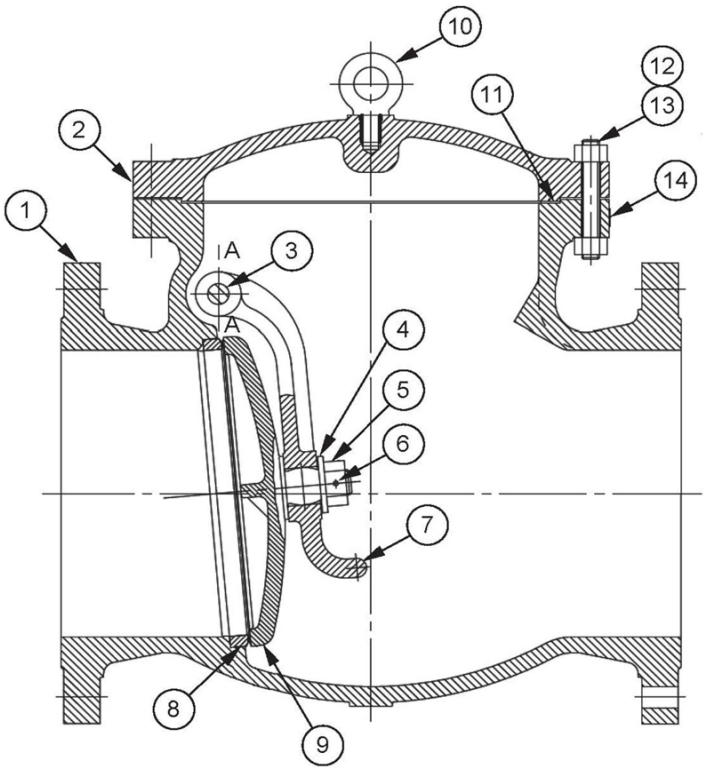
Key

1 hinge pin retainers	5 body
2 spring	6 plates
3 washer	7 stop pin
4 stop pin retainers	

NOTE 1 Double-flanged valves shall only be supplied where nut space between flanges is adequate.

NOTE 2 Unless otherwise specified in the purchase order, the bolt holes will be through-drilled (see 5.1.11).

Figure C.4—Dual-plate Double-flanged Check Valve



Key

1 body	8 seat
2 bonnet	9 disc
3 hinge pin	10 eye bolt
4 disk washer	11 gasket
5 disc nut retainer	12 cover stud
6 spring cotter	13 cover nut
7 arm	14 name plate

Figure C.5—Flanged Swing Check Valve

Bibliography

[1] API Standard 600, *Bolted Bonnet Steel Gate Valves for Petroleum and Natural Gas Industries*

[2] ASME B16.20, *Metallic Gaskets for Pipe Flanges—Ring Joint, Spiral-wound, and Jacketed*

[3] ASME B18.15, *Forged Eyebolts*

[4] ASME B18.2.1, *Square and Hex Bolts and Screws*

[5] ASME *BPVC,* Section VIII

[6] ASTM A182,[1] *Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service*

[7] ASTM A217, *Steel Castings, Martensitic Stainless and Alloy, for Pressure-Containing Parts Suitable for High-Temperature Service*

[8] ASTM A351, *Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure Containing Parts*

[9] ASTM A494, *Castings, Nickel and Nickel Alloy*

[10] ASTM B473, *UNS N08020, UNS N08024, and UNS N08026 Nickel Alloy Bar and Wire*

[11] ASTM B564, *Nickel Alloy Forgings*

[12] AWS A5.9,[2] *Corrosion-Resisting Chromium and Chromium-Nickel Steel Bare and Composite Metal Cored and Stranded Welding Electrodes and Welding Rods*

[13] AWS A5.13, *Solid Surfacing Welding Rods and Electrodes*

[14] MSS-SP-25, *Standard Marking System for Valves, Fittings, Flanges and Unions*

[15] MSS-SP-44, *Steel Pipe Line Flanges*

[1] ASTM International, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428, www.astm.org.

[2] American Welding Society, 8669 NW 36th Street, #130, Miami, Florida 33166, www.aws.org.

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