

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

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

1 Scope

If a product is supplied bearing the API Monogram and manufactured at a facility licensed by API, the requirements of Annex A apply.

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

- Type “A” check valves are short face-to-face as defined in Table 2 and can be: wafer, lug, or double flanged; double flange as defined in Table 3; single plate or dual plate; gray iron, ductile iron, steel, nickel alloy, or other alloy designed for installation between Classes 125 and 250 gray iron flanges as specified in ASME B16.1, between Classes 150 and 300 ductile iron flanges as specified in ASME B16.42, between Classes 150 and 2500 flanges as specified in ASME B16.5, and between Classes 150 and 900 pipeline flanges as specified in MSS SP-44 or flanges as specified in ASME B16.47 Series A.
- Type “B” bolted cover swing check valves are long face-to-face as defined in 5.1.2 and can be: flanged or butt-welding ends of steel, nickel alloy, or other alloy material. End flanges shall be as specified in ASME B16.5, or ends shall be butt-welding as specified in ASME B16.25.

This standard covers the following ranges:

- Type “A” valves:

Classes 125 and 250, $50 \leq DN \leq 1200$ ($2 \leq NPS \leq 48$) (excluding DN 90 [NPS $3\frac{1}{2}$]);

- a) Classes 150 and 300, $50 \leq DN \leq 1200$ ($2 \leq NPS \leq 48$)*;
- b) Class 600, $50 \leq DN \leq 1050$ ($2 \leq NPS \leq 42$)*;
- c) Classes 900 and 1500, $50 \leq DN \leq 600$ ($2 \leq NPS \leq 24$)*;
- d) Class 2500, $50 \leq DN \leq 300$ ($2 \leq NPS \leq 12$)*;

- Type “B” valves:

- a) Classes 150 through 1500, $50 \leq DN \leq 600$ ($2 \leq NPS \leq 24$)*;
- b) Class 2500, $50 \leq DN \leq 300$ ($2 \leq NPS \leq 12$)*.

NOTE *Valve sizes DN 90 and DN 125 (NPS $3\frac{1}{2}$ and 5) are non-preferred sizes whose usage is discouraged.

- Sizes:

DN: 50, 65, 80, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 750, 900, 1050, 1200;

corresponding to nominal pipe sizes (NPS):

NPS: 2, $2\frac{1}{2}$, 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24, 30, 36, 42, 48.

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

The standard nomenclature for valve parts is shown in Annex C. Figure C.1, Figure C.2, Figure C.3, and Figure C.4 illustrate typical Type “A” check valves, and Figure C.5 illustrates a typical Type “B” check valve. These figures show typical designs only and are not to be construed as precluding other available designs that comply with the requirements of this standard. The only purpose of these figures is to identify part names. The construction of a valve is acceptable only when it complies with this standard in all respects.

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.

API Standard 598, *Valve Inspection and Testing*

ASME B1.1¹, *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 BPVC, *Section VIII*

ASME BPVC, *Section IX*

MSS-SP-6², *Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings*

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, taking into account 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 except where specified in this standard. The allowable pressure for a valve having

¹ ASME International, 3 Park Avenue, New York, New York 10016-5990, www.asme.org.

² Manufacturers Standardization Society of the Valve and Fittings Industry, Inc., 127 Park Street, NE, Vienna, Virginia 22180-4602, www.mss-hq.com.

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, used for reference purposes, comprising 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 except where specified.

3.3

NPS

An alphanumeric designation of size that is common for components used in a piping system, used for reference purposes, comprising 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.

4 Pressure-temperature Ratings

4.1 Valve Rating

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

— Type “A” valves only:

- a) gray iron: the pressure-temperature rating for the applicable flange class as specified in ASME B16.1;
- b) ductile iron: the pressure-temperature rating for the applicable flange class as specified in ASME B16.42.

— Type “A” and Type “B” valves:

- a) Steel, nickel alloy, and other alloy: The pressure-temperature rating shall be in accordance with Standard Class ratings of ASME B16.34, Table 2, for the applicable Group 1, 2, or 3 material of ASME B16.34.
- b) Special materials: The pressure-temperature rating for materials not covered by ASME B16.34 shall be determined by the procedures in ASME B16.34.

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 shell 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:

— Type “A” valves only:

- a) gray iron: as shown in Table 1 for Class 125 and Class 250 only;
- b) ductile iron: as shown in Table 1 for Class 150 and Class 300 only.

— Type “A” and Type “B” valves:

- a) steel and chrome-moly steels per ASME B16.34, as shown in Table 1, for Classes 150, 300, 600, 900, 1500, and 2500;
- b) corrosion-resistant steels per ASME B16.34, Table 1, Group 2, and nickel-based alloys per ASME B16.34, Table 1, Group 3, as shown in ASME B16.34, Table 3. Other wall thicknesses shall be as agreed between purchaser and manufacturer.
- c) special materials: The minimum body wall thickness for materials not covered by ASME B16.34 shall be as agreed between the purchaser and manufacturer.

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

- Type “A” valves (including valves with ring-joint facings) shall conform to those shown in Table 2 and Table 3.
- Type “B” valves shall conform to ASME B16.10 long pattern.
- For Type A or Type B valves, special lengths are only permitted by agreement between purchaser and manufacturer.

5.1.3 The purchase order shall specify for Type “A” valves whether the body type shall be wafer, lug, or double-flanged, and for Type “B” valves whether the body type shall be flanged or butt-welding. Type “A” double-flanged valves will only be supplied where nut space between flanges is adequate. End and cover flanges of steel, nickel alloy, and other alloy valves shall be integrally cast or forged with the body. However, flanges may be attached by full penetration butt-welding if agreed to by the purchaser. Flanges shall conform to ASME B16.5 or ASME B16.47, and have butt-welding ends for use without backing rings. Flanges for iron valves shall only be the integral type.

Table 1—Minimum Body-wall Thickness by Class Designation

Dimensions in mm (inches)

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 (2½)	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)	23.1 (0.91)	35.1 (1.38)	60.5 (2.38)	—	—	—
800 (32)	—	—	23.8 (0.94)	36.0 (1.41)	—	—	—	—
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)	—	—	—	—

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 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.

Table 2—Type “A” Valve Face-to-Face Dimensions by Class Designation
Dimensions in mm (inches)

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 (2½)	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)	99 (3.88)*	99 (3.88)*	137 (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)	1940 (7.50)	232 (9.12)	190 (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)*	—
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)	—	—	—
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)	—	—	—	—
<p>The face-to-face tolerance 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).</p> <p>*These valve face-to-face dimensions are for wafer and lug designs. For double-flange face-to-face dimensions, see Table 3.</p>								

Table 3—Face-to-Face Dimensions by Class Designation for Double-flanged Valves
Dimensions in mm (inches)

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)	*	152 (6.00)	219 (8.63)	254 (10.00)	340 (13.37)	489 (19.25)
250 (10)	*	178 (7.00)	244 (9.63)	267 (10.50)	387 (15.25)	622 (24.50)
300 (12)	*	*	*	*	435 (17.12)	686 (27.00)
350 (14)	*	*	*	*	476 (18.75)	—
400 (16)	*	*	*	*	537 (21.15)	—
450 (18)	*	*	*	*	565 (22.25)	—
500 (20)	*	*	*	*	629 (24.75)	—
600 (24)	*	*	*	*	733 (28.87)	—
<p>* These size valves already exist in the double-flange design; see Table 2.</p> <p>This Table represents the face to face dimensions for double flange valves in sizes and pressure classes available as wafer or lug valves in Table 2.</p>						

5.1.3.1 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 having flanges attached by welding shall meet the requirements of paragraph 2.1.6 of ASME B16.34.

5.1.3.2 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:

— Type “A” valves only: Gray iron and ductile iron valves shall be finished as specified in MSS SP-6;

- Type “A” and Type “B” valves: Steel, nickel-alloy, and other alloy valves shall be finished as specified in ASME B16.5 and ASME B16.47 Series A.

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

- 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.
- Type “A” steel, nickel-alloy, and other alloy valves: Auxiliary connections shall comply with the requirements of ASME B16.34. The location and designation of auxiliary connections shall be the manufacturer’s standard.
- Type “B” valves: For steel, nickel-alloy, and other alloy valves, auxiliary connections shall comply with 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 having a viscosity no greater than kerosene may be used to prevent galling of mating threaded surfaces.

5.1.9 Tapped test openings are permitted only if specified in the purchase order. If a tap is made in the body for testing the valve, the tap shall not be larger than DN 15 (NPS $1/2$). 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 comply with ASME B16.34.

5.1.10 For Type “A” valves, a tapped blind hole shall be provided in the body of valves that are either NPS 10 or larger, or which 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. If an eyebolt is specified in the purchase order, it shall conform to ASME B18.15.

5.1.11 Unless otherwise specified in the purchase order, for Type “A” valves, the lugs of lu -type valves and flanges of double-flanged type valves shall be provided with non-threaded (drilled) bolt clearance holes.

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

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

5.1.14 Type “B” valves shall have a bolted flat or dished cover design that meets the requirements of ASME BPVC, Section VIII-Division 1. Cover and cover flanges shall be circular, except DN 50 and DN 65 (NPS 2 and NPS $2\frac{1}{2}$) may be of noncircular design. Body-to-cover joints shall be flanged with a flat face (Class 150 only), raised face, tongue and groove, spigot and recess, or ring joint based on ASME B16.5 and ASME B16.47.

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

- M10 or $3/8$ in. when $50 \leq DN \leq 65$ ($2 \leq NPS \leq 2\frac{1}{2}$);
- M12 or $1/2$ in. when $80 \leq DN \leq 200$ ($3 \leq NPS \leq 8$);
- M16 or $5/8$ in. when $DN \geq 250$ ($NPS \geq 10$)

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

5.1.16 When 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.

5.1.17 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.

5.2 Plates and Disc

5.2.1 Valves are classified as follows:

- 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 by the use of springs or other devices.
- A dual-plate valve has plates that close the valve with the assistance of one or more springs when flow reversal forces the plates against the valve-body seat.

5.2.2 For Type “A” single-plate valves and Type “B” valves, when 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 single tack weld, lock washer, or lock nut are not acceptable means for positively securing the nut. The closure assembly materials and design shall not limit the overall corrosion resistance of the valve.

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

5.3 Seating Surfaces

5.3.1 The body and plate or disc seating surfaces may be of deposited weld metal, integral metal, mechanically retained metal, or a resilient material. 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 resilient seal ring shall be designed to give a full metal-to-metal seal if the resilient seal is completely missing.

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

5.3.3 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.

5.4 External Bolts and Threaded Holes

5.4.1 Bolting shall be standard inch-series bolting, unless the purchaser specifies metric-series bolting. Bolts and threaded holes with a diameter of 1 inch or smaller shall have coarse (UNC) threads or the most nearly corresponding metric threads. Those larger than 1 inch 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. Threads shall conform to ASME B1.1 and metric threads to ASME B1.13M.

5.4.2 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.

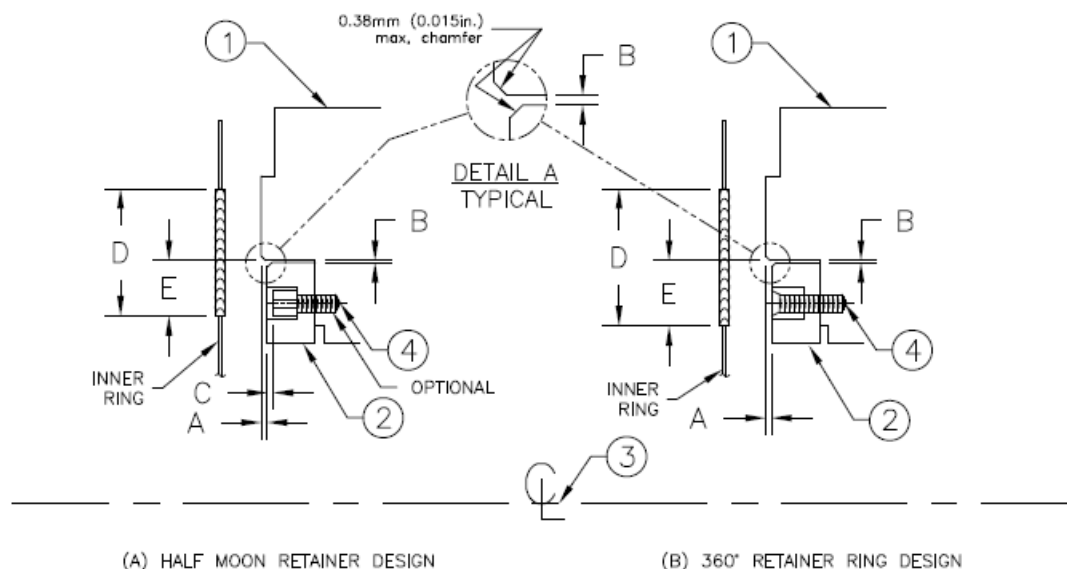
5.5 Flow Indication

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

5.6 Gasket Surface

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 sealability of a spiral-wound gasket.



DIMENSION	DEFINITION	RANGE, In.	RANGE, mm.
A.	Distance of retainer below valve body face (after being compressed by mating flange).	+0.00 to -0.010	+0.00 to -0.25
B.	Width of annular gap between valve body and retainer (exclusive of chamfer).	0.030 max.	0.76 max.
C.	Distance of screw head below face of retainer.	0 to 0.015	0 to 0.38
D.	Width of sealing area of spiral-wound gasket for valve's size and rating.	-	-
E.	Distance gasket sealing area overlaps retainer / fastener (may occur at the I.D. or O.D. of gasket).	35% of D max.	35% of D max.

KEY:

1. Valve Body
2. Retainer
3. Valve Centerline
4. Fastener (Flat or Socket Head) IF APPLICABLE.

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

A plate or disc shall be made of a material whose corrosion resistance is greater than or equal to that of the valve body.

6.3 Cover Gasket (Type “B” Valves)

6.3.1 The cover flange gasket shall be:

- solid metal, corrugated, or flat;
- filled metal jacketed, corrugated, or flat;
- metal ring joint;
- spiral-wound metal gasket with filler and a centering/compression ring;
- 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:

- corrugated metal insert with graphite facings;
- when approved by the purchaser, a flexible graphite sheet, reinforced with a stainless steel flat, perforated, tanged, or corrugated insert equipped with annular containment rings.

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 538°C (1000°F).

6.4 Trim

6.4.1 The trim includes the following:

- body seating surfaces;
- plate or disc seating surfaces.
- hinge pin (contained within the pressure boundary)

6.4.2 Metallic seating surface material shall be the manufacturer's standard, which may be the same as the body material. Where 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 manufacturer's standard hard facing with a maximum iron content of 25 %.

6.4.3 Resilient seat material, when required, shall be specified by the purchaser, and if located in the body, there shall not be an overlay in the seat area 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 A 217 (CA15)	ASTM A 182 (F6)	AWS A5.9 (ER410)	13 Cr	ASTM A276-T410
2	304	18Cr-8Ni	ASTM A 351 (CF8)	ASTM A 182 (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	13Cr Co-Cr-A	ASTM A 217 (CA15) N/A	ASTM A 182 (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 A 494 (M-35-1)	ASTM B 564 (UNS N04400)	Manufacturer's standard	Ni-Cu alloy	Manufacturer's standard
10	316	18Cr-8Ni-Mo	ASTM A 351 (CF8M)	ASTM A 182 (F316)	AWS A5.9 (ER316)	18Cr-8Ni-Mo	ASTM A276-T316
12	316 and hard-faced	18Cr-8Ni-Mo Trim 5 or 5A	ASTM A 351 (CF8M)	ASTM A 182 (F316)	AWS A5.9 (ER316) Trim 5 or 5A	18Cr-8Ni-Mo	ASTM A276-T316
13	Alloy 20	19Cr-29Ni	ASTM A 351 (CN7M)	ASTM B 473	AWS A5.9 (ER320)	19Cr-29Ni	ASTM B 473
14	Alloy 20 and hard-faced	19Cr-29Ni Trim 5 or 5A	ASTM A 351 (CN7M)	ASTM B 473	AWS A5.9 (ER320) Trim 5 or 5A	19Cr-29Ni	ASTM B 473
AA	Bronze	Bronze	Manufacturer's standard	Manufacturer's standard	—	—	—

6.5 Internal Wetted Parts

Internal wetted parts shall be the manufacturer's standard unless otherwise specified in the purchase order. The term "wetted parts" shall include, but not be limited to hinges, bolts, bearings, and any other part in contact with the fluid medium other than the body, cover, plates or disc, trim, springs, and pipe plugs. Corrosion resistance of internal wetted parts shall be at least equal to that of the valve-body material.

6.6 Body Seat Rings

If the body seat ring material is different from the seating-surface material, its corrosion resistance shall be greater than or equal to that of the valve-body material.

6.7 Springs

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

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

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

6.8 Pipe Plugs and Pin Retainers

6.8.1 Any pipe plugs and pin retainers used shall be solid and shall have the same nominal chemical composition and material properties as the valve body.

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

6.8.3 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 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 Each valve shall be visually examined by the manufacturer in accordance with API 598.

7.1.2 When inspection by the purchaser is specified by the purchase order, it 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, carbon or alloy steel 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 6.9) of valves made in compliance with this standard shall be marked "API 594" and shall also be marked as follows:

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

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

8.3 Where 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 Unmachined exterior surfaces of the shell shall be painted per the manufacturer's standard rust preventative paint. Nonferrous and austenitic stainless steel valves shall not be painted.

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

9.1.3 All coatings and/or paints shall not contain lead.³

9.2 Valve Openings

9.2.1 Except for the ends of small, individually packaged valves, valve ends shall be covered to protect the gasket surfaces and valve internals during shipment and storage. The protective covers shall be wood, wood fiber, plastic, or metal, and securely attached to the valve ends by bolts, steel straps, or suitable friction locking devices. The covers shall be no smaller than the outside diameter of the valve ends and designed so that the valves cannot be installed without complete removal of the covers.

9.2.2 All threaded connections in the valve body shall be fitted 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 Type "B" 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.

9.3 Packaging

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

10 Recommended Spare Parts

When specified on the purchase order, the vendor shall submit a complete list of spare parts. The list shall include cross-sectional or assembly-type drawings for identification with parts.

³ 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).

Annex A (informative)

API Monogram Program

Use of the API Monogram by Licensees

A.1 Scope

A.1.1 Applicability

This annex is only normative for product supplied bearing the API Monogram and manufactured at a facility licensed by API; for all other instances it is not applicable.

A.1.2 General

The API Monogram® is a registered certification mark owned by the American Petroleum Institute (API) and authorized for licensing by the API Board of Directors. Through the [API Monogram Program](#), API licenses product manufacturers to apply the API Monogram to products which comply with product specifications and have been manufactured under a quality management system that meets the requirements of API Q1. API maintains a complete, searchable list of all Monogram licensees on the [API Composite List](#) website.

The application of the API Monogram and license number on products constitutes a representation and warranty by the licensee to API and to purchasers of the products that, as of the date indicated, the products were manufactured under a quality management system conforming to the requirements of API Q1 and that the product conforms in every detail with the applicable standard(s) or product specification(s). API Monogram program licenses are issued only after an on-site audit has verified that an organization has implemented and continually maintained a quality management system that meets the requirements of API Q1 and that the resulting products satisfy the requirements of the applicable API product specification(s) and/or standard(s). Although any manufacturer may claim that its products meet API product requirements without monogramming them, only manufacturers with a license from API can apply the API Monogram to their products.

Together with the requirements of the API Monogram license agreement, this annex establishes the requirements for those organizations who wish to voluntarily obtain an API license to provide API monogrammed products that satisfy the requirements of the applicable API product specification(s) and/or standard(s) and API Monogram Program requirements.

For information on becoming an API Monogram Licensee, please contact API, Certification Programs, 1220 L Street, N. W., Washington, DC 20005 or call 202-682-8145 or by email at certification@api.org.

A.2 Normative References

In addition to the referenced standards listed earlier in this document, this annex references the following standard:

API Specification Q1, *Specification for Quality Management System Requirements for Manufacturing Organizations for the Petroleum and Natural Gas Industry*

For Licensees under the Monogram Program, the latest version of this document shall be used. The requirements identified therein are mandatory.

A.3 API Monogram Program: Licensee Responsibilities

A.3.1 Monogram Program Requirements

For all organizations desiring to acquire and maintain a license to use the API Monogram, conformance with the following shall be required at all times:

- a) the quality management system requirements of API Q1;
- b) the API Monogram Program requirements of API Q1, Annex A;
- c) the requirements contained in the API product specification(s) to which the organization is licensed;
- d) the requirements contained in the API Monogram Program License Agreement.

A.3.2 Control of the Application and Removal of the API Monogram

Each licensee shall control the application and removal of the API Monogram in accordance with the following:

- a) Products that do not conform to API specified requirements shall not bear the API Monogram.
- b) Each licensee shall develop and maintain an API Monogram marking procedure that documents the marking/monogramming requirements specified by this annex and any applicable API product specification(s) and/or standard(s). The marking procedure shall:
 - 1) define the authority responsible for application and removal of the API Monogram and license number;
 - 2) define the method(s) used to apply the Monogram and license number;
 - 3) identify the location on the product where the API Monogram and license number are to be applied;
 - 4) require the application of the date of manufacture of the product in conjunction with the use of the API Monogram and license number;
 - 5) require that the date of manufacture, at a minimum, be two digits representing the month and two digits representing the year (e.g. 05-12 for May 2012) unless otherwise stipulated in the applicable API product specification(s) or standard(s); and
 - 6) define the application of all other required API product specification(s) and/or standard(s) marking requirements.
- c) Only an API licensee shall apply the API Monogram and its designated license number to API monogramable products.
- d) The API Monogram and license number, when issued, are site-specific and subsequently the API Monogram shall only be applied at that site specific licensed facility location.
- e) The API Monogram may be applied at any time appropriate during the production process but shall be removed in accordance with the licensee's API Monogram marking procedure if the product is subsequently found to be out of conformance with any of the requirements of the applicable API product specification(s) and/or standard(s) and API Monogram Program.

For certain manufacturing processes or types of products, alternative API Monogram marking procedures may be acceptable. Requirements for alternative API Monogram marking are detailed in the, [API Monogram Program Alternative Marking of Products License Agreement](http://www.api.org/alternative-marking), available on the API Monogram Program website at <http://www.api.org/alternative-marking>.

A.3.3 Design and Design Documentation

Each licensee and/or applicant for licensing shall maintain current design documentation as identified in API Q1 for all of the applicable products that fall under the scope of each Monogram license. The design document information shall provide objective evidence that the product design meets the requirements of the applicable and most current API product specification(s) and/or standard(s). The design documentation shall be made available during API audits of the facility.

In specific instances, the exclusion of design activities is allowed under the Monogram Program, as detailed in Advisory # 6, available on API Monogram Program website at <http://www.api.org/advisories>.

A.3.4 Manufacturing Capability

The API Monogram Program is designed to identify facilities that have demonstrated the ability to manufacture equipment that conforms to API specifications and/or standards. API may refuse initial licensing or suspend current licensing based on a facility's level of manufacturing capability. If API determines that an additional review is warranted, API may perform additional audits (at the organization's expense) of any subcontractors to ensure their conformance with the requirements of the applicable API product specification(s) and/or standard(s).

A.3.5 Use of the API Monogram in Advertising

An API Monogram licensee shall not use the API Monogram and/or license number on letterheads, buildings or other structures, websites or in any advertising without an express statement of fact describing the scope of Licensee's authorization (license number and product specification). The Licensee should contact API for guidance on the use of the API Monogram other than on products.

A.4 Product Marking Requirements

A.4.1 General

These marking requirements shall apply only to those API Licensees wishing to mark applicable products in conjunction with the requirements of the API Monogram Program.

A.4.2 Product Specification Identification

Manufacturers shall mark products as specified by the applicable API specifications or standards. Marking shall include reference to the applicable API specification and/or standard. Unless otherwise specified, reference to the API specifications and/or standards shall be, as a minimum, "API [Document Number]" (e.g., API 6A, or API 600). Unless otherwise specified, when space allows, the marking may include use of "Spec" or "Std", as applicable (e.g., API Spec 6A or API Std 600).

A.4.3 Units

Products shall be marked with units as specified in the API specification and/or standard. If not specified, equipment shall be marked with U.S. customary (USC) units. Use of dual units [USC units and metric (SI) units] may be acceptable, if such units are allowed by the applicable product specification and/or standard.

A.4.4 Nameplates

Nameplates, when applicable, shall be made of a corrosion-resistant material unless otherwise specified by the API specification and/or standard. Nameplate shall be located as specified by the API specification and/or standard. If the location is not specified, then the licensee shall develop and maintain a procedure detailing the location to which the nameplate shall be applied. Nameplates may be attached at any time during the manufacturing process.

The API Monogram and license number shall be marked on the nameplate, in addition to the other product marking requirements specified by the applicable product specification and/or standard.

A.4.5 License Number

The API Monogram license number shall not be used unless it is marked in conjunction with the API Monogram. The license number shall be used in close proximity to the API Monogram.

A.5 API Monogram Program: Nonconformance Reporting

API solicits information on products that are found to be nonconforming with API specified requirements, as well as field failures (or malfunctions), which are judged to be caused by either specification and/or standard deficiencies or nonconformities against API specified requirements. Customers are requested to report to API all problems with API monogrammed products. A nonconformance may be reported using the API Nonconformance Reporting System available at <http://compositelist.api.org/ncr.aspx>.

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) wafer, lug, double flange, flanged, or butt-welding body type * [5.1.3];
 - d) material of the valve shell * [6.1];
 - e) seating surface material* [6.4.2];
 - f) flange standard for NPS 26 and larger* [5.1.4];
 - g) nominal trim material * [6.4.1];
 - h) type "A," single plate, or dual plate* [5.2];
 - i) facing requirements, flanged, ring joint, or butt-weld* [5.1.5, 5.1.6, 5.1.12];
 - j) design temperature for proper spring selection* [6.7];
 - 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 manufacturer's permissible options (e.g., NACE MR 0103);
 - 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 [Section 10];

- 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 $50 \leq DN \leq 125$ ($2 \leq NPS \leq 5$) [5.6];
 - 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

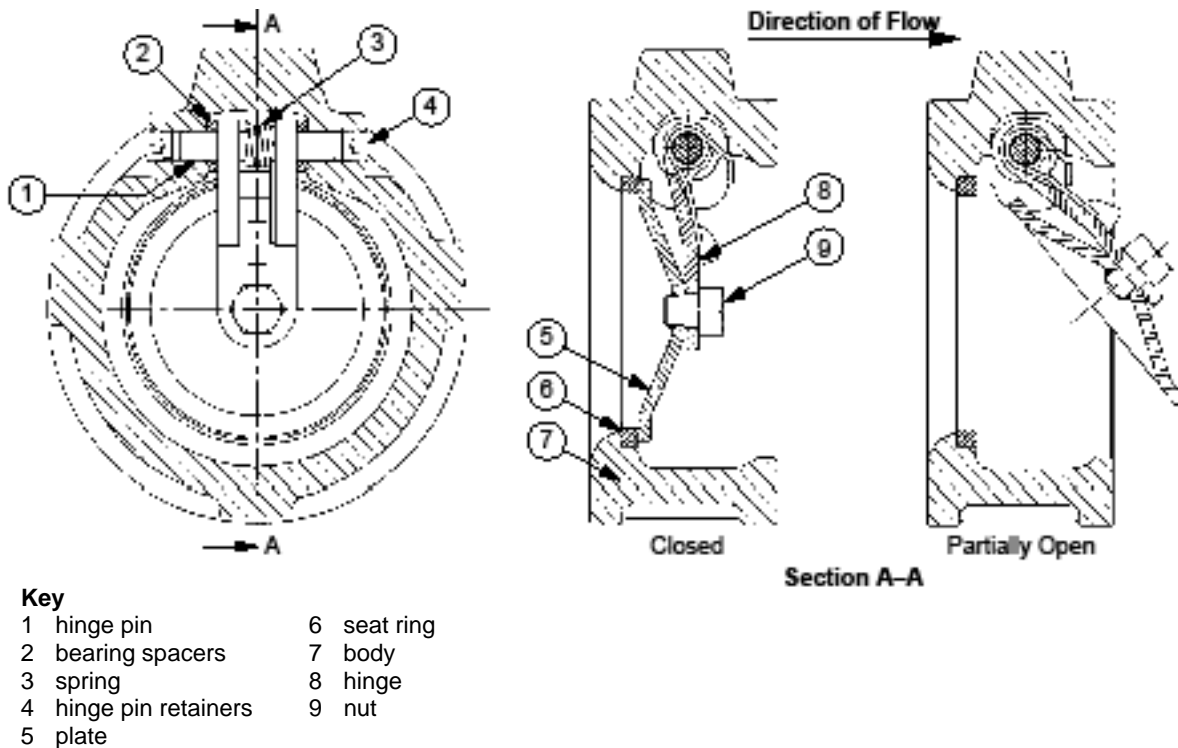


Figure C.1—Typical Type “A” Single-plate Wafer Check Valve

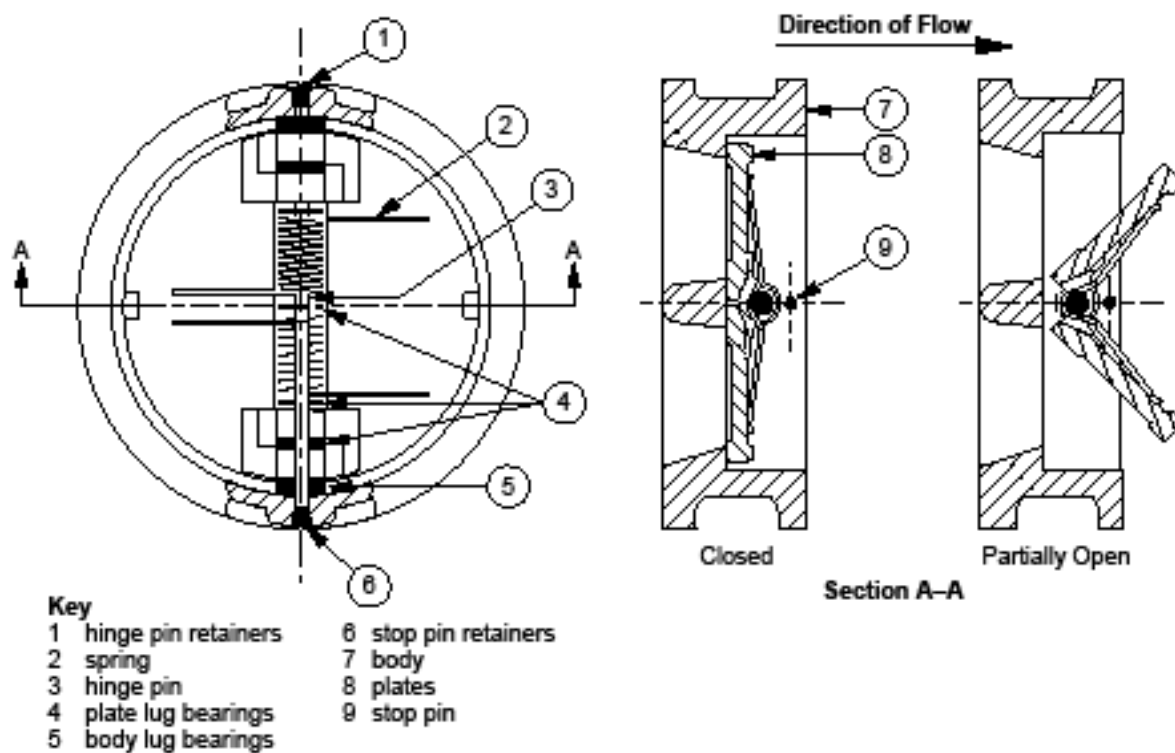
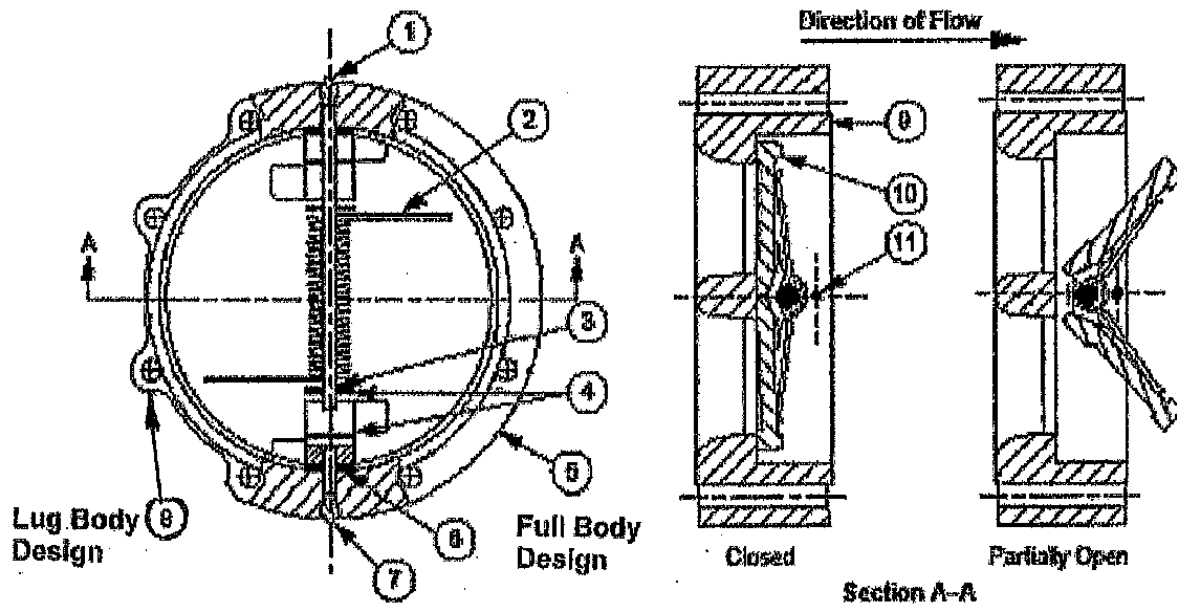


Figure C.2—Typical Type “A” Dual-plate Wafer Check Valve

**Key**

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

NOTE 1 The optional configuration of a full body design (5) and the lug body design (8) will 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—Typical Type “A” Dual-plate Lug Check Valve

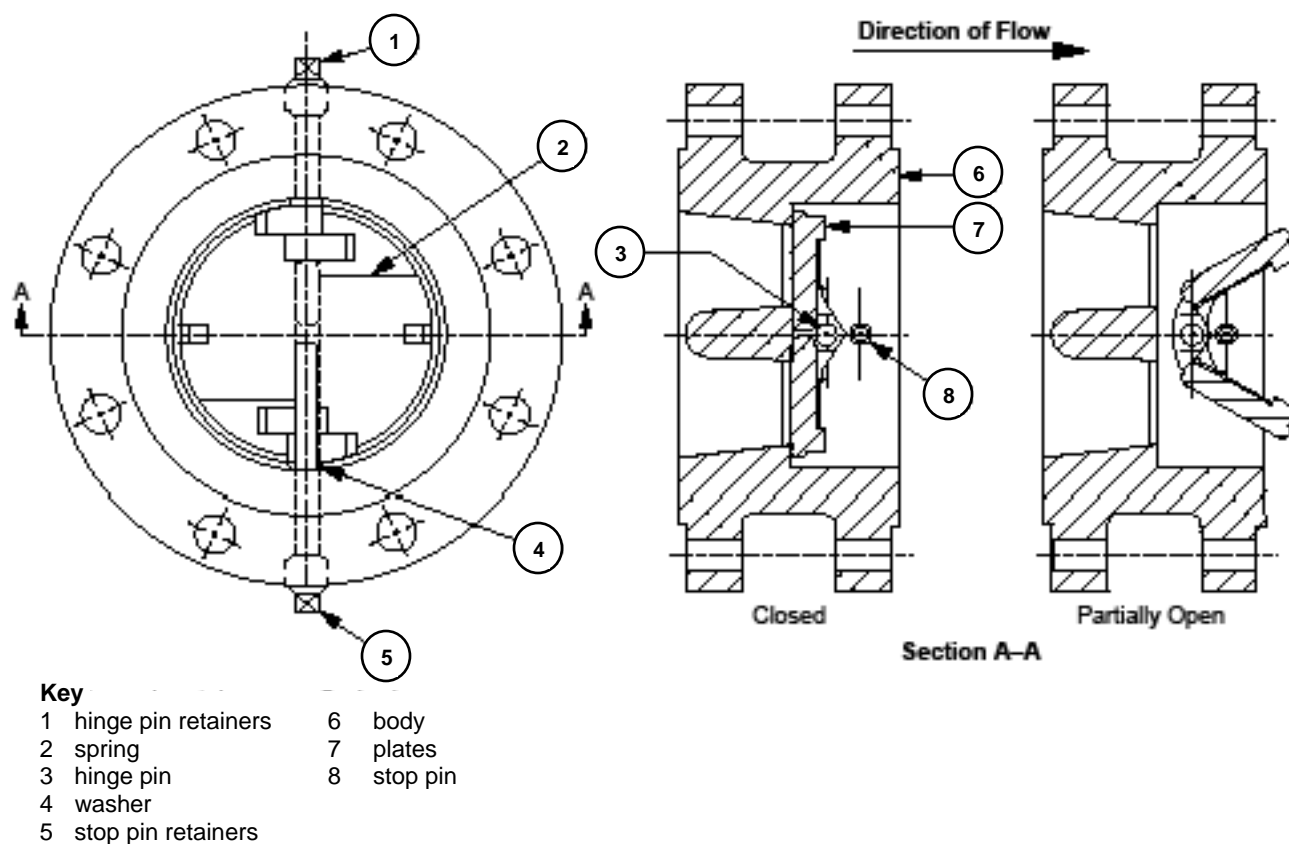
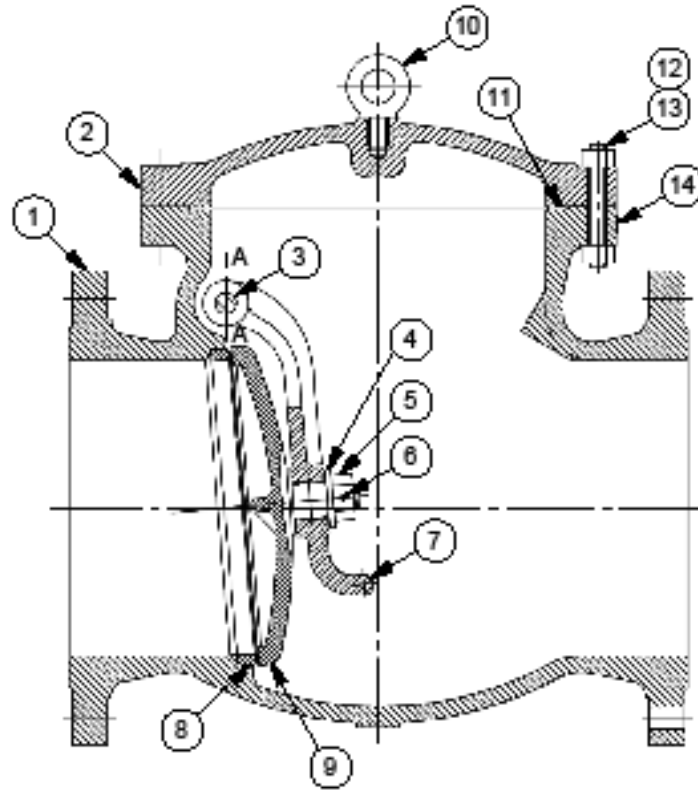


Figure C.4—Typical Type “A” Dual-plate Double-flanged Check Valve

**Key**

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

Figure C.5—Typical Type “B” Flanged Swing Check Valve

Bibliography

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

ASME B16.20⁴, *Metallic Gaskets for Pipe Flanges—Ring Joint, Spiral-wound, and Jacketed*

ASME B18.15, *Forged Eyebolts*

ASME B18.2.1, *Square and Hex Bolts and Screws*

ASME BPVC, Section VIII

ASTM A182⁵, *Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service*

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

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

ASTM A494, *Castings, Nickel and Nickel Alloy*

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

ASTM B564, *Nickel Alloy Forgings*

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⁴ ASME International, 3 Park Avenue, New York, New York 10016-5990, www.asme.org.

⁵ ASTM International, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428, www.astm.org.

⁶ American Welding Society, 550 NW LeJeune Road, Miami, Florida 33126, www.aws.org.

⁷ Manufacturers Standardization Society, 127 Park Street NE, Vienna, VA 22180-4620, www.mss.org.



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