

Steel Globe Valves—Flanged and Butt-welding Ends, Bolted Bonnets

API STANDARD 623

THIRD EDITION, XX 202X

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1 Scope

1.1 This API standard specifies the requirements for a heavy-duty series of bolted bonnet steel globe valves for petroleum refinery and related applications where corrosion, erosion, and other service conditions would indicate a need for heavy wall sections and large stem diameters. Engineered control valves are not covered in this standard.

Note: API RP 615 provides background guidance and definitions related to valve selection.

1.2 This standard establishes additional requirements for globe valves that are otherwise in full conformance to the requirements of ASME B16.34, Standard Class.

1.3 This standard sets forth the requirements for the following globe valve features:

- bolted bonnet;
- pressure seal bonnet;
- outside screw and yoke;
- rotating rising stems/rising handwheels and non-rotating rising stems/non-rising handwheels;
- straight pattern, y-pattern, right-angle;
- stop-check (non-return type globe valves in which the disc may be positioned against the seat by action of the stem but is free to rise as a check valve due to flow from under the disc when the stem is in a full or partially open position);
- plug, narrow, conical, ball, or guided disc;
- metallic seating surfaces;
- End connections: flanged or butt-welding ends.

1.4 It covers valves of the nominal pipe sizes NPS:

- 2, 2½, 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24;

corresponding to nominal pipe sizes DN:

- 50, 65, 80, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600;

applies for pressure class designations:

- 150, 300, 600, 900, 1500, 2500.

1.5 This edition of API 623 states values in both metric 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 documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any addenda) applies.

API Standard 598, *Valve Inspection and Testing*

API Standard 602, *Gate, Globe, and Check Valves for Sizes DN 100 (NPS 4) and Smaller for the Petroleum and Natural Gas Industries*

API Standard 624, *Type Testing of Rising Stem Valves Equipped with Graphite Packing for Fugitive Emissions*

API Recommended Practice 615, *Valve Selection Guide*

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

ASME B1.5, *Acme Screw Threads*

ASME B1.8, *Stub Acme Screw Threads*

ASME B1.12, *Class 5 Interference—Fit Thread*

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

ASME B16.5, *Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch*

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

ASME B16.25, *Buttwelding Ends*

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

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

ASME B18.2.6M, *Metric Fasteners for Use in Structural Applications*

ASME B18.31.1M, *Metric Continuous and Double-End Studs*

ASME B18.31.2, *Continuous Thread Stud, Double-End Stud, and Flange Bolting Stud (Stud Bolt) (Inch Series)*

ASME B31.3, *Process Piping*

ASME Boiler and Pressure Vessel Code Section IX, *Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators*

ASTM A307,² *Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength*

ISO 5210,³ *Industrial valves—Multi-turn valve actuator attachments*

ISO 5752, *Metal valves for use in flanged pipe systems—Face-to-face and centre-to-face dimensions*

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

²ASTM International, 100 Barr Harbor Drive, C700, West Conshohocken, Pennsylvania 19428-2959, www.astm.org.

³International Organization for Standardization, ISO Central Secretariat, Chemin de Blandonnet 8, CP 401 -1214 Vernier, Geneva, Switzerland, www.iso.org.

MSS SP-45,⁴ *Bypass and Drain Connections*

MSS SP-55, *Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components—Visual Method for Evaluation of Surface Irregularities*

MSS SP-91, *Guidelines for Manual Operation of Valves*

MSS SP-102, *Multi-turn Valve Actuator Attachment—Flange and Driving Component Dimensions and Performance Characteristics*

MSS SP-134, *Valves for Cryogenic Service, including Requirements for Body/Bonnet Extensions*

MSS SP-144, *Pressure Seal Bonnet Valves*

MSS SP-160, *Valves for Hydrogen Fluoride Alkylation Service*

NACE MR 0103⁵/ ISO 17945, *Petroleum, petrochemical and natural gas industries—Metallic materials resistant to sulfide stress cracking in corrosive petroleum refining environments*

NACE MR0175/ ISO 15156, *Petroleum and natural gas industries —Materials for use in H₂S-containing environments in oil and gas production*

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 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.

3.4

shell

Comprised of the body and bonnet which are parts of the pressure boundary of an API 623 valve.

3.5

Stop-check valve

Valve that provides both check valve and globe valve functionality in one design in which the piston-type disc can also be closed against the seat by mechanical means similar to that of a globe valve.

Note: Stop-check valves are available in T-pattern, Y-pattern, and angle pattern configurations and normally operate as check valves while providing block valve capability when mechanically closed.

⁴Manufacturers Standard Society of the Valve and Fittings Industry, Inc., 127 Park Street, N.E., Vienna, Virginia 22180-4602, www.msshq.org.

4 Pressure/Temperature Ratings

4.1 Pressure/temperature ratings shall be in accordance with those specified in the tables of ASME B16.34 for Standard Class for the applicable material specification and the applicable class.

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

4.3 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.

4.4 For temperatures below the lowest temperature listed in the pressure/temperature tables, the pressure rating shall be no greater than the pressure for the lowest-listed temperature. Consideration shall be given to the loss of ductility and toughness of materials at low temperatures. Reference ASME B16.34 Nonmandatory Appendix D.

5 Design

5.1 Body Wall Thickness

5.1.1 A valve body schematic is shown as Figure 1. The minimum body wall thickness, t_m , at the time of manufacture shall be as given in Table 1. For ASME B16.34 Group 3 materials, minimum body wall thickness, t_m , at the time of manufacture shall be calculated from an equation in ASME B16.34, with minimum flow diameter (d) per ASME B16.34 for applicable valve DN or NPS and pressure class. Thickness requirements of butt-welding valve ends shall be in accordance with 5.1.3.

5.1.2 The manufacturer shall determine if additional metal thickness is needed for assembly stresses, stress concentrations, and shapes other than circular.

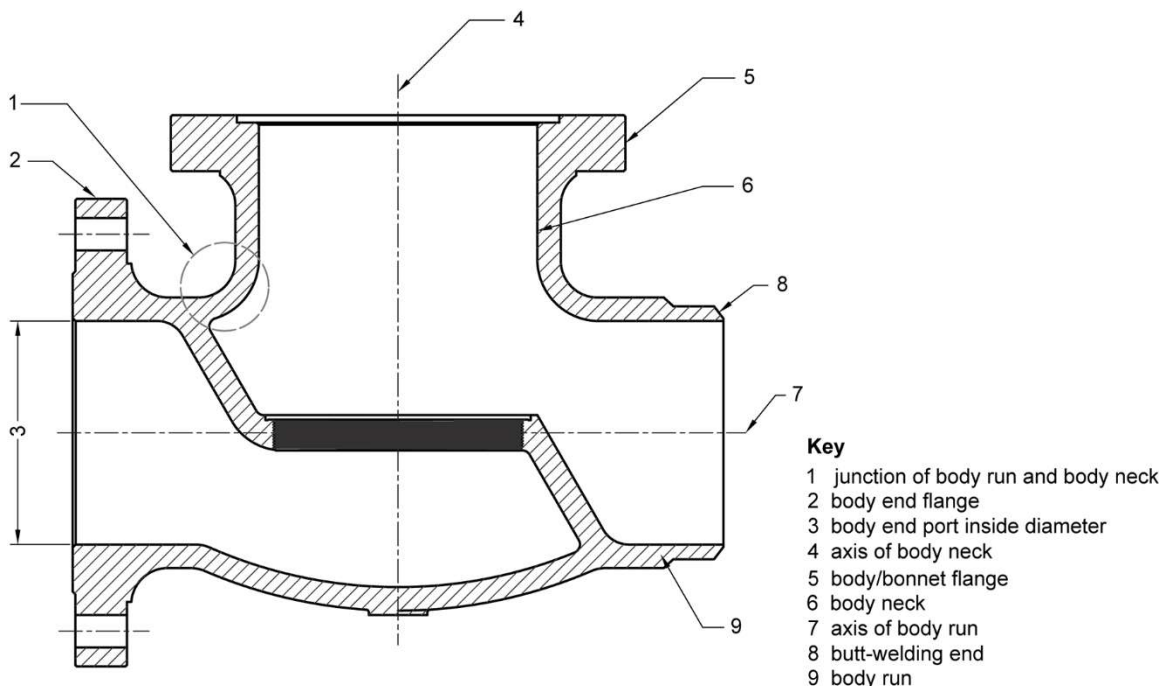


Figure 1—Identification of Terms

Table 1—Minimum Wall Thickness for Body and Bonnet

Class Designation	150	300	600	900	1500	2500	Class Designation
Nominal Size DN	Minimum Wall Thickness t_m mm (in.)						Nominal Size NPS
50	8.6 (0.34)	9.7 (0.38)	11.2 (0.44)	13.7 (0.54)	19.1 (0.75)	22.4 (0.88)	2
65	9.7 (0.38)	11.2 (0.44)	11.9 (0.47)	15.5 (0.61)	22.4 (0.88)	25.4 (1.00)	2½
80	10.4 (0.41)	11.9 (0.47)	12.7 (0.50)	19.1 (0.75)	23.9 (0.94)	30.2 (1.19)	3
100	11.2 (0.44)	12.7 (0.50)	16.0 (0.63)	21.3 (0.84)	28.7 (1.13)	35.8 (1.41)	4
150	11.9 (0.47)	16.0 (0.63)	19.1 (0.75)	26.2 (1.03)	38.1 (1.50)	48.5 (1.91)	6
200	12.7 (0.50)	17.5 (0.69)	25.4 (1.00)	31.8 (1.25)	47.8 (1.88)	62.0 (2.44)	8
250	14.2 (0.56)	19.1 (0.75)	28.7 (1.13)	36.6 (1.44)	57.2 (2.25)	67.6 (2.66)	10
300	16.0 (0.63)	20.6 (0.81)	31.8 (1.25)	42.2 (1.66)	66.8 (2.63)	86.6 (3.41)	12
350	16.8 (0.66)	22.4 (0.88)	35.1 (1.38)	46.0 (1.81)	69.9 (2.75)	—	14
400	17.5 (0.69)	23.9 (0.94)	38.1 (1.50)	52.3 (2.06)	79.5 (3.13)	—	16
450	18.3 (0.72)	25.4 (1.00)	41.4 (1.63)	57.2 (2.25)	88.9 (3.50)	—	18
500	19.1 (0.75)	26.9 (1.06)	44.5 (1.75)	63.5 (2.50)	98.6 (3.88)	—	20
600	20.6 (0.81)	30.2 (1.19)	50.8 (2.00)	73.2 (2.88)	114.3 (4.50)	—	24

5.1.3 The weld end preparation in butt-welding end valves (see 5.3.2) shall not reduce the body wall thickness to less than the values specified in 5.1.1 within a region closer than t_m to the outside surface of the body neck, measured along the run direction. The transition to the weld preparation shall meet ASME B16.34 requirements.

5.2 Bonnet Wall Thickness

The minimum bonnet wall thickness at the time of manufacture, except for the neck extension that contains the packing, shall be t_m as given in Table 1. For the neck extension, the local minimum wall thickness shall be based on the local diameter, e.g. the inside diameter of the stem bore or packing box bore, and shall be in accordance with the valve body neck rules of ASME B16.34.

5.3 Body Dimensions

5.3.1 Flanged Ends

5.3.1.1 Body end flanges shall comply with the dimensional requirements of ASME B16.5. Raised face end flanges shall be provided unless otherwise specified in the purchase order. The purchase order may specify a flange facing finish other than that specified in ASME B16.5.

5.3.1.2 Face-to-face dimensions shall be in accordance with ASME B16.10 or ISO 5752. Body end flanges and bonnet flanges shall be cast or forged integral with the body. However, flanges may be attached by welding as specified in the purchase order.

5.3.1.2.1 Welding a flange to a valve body shall be by full penetration butt-welding. Attachment weld shall conform to ASME B31.3 for normal fluid service, including required NDE and weld quality acceptance criteria and qualifications for the weld procedure and welder or welding operator unless otherwise specified in the purchase order. Heat treatment shall be performed in accordance with ASME B31.3 unless otherwise specified in the purchase order.

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

5.3.2 Butt-welding Ends

5.3.2.1 Butt-welding ends for valves shall conform to the requirements of ASME B16.25 for the bore specified for use without backing rings. Conversion of a flanged end valve to a butt-welding valve is not permitted unless otherwise specified in the purchase order.

The chemical composition of carbon steel welding ends shall meet the following requirements unless otherwise specified in the purchase order:

- the carbon content shall not exceed 0.23 % by mass;
- the carbon equivalent, CE, shall not exceed 0.43 as determined by the following Equation 1:

Equation 1: $CE = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15$

where

- C is weight % carbon
- Mn is weight % manganese
- Cr is weight % chromium
- Mo is weight % molybdenum
- Ni is weight % nickel
- Cu is weight % copper
- V is weight % vanadium

5.3.2.2 End-to-end dimensions for butt-welding end class-designated valves shall be in accordance with ASME B16.10 unless otherwise specified in the purchase order.

5.3.2.3 The extent of the NDE requirements for butt-welding ends above those listed in ASME B16.34 shall be specified in the purchase order.

5.3.3 Body Seat

5.3.3.1 The inside diameter of the seat opening shall not be less than that specified in Table 2 for the nominal pipe size and pressure class. Unlisted seat diameter shall be in agreement between the manufacturer and the purchaser.

5.3.3.2 Integral seats with overlays per Table 6 are permitted. Integral body seats without overlays are permitted in ASME B16.34 Group 2 and Group 3 material bodies.

5.3.3.3 Seating surfaces shall be integral or faced with weld metal. Finished thickness of any facing material shall be not less than 1.6 mm (0.06 in.).

5.3.3.4 Where separate seat rings are provided, they shall be shoulder or bottom seated, and either threaded and seal-welded, or inserted and seal welded in place. Tack welding or stitch welding shall not be used.

5.3.3.5 Body and disc seating surfaces shall be designed to prevent galling. [e.g. by providing a differential hardness].

5.3.3.6 When assembling seat rings a light thread lubricant having a viscosity no greater than kerosene may be used to prevent galling of mating threaded surfaces.

Table 2—Minimum Seat Diameter

Class Designation	150	300	600	900	1500	2500	Class Designation
Nominal Size DN	Minimum Seat Diameter mm (in.)						Nominal Size NPS
50	42 (1.65)	42 (1.65)	42 (1.65)	42 (1.65)	42 (1.65)	38 (1.50)	2
65	56 (2.20)	56 (2.20)	56 (2.20)	52 (2.07)	52 (2.07)	47 (1.87)	2 1/2
80	69 (2.71)	69 (2.71)	69 (2.71)	69 (2.71)	63 (2.48)	57 (2.25)	3
100	90 (3.54)	90 (3.54)	90 (3.54)	90 (3.54)	83 (3.26)	73 (2.87)	4
150	135 (5.31)	135 (5.31)	135 (5.31)	132 (5.18)	123 (4.85)	111 (4.37)	6
200	182 (7.17)	182 (7.17)	182 (7.17)	172 (6.76)	160 (6.31)	146 (5.75)	8
250	224 (8.82)	224 (8.82)	222 (8.74)	215 (8.45)	200 (7.88)	184 (7.25)	10
300	275 (10.81)	275 (10.81)	250 (9.84)	250 (9.84)	238 (9.38)	219 (8.62)	12
350	303 (11.93)	303 (11.93)	294 (11.59)	Unlisted	Unlisted	Unlisted	14
400	349 (13.73)	349 (13.73)	Unlisted	Unlisted	Unlisted	Unlisted	16
450	396 (15.60)	Unlisted	Unlisted	Unlisted	Unlisted	Unlisted	18
500	444 (17.47)	Unlisted	Unlisted	Unlisted	Unlisted	Unlisted	20
600	539 (21.21)	Unlisted	Unlisted	Unlisted	Unlisted	Unlisted	24
NOTE Reference 5.3.3.1 for unlisted seat diameters.							

5.4 Bonnet

5.4.1 The stem, gland, lantern ring or spacer ring (if supplied), and backseat design shall minimize clearances to provide stem guiding and the prevention of packing extrusion.

5.4.2 The bonnet shall include a conical stem backseat in one of the following forms:

- a bushing positively secured by tab, tack, or seal welding against coming loose, i.e. not relying on friction;
- an integral surface in the case of an austenitic stainless steel or nickel alloy valve;
- an austenitic stainless steel, nickel alloy or hardfaced weld overlay that is a minimum of 1.6 mm (0.06 in.) thick.

5.4.3 The gland bolting shall be secured to the bonnet so that the bolting is retained during repacking. When eyebolts are used, the eyebolt pin shall be anchored on both sides of the eyebolt. The anchors shall not include open slotted holes or be attached by fillet welds.

5.5 Bonnet-to-body Joint

5.5.1 The bonnet-to-body joint shall be a flange and gasket type.

5.5.2 The bonnet-to-body joint shall be one of the following types, as illustrated in ASME B16.5:

- raised face;
- tongue and groove;
- spigot and recess;
- ring joint.

5.5.3 The bonnet flange gasket shall be one of the following:

- solid metal, corrugated, or grooved (profiled) metal gasket with graphite filler;
- metal ring joint;
- spiral wound metal gasket with filler and a centering/compression ring;
- spiral wound metal gasket with filler and without a centering/compression ring.

Spiral wound metal gaskets with filler and without a centering/compression ring shall only be used in 'tongue and groove' or 'spigot and recess' bonnet-to-body joints.

5.5.4 Bonnet-to-body bolt pattern and gasket shall be circular.

5.5.5 Bonnet and body flange nut bearing surfaces shall be parallel to the flange face within $\pm 1^\circ$. Spot facing or back-facing required to meet the parallelism requirement shall be in accordance with ASME B16.5.

5.5.6 The bonnet-to-body joint shall be secured by a minimum of four through type stud bolts. The minimum stud bolt size for each valve size shall be as follows:

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

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

5.5.8 At assembly, gasket contact surfaces shall be free of sealing compounds.

5.5.9 If pressure seal bonnet design is specified, the bonnet joint construction shall be in accordance with MSS SP-144 Style B unless otherwise specified in the purchase order.

5.6 Disc

5.6.1 A one-piece disc design shall be furnished unless otherwise specified in the purchase order.

5.6.2 The globe valve disc-to-stem retention (except stop-check valves) shall be such that the disc cannot become detached from the stem as a result of flow-induced vibrations or attached piping movement while the valve is in service. The disc-to-stem retention shall be of a design that allows the disc to align with the valve seat.

5.6.3 Disc guiding by stem alone is not acceptable. The disc shall be body guided throughout its full range of travel to provide disc stability and avoid vibration. Guides shall be hardfaced if specified in the purchase order or when required for proper valve function. Typical disc and guiding configuration is illustrated in **Figure 2**.

5.6.4 Disc seating surfaces shall be integral or have a facing of weld material. Weld-deposited seating surfaces shall have a minimum finished facing material thickness of 1.6 mm (0.06 in.). A disc of solid metal equal to the trim material is permitted.

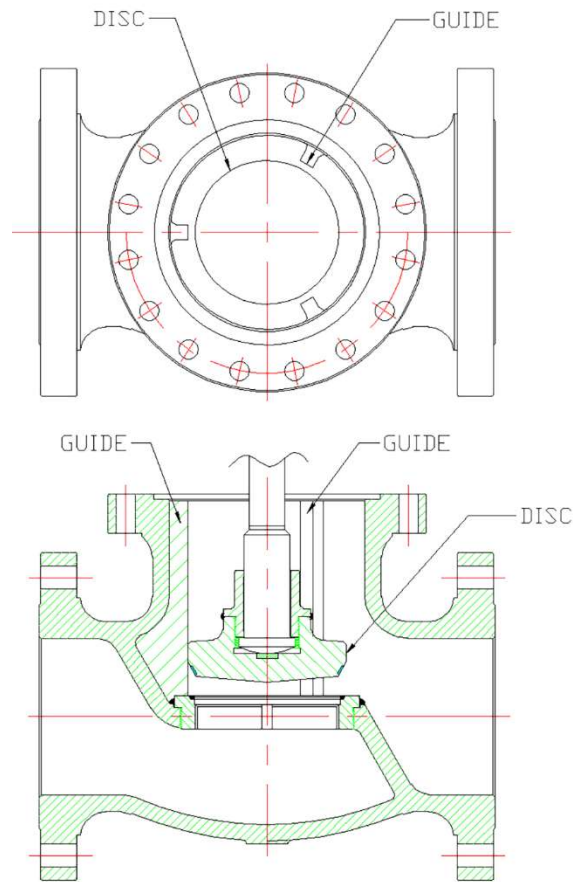


Figure 2—Typical Disc and Guiding

5.6.5 A hardened wear pad may be provided between the disc and stem to prevent wear and galling. The wear pad may be either a separate thrust plate or an integrally welded pad.

5.7 Yoke

5.7.1 The yoke shall retain the yoke bushing for rising and rotating stem valves or the stem nut for non-rotating rising stem globe valves. The yoke can be either an integral part of the bonnet or a separate component.

5.7.2 Yokes that are separate shall have yoke-to-bonnet mating surfaces machined so as to assure a proper bearing assembly interface.

5.7.3 Where used, the yoke-to-stem nut bearing surfaces shall be machined flat and parallel. A lubricating fitting shall be provided for the bearing surfaces.

5.7.4 If the non-rotating stem feature is accomplished by using flat guiding surfaces on the yoke these surfaces shall be machined to provide proper guiding without galling.

5.8 Stem, Stem Nut, (Yoke Bushing)

5.8.1 Stem Diameter:

- a. The minimum stem diameter, d_s , shall be as given in Table 3.

- b. The minimum stem diameter applies to the stem along the surface area that comes into contact with the packing and to the major diameter of the trapezoidal stem thread. However, the major diameter of the stem thread may be reduced, at the manufacturer's option, by no more than 1.6 mm (0.06 in.).
- c. The actual stem diameter shall take into account the valve design details and the stem material strength characteristics.

5.8.2 The stem surface area in contact with the packing shall have a surface finish, Ra, of 0.80 µm (32 µin.) or smoother.

5.8.3 Out of straightness of the entire length of the stem shall not exceed 0.001 mm/mm (0.001 in./in.).

5.8.4 Stems shall have a disc attachment means at one end and an external trapezoidal style thread form at the other. A yoke bushing on rising and rotating stems or a stem nut on non-rotating rising stems shall be provided.

Table 3—Minimum Stem Diameter

Class Designation	150	300	600	900	1500	2500	Class Designation
Nominal Size DN	Minimum Stem Diameter d_s mm (in.)						Nominal Size NPS
50	19 (0.75)	19 (0.75)	22 (0.88)	25 (1.00)	29 (1.13)	38 (1.50)	2
65	22 (0.88)	22 (0.88)	25 (1.00)	35 (1.38)	35 (1.38)	41 (1.62)	2½
80	25 (1.00)	25 (1.00)	29 (1.13)	35 (1.38)	38 (1.50)	44 (1.75)	3
100	29 (1.13)	29 (1.13)	32 (1.25)	44 (1.75)	48 (1.88)	51 (2.00)	4
150	32 (1.25)	35 (1.38)	48 (1.88)	57 (2.25)	70 (2.75)	79 (3.12)	6
200	35 (1.38)	44 (1.75)	64 (2.50)	73 (2.88)	89 (3.50)	102 (4.00)	8
250	38 (1.50)	57 (2.25)	83 (3.25)	89 (3.50)	108 (4.25)	124 (4.88)	10
300	44 (1.75)	67 (2.62)	86 (3.38)	105 (4.12)	127 (5.00)	146 (5.75)	12
350	48 (1.88)	73 (2.88)	98 (3.88)	—	—	—	14
400	57 (2.25)	86 (3.38)	—	—	—	—	16
450	64 (2.50)	—	—	—	—	—	18
500	70 (2.75)	—	—	—	—	—	20
600	89 (3.50)	—	—	—	—	—	24

5.8.5 The yoke bushing shall be threaded internally to engage the stem, and it shall be threaded or otherwise designed to be securely fitted into the yoke. The bushing shall be secured in place using either a lock weld or a positive mechanical lock. Locking by simple metal upsetting such as peening or staking is not permitted.

5.8.6 The stem-to-yoke bushing or stem-to-stem nut threads shall be of trapezoidal form as specified in ASME B1.5 or ASME B1.8, with nominal dimensional variations allowed. Stem threads shall be oriented so that a direct operated handwheel rotated in a clockwise direction closes the valve, regardless of whether the valve is equipped with yoke bushing or with stem nut.

5.8.7 The stem shall be one-piece wrought material. A stem that is a welded fabrication or threaded assembly shall not be provided.

5.8.8 The stem-to-disc connection (except for stop-check valves) shall prevent disengagement of the stem from the disc in any position of the disc or orientation of the valve. The bottom of the stem shall be contoured with a radial curvature large enough to allow contact with the closure element through any misalignment.

5.8.9 The stem design shall be such that the strength of the stem within the valve pressure boundary shall exceed the strength of the stem at the root of the operating thread.

5.8.10 The stem strength shall be designed to withstand at least 1.5 times the required operating torque under the maximum rated differential pressure, without mechanical failure. The maximum permissible input force shall be documented by the valve manufacturer.

5.8.11 The stem, stem nut (yoke bushing), disc connection, and bonnet shall be designed to withstand the opening and closing of the valve against the full rated pressure under the disc. Purchaser shall specify when valve shall be designed to withstand the opening and closing of the valve against the full rated pressure with flow over the disc.

5.8.12 The one-piece stem or the disc retainer shall include a conical or spherical raised surface that seats against the bonnet backseat when the valve is at its full open position.

Note: A stem-bonnet backseat is a requirement of this standard and, as such, is not meant to imply a manufacturer's recommendation of its use for the purpose of adding or replacing packing while the valve is under pressure.

5.8.13 The yoke bushing or stem nut design shall allow for the removal of the handwheel while keeping the stem (and disc) in a fixed position.

5.8.14 The stem or stem nut-to-handwheel attachment shall be through a non-round interface or a round interface having a keyway. A threaded extension shall be provided at the top of the stem or stem nut for engaging a handwheel retainer nut.

5.8.15 For rising handwheels, the manufacturer shall provide design clearance between the handwheel or the adapter plate and yoke bushing or stem nut when the valve is in the closed position (including seat wear). The design shall have unobstructed hand clearance between the handwheel and any part of the yoke.

5.8.16 Valves shall have a means to indicate disc position in both the open and closed positions, using one of the following criteria:

- For rotating rising stems with rising handwheels, the following maximum stem exposures between the handwheel and the stem nut in the closed position shall be met for the following valve sizes:
 - a) valve sizes $50 \leq DN \leq 80$, 12.7 mm: $2 \leq NPS \leq 3$, $\frac{1}{2}$ in. (maximum stem exposure);
 - b) valve sizes $100 \leq DN \leq 300$, 19.1 mm: $4 \leq NPS \leq 12$, $\frac{3}{4}$ in. (maximum stem exposure);
 - c) valve sizes $350 \leq DN \leq 600$, 25.4 mm: $14 \leq NPS \leq 24$, 1 in. (maximum stem exposure).
- For non-rotating rising stems with non-rising handwheels the manufacturer shall provide a means to indicate disc position in both the open and closed positions.
- For gear-operated valves, the manufacturer shall provide a means to determine the disc position in both the open and closed positions.

5.8.17 Valves $DN \geq 150$ ($NPS \geq 6$) with pressure class ≥ 600 , shall be furnished with stem nuts having ball or roller bearings.

5.9 Packing and Packing Box

5.9.1 The packing may be either square, rectangular, or trapezoidal in cross-section. The nominal radial width of the packing, w , shall be in accordance with Table 4.

5.9.2 The nominal depth of the packing box shall accommodate a minimum of five uncompressed rings of packing. The packing box surface area in contact with the packing material shall have a surface finish, Ra , of $4.5 \mu\text{m}$ (175 $\mu\text{in.}$) or smoother.

Table 4—Nominal Radial Width of Packing

Nominal Stem Diameter d_n mm (in.)	Nominal Radial Width of the Packing w mm (in.)	Maximum Packing Box Clearance Factor y mm (in.)
$19 < d \leq 27$ ($3/4 < d \leq 1$)	6.4 (1/4)	0.4 (1/64)
$27 < d \leq 37$ ($1 < d \leq 1\frac{3}{8}$)	7.9 (5/16)	0.4 (1/64)
$37 < d \leq 49$ ($1\frac{3}{8} < d \leq 1\frac{7}{8}$)	9.5 (3/8)	0.4 (1/64)
$49 < d \leq 56$ ($1\frac{7}{8} < d \leq 2\frac{1}{8}$)	11.1 (7/16)	0.8 (1/32)
$56 < d \leq 74$ ($2\frac{1}{8} < d \leq 2\frac{7}{8}$)	12.7 (1/2)	0.8 (1/32)
$74 < d < 92$ ($2\frac{7}{8} < d \leq 3\frac{5}{8}$)	14.3 (9/16)	0.8 (1/32)
$92 < d < 108$ ($3\frac{5}{8} < d \leq 4\frac{1}{4}$)	15.9 (5/8)	0.8 (1/32)
$108 < d < 124$ ($4\frac{1}{4} < d \leq 4\frac{7}{8}$)	17.5 (11/16)	0.8 (1/32)
$124 < d < 146$ ($4\frac{7}{8} < d \leq 5\frac{3}{4}$)	20.6 (13/16)	0.8 (1/32)

5.9.3 The maximum bore (inside diameter) of the packing box shall be per **Equation 2** below: Values shall be taken from **Table 4**.

Equation 2 Packing Box Maximum Bore = $d_n + 2w + y$

5.9.4 A one piece gland and a separate gland flange shall be provided for packing compression. The gland flange shall have two holes to receive the gland bolting. Slots for gland flange bolts shall not be used. The gland and gland flange shall be self-aligning. The gland shall have a shoulder at its outer edge so as to prevent complete entry of the gland into the packing box. Packing gland assembly (including gland flange, follower, bolting, and anchoring pins) shall have adequate strength to transmit load without permanent deformation under required packing load.

5.9.5 The stem, gland, lantern ring or spacer ring (if supplied), and backseat design shall minimize clearances to provide stem guiding and the prevention of packing extrusion.

5.9.6 A lantern ring shall not be provided unless otherwise specified in the purchase order. To accommodate the lantern ring, the packing box depth shall be at least equivalent to that of a minimum of three uncompressed rings of packing above the lantern ring and three uncompressed rings of packing below the lantern ring plus the length of the lantern ring. The clearance between the packing box bore (inside diameter) and the outside diameter of the gland and the spacer ring (see Figure B.1) shall be less than the diametrical clearance between the inside diameter of the gland and the stem diameter.

Note: Consideration should be given to the clearance between the spacer ring and the stem to prevent galling.

5.9.7 The remaining adjustment length of the packing gland shall be greater than one and a half times the packing width specified in Table 4.

5.9.8 Design of the valve shall allow adjustment of stem packing without removing the valve operator as specified in section 5.11.

5.10 Bolting

5.10.1 Bolting for the bonnet-to-body joint shall be continuously threaded stud bolts with heavy hexagon nuts. Bolting shall be standard inch series meeting the standards ASME B18.31.2 and ASME B18.2.2. Metric series bolting may be specified by the purchaser meeting the standards ASME B18.31.1M and ASME B18.2.6M.

5.10.2 Body-to-bonnet bolting materials shall meet the requirements of ASME B16.34.

5.10.3 Yoke-to-bonnet bolting shall be either continuously threaded stud bolts or headed bolts with hexagon nuts.

5.10.4 Gland bolts, with hexagonal nuts, shall be hinged eyebolts, headed bolts, stud bolts, or studs.

5.10.5 Bolting with diameters 25 mm (1 in.) and smaller shall have coarse (UNC) threads or the most nearly corresponding metric threads. Bolting with diameters larger than 25 mm (1 in.) shall be 8-thread series (8UN) or the most nearly corresponding metric threads. Bolt threads shall be Class 2A and nut threads shall be Class 2B, in accordance with ASME B1.1. When metric bolting is used, metric bolt threads shall be tolerance Class 6g and nuts tolerance Class 6H in accordance with ASME B1.13M.

5.11 Operation

5.11.1 The valve shall be supplied with a direct operated handwheel, hammer-blow handwheel, or gear operator that opens the valve when turned in a counter-clockwise direction unless otherwise specified in the purchase order.

5.11.1.1 The handwheel and gear box (if equipped) shall be sized in accordance with MSS SP-91 unless otherwise specified in the purchase order.

5.11.1.2 The handwheel (including gear operator handwheel) diameter shall not be smaller than 150 mm (6 in.) and shall not exceed 800 mm (31.5 in.). Other handwheel diameters are permitted by agreement between the purchaser and the manufacturer.

5.11.2 The handwheel shall be a spoke-rim type with a maximum of six spokes and shall be free from burrs and sharp edges.

5.11.2.1 The handwheel shall be a one-piece casting or forging or a multipiece carbon steel fabrication that includes other carbon steel product forms unless otherwise specified in the purchase order.

5.11.2.2 Fabricated handwheels shall have strength and toughness characteristics at least equal to that of handwheels made as one-piece castings or forgings.

5.11.3 The handwheel shall be marked with the word "OPEN" and an arrow pointing in the direction of opening.

5.11.4 The handwheel shall be retained on the stem or stem nut by a threaded handwheel nut.

5.11.5 If operation by a chain wheel, gearbox, or power actuator is to be added to the valve, the purchaser shall specify the following in the purchase order:

- for chainwheel operation, the dimension from the centerline of the valve stem (for handwheel operated valves) or gear input shaft (for gear operated valves) to the bottom of the chain loop;
- addition of safety cables for chainwheel operators
- spur or bevel gear and the position of gearing handwheel relative to the pipe axis;
- electric, hydraulic, pneumatic, or other actuator type;
- maximum service temperature and pressure differential across the valve disc;
- power supply attributes for power actuators.

NOTE Chainwheels may present a risk of injury or damage if not properly designed, installed, secured, operated, and maintained.

5.11.6 Valve-to-gear-box or power actuator flange mating dimensions shall be according to ISO 5210 or MSS SP-102 unless otherwise specified in the purchase order.

5.11.7 Gearboxes shall be equipped with a position indicator.

5.11.8 If the number of turns from open to close exceeds 100, the gear operator shall have provision for connection to a power wrench.

5.12 Stop-check

5.12.1 Stop-check valves shall be provided with a means to equalize pressure in the bonnet above the disc to the downstream side.

5.12.2 Stop-check valves shall have suitable disc or bottom guiding to ensure the disc moves freely during check valve operation.

5.12.3 Stop-check valves shall be tested in accordance with the requirements of API 598 for both globe and check valves and shall meet the acceptance criteria of both types of tests.

5.12.4 Stop-check valves shall be suitable for installation with the stem in the vertical orientation or in an orientation where the stem is within 45° of vertical orientation.

5.13 Bypasses and Other Auxiliary Connections

Auxiliary connections and tapped test openings to the body and/or bonnet, such as drains, shall not be furnished unless otherwise specified in the purchase order. The design and construction of the joint and the piping of auxiliary connections shall conform to the requirements of ASME B16.34. When required, auxiliary connections shall be sized and located as specified in ASME B16.34. The size, type, and location of auxiliary connections shall be as specified on the purchase order.

If a bypass is furnished, it shall be of the external type and of a size specified in ASME B16.34 and MSS SP-45. The bypass valve shall conform to API 602, and be of a pressure class equal to or greater than that of the primary valve unless otherwise specified in the purchase order.

5.14 Fugitive Emission Requirement

Valves shall be type tested to the requirements of API 624. Refer to Section 8.2 for marking requirements.

6 Materials

6.1 Materials Other Than Trim Materials

Materials for body, bonnet, and valve parts other than trim items shall be selected from Table 5.

6.2 Trim

6.2.1 The trim comprises the following:

- a) stem;
- b) body seating surface;
- c) disc seating surface;
- d) bushing, or a deposited weld, for the backseat;
- e) small internal parts that normally contact the service fluid, including split rings and other disc-to-stem retaining components, are considered part of the trim.

6.2.2 The trim material, except as stated in a) through e) below, shall be the manufacturer's standard material for the type listed in Table 6 for the trim number specified in the purchase order. The typical specifications included in Table 6 represent some acceptable grades.

- a) If a trim number listed in Table 6 is specified, then an alternative trim number as shown in Table 7 may be furnished if agreed to by the purchaser.
- b) If a single trim (e.g. trim 5) is furnished, both the seating surface of the body and the seating surface of the disc shall be made of the type of material shown in Table 6.

- c) If a combination trim (e.g. trim 8) is furnished, the seating surface of the body shall be made of one of the two types of material shown in Table 6, and the seating surface of the disc shall be made of the other type of material shown.
- d) The stem, backseat, and stem hole guide, and the small internal parts (see 6.2.1 e) shall be of the type of material and hardness listed in Table 6. The stem shall be a wrought material.
- e) Hardfacing of both the seat ring and disc seating surface is required for Class 900 and higher-rated valves (e.g. Trim Number 16 in Table 6).

6.2.3 The base material of the valve disc and separate body seat ring, when used, shall be of a nominal material composition at least equal to the body or to that of the stem material, except for disc material made of solid trim material as allowed by 5.6.4.

6.2.4 Trim materials, including the base material for Hardfaced trim items, shall have a corrosion resistance at least equal to the valve body's corrosion resistance and pressure temperature rating.

Table 5—Materials for Parts

Part	Material
Body ^a and bonnet	As selected from ASME B16.34, Group 1, Group 2, and Group 3.
Disc	Steel or other corrosive-resistant alloy, at least equal in corrosion resistance to that of the body material or the stem material (see 6.2.3).
Yoke, separate	Carbon steel, stainless steel, or same material as the bonnet.
Bolting: body-to-bonnet	Unless other materials are agreed between the purchaser and manufacturer, the bolting material listed in Annex C is recommended. Bolting shall be selected to satisfy valve pressure and temperature range. However, for service temperatures below -29°C (-20°F) or above 454°C (850°F), the purchase order shall specify the bolting material.
Bonnet gasket	For temperature range from -29°C to 427°C (-20°F to 800°F). The metallic portion exposed to the service environment shall be of a material that has corrosion resistance at least equal to that of the body material. The purchaser may specify alternate material.
Bolting: gland and yoke	Bolting material at least equal to ASTM A307—Grade B. Gland bolts and nuts shall be at least equal in corrosion resistance to that of the body material unless otherwise specified.
Seat ring	As in Table 6 except the base material of the seat ring, if used, and the base weld material of seal welds, strength welds, or weld deposit facings shall be of nominal material composition equal to the body material or the stem material (see 6.2.3).
Gland flange	Austenitic stainless steel or same nominal chemical composition as the body.
Gland	Material having corrosion resistance at least equal to that of the stem material and with melting point above 955°C (1750°F).
Packing	Graphitic material suitable for steam and petroleum fluids for temperature range from -29°C to 427°C (-20°F to 800°F) ^b . Shall contain a corrosion inhibitor. The purchaser may specify alternate material.
Lantern ring or spacer ring	Material having corrosion resistance at least equal to that of the stem material and with melting point above 955°C (1750°F)
Stem nut or yoke bushing	Austenitic ductile iron, 13Cr steel or copper alloy with melting point above 955°C (1750°F).
Handwheel	Malleable iron, carbon steel, or ductile iron. Corrosion resistant materials may be specified by the purchaser (see 5.11.2).
Handwheel nut (retaining)	Steel, malleable iron, ductile iron, or nonferrous copper alloy.

Pipe plugs	Nominal composition shall be the same as the body material. Welded plugs shall be of the same P-group material as the body, as defined in ASME BPVC Section IX. Cast iron plugs shall not be used.
Bypass piping and valves	Nominal composition shall be the same as the body material and trim materials shall be the same as the primary valve.
Identification plate	Austenitic stainless steel or nickel alloy attached to the valve by corrosion-resistant fasteners or by welding.
^a Welded on flanges shall be of the same nominal composition as the body. ^b Effective low emissions performance may be limited to lower temperatures.	

Table 6—Nominal Seating Surface, Stem and Backseat Bushing or Weld-deposit Materials and Hardness^f

Trim	Seating Trim	Seating Surface Hardness (HB) Minimum ^a	Seating Surface Material Type	Seating Surface Typical Specifications Grade			Stem/Backseat Bushing ^p		Stem Hardness (HB) ^a	Backseat Bushing Hardness (HB) ^a
				Cast (Integral)	Forged (Integral)	Welded ^m	Material Type	Typical Specifications Type		
1	F6	TRIM NUMBER 1 IS OBSOLETE								
2 ^q	304	Note ^d	18Cr-8Ni	ASTM A351 CF8 UNS J92600	ASTM A182 F 304 UNS S30400	AWS A5.9 ER308	18Cr-8Ni	ASTM A276 304 UNS S30400	Note ^d	Note ^d
2A ^q	304 and Hardfaced	Note ^d	18Cr-8Ni	ASTM A351 CF8 UNS J92600	ASTM A182 F 304 UNS S30400	AWS A5.9 ER308	18Cr-8Ni	ASTM A276 304 UNS S30400	Note ^d	Note ^d
		350 ⁱ	Co-Cr Alloy ^g	NA	NA	AWS A5.13 ECoCr-A or AWS A5.21 ERCoCr-A				
2B ^q		Note ^d	18Cr-8Ni	ASTM A351 CF8 UNS J92600	ASTM A182 F 304 UNS S30400	AWS A5.9 ER308				
		350 ⁱ	Ni-Cr Alloy	NA	NA	MFG Standard				
3 ^q	310	Note ^d	25Cr-20Ni	NA	ASTM A182 F 310 UNS S31000	AWS A5.9 ER310	25Cr-20Ni	ASTM A276 310 UNS S31000	Note ^d	Note ^d
4 ^q	Hard F6	750 ^e	Hard 13Cr ^b	NA	Note ^f	NA	13Cr ^b	ASTM A276 410 UNS S41000 or ASTM A276 420 UNS S42000	200 min 275 max	250 min.
5	F6 and Full Hardfaced	350 ^e	Co-Cr Alloy ^g	NA	NA	AWS A5.13 ECoCr-A or AWS A5.21 ERCoCr-A	13Cr ^b	ASTM A276 410 UNS S41000 or ASTM A276 420 UNS S42000	200 min 275 max	250 min.
5A			Ni-Cr Alloy	NA	NA	MFG Standard				
5B			Co-Cr-Ni-Mo ^j	NA	NA	UNS R31233				
6 ^q	F6 and Cu-Ni	250 ⁱ	13Cr ^b	ASTM A217 CA15 UNS J91150	ASTM A182 F 6a S41000	AWS A5.9 ER410	13Cr ^b	ASTM A276 410 UNS S41000 or ASTM A276 420 UNS S42000	200 min 275 max	250 min
		175 ⁱ	Cu-Ni Alloy	NA	Note ^k	NA				
7 ^q	F6 and Hard F6	250 ⁱ	13Cr ^b	ASTM A217 CA15	ASTM A182 F 6a	AWS A5.9 ER410	13Cr ^b	ASTM A276 410 UNS S41000	200 min 275 max	250 min.

				UNS J91150	S41000			or ASTM A276 420 UNS S42000		
		750 ⁱ	Hard 13Cr ^b	NA	Note ^f	NA				

Table 6—Nominal Seating Surface, Stem and Backseat Bushing or Weld-deposit Materials and Hardness (Continued)

Trim	Seating Trim	Seating Surface Hardness (HB) Minimum ^a	Seating Surface Material Type	Seating Surface Typical Specifications Grade			Stem/Backseat Bushing ^p		Stem Hardness (HB)	Backseat Bushing Hardness (HB)
				Cast (Integral)	Forged (Integral)	Welded ^m	Material Type	Typical Specifications Type		
8 ^q	F6 and Hardfaced	250 ⁱ	13Cr ^b	ASTM A217 CA15 UNS J91150	ASTM A182 F 6a S41000	AWS A5.9 ER410	13Cr ^b	ASTM A276 410 UNS S41000 Or ASTM A276 420 UNS S42000	200 min 275 max	250 min.
		350 ⁱ	Co-Cr Alloy ^g	NA	NA	AWS A5.13 ECoCr-A or AWS A5.21 ERCoCr-A				
8A ^q		250 ⁱ	13Cr ^b	ASTM A217 CA15 UNS J91150	ASTM A182 F 6a S41000	AWS A5.9 ER410				
		350 ⁱ	Ni-Cr Alloy	NA	NA	MFG Standard				
9 ^q	Alloy 400	Note ^d	Ni-Cu Alloy	NA	MFG Standard	NA	Ni-Cu Alloy	MFG Standard	Note ^d	Note ^d
10 ^q	316	Note ^d	18Cr-8Ni-2Mo	ASTM A351 CF8M UNS J92900	ASTM A182 F 316 UNS S31600	AWS A5.9 ER316	18Cr-8Ni-2Mo	ASTM A276 316 UNS S31600	Note ^d	Note ^d
11	Alloy 400 and Hardfaced	Note ^d	Ni-Cu Alloy	NA	MFG Standard	NA	Ni-Cu Alloy	MFG Standard	Note ^d	Note ^d
		350 ⁱ	Co-Cr ^g	NA	NA	AWS A5.13 ECoCr-A or AWS A5.21 ERCoCr-A				
11A		Note ^d	Ni-Cu Alloy	NA	MFG Standard	NA				
		350 ⁱ	Ni-Cr Alloy	NA	NA	MFG Standard				
12 ^q	316 and Hardfaced	Note ^d	18Cr-8Ni-2Mo	ASTM A351 CF8M UNS J92900	ASTM A182 F 316 UNS S31600	AWS A5.9 ER316	18Cr-8Ni-2Mo	ASTM A276 316 UNS S31600	Note ^d	Note ^d
		350 ⁱ	Co-Cr Alloy ^g	NA	NA	AWS A5.13 ECoCr-A or AWS A5.21 ERCoCr-A				
12A ^q		Note ^d	18Cr-8Ni-2Mo	ASTM A351 CF8M UNS J92900	ASTM A182 F 316 UNS S31600	AWS A5.9 ER316				
		350 ⁱ	Ni-Cr Alloy	NA	NA	MFG Standard				
13 ^q	Alloy 20	Note ^d	19Cr-29Ni	ASTM A351 CN7M UNS N08007	ASTM B462 UNS N08020	AWS A5.9 ER320	19Cr-29Ni	ASTM B473 UNS N08020	Note ^d	Note ^d
14 ^q	Alloy 20 and Hardfaced	Note ^d	19Cr-29Ni	ASTM A351 CN7M UNS N08807	ASTM B462 UNS N08020	AWS A5.9 ER320	19Cr-29Ni	ASTM B473 UNS N08020	Note ^d	Note ^d

		350 ⁱ	Co-Cr Alloy ^g	NA	NA	AWS A5.13 ECoCr-A or AWS A5.21 ERCoCr-A				
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Table 6—Nominal Seating Surface, Stem and Backseat Bushing or Weld-deposit Materials and Hardness (Continued)

Trim	Seating Trim	Seating Surface Hardness (HB) Minimum ^a	Seating Surface Material Type	Seating Surface Typical Specifications Grade			Stem/Backseat Bushing ^p		Stem Hardness (HB)	Backseat Bushing Hardness (HB)
				Cast (Integral)	Forged (Integral)	Welded ^m	Material Type	Typical Specifications Type		
14A ^q	Alloy 20 and Hardfaced	Note ^d	19Cr-29Ni	ASTM A351 CN7M UNS N08807	ASTM B462 UNS N08020	AWS A5.9 ER320	19Cr-29Ni	ASTM B473 UNS N08020	Note ^d	Note ^d
		350 ⁱ	Ni-Cr Alloy	NA	NA	MFG Standard				
15	304 and Full Hardfaced	350 ^e	Co-Cr Alloy ^g	NA	NA	AWS A5.13 ECoCr-A or AWS A5.21 ERCoCr-A	18Cr-8Ni	ASTM A276 304 UNS S30400	Note ^d	Note ⁿ
			Ni-Cr Alloy	NA	NA	MFG Standard				
16	316 and Full Hardfaced	350 ^e	Co-Cr Alloy ^g	NA	NA	AWS A5.13 ECoCr-A or AWS A5.21 ERCoCr-A	18Cr-8Ni-2Mo	ASTM A276 316 UNS S31600	Note ^d	Note ⁿ
			Ni-Cr Alloy	NA	NA	MFG Standard				
17	347 and Full Hardfaced	350 ^e	Co-Cr Alloy ^g	NA	NA	AWS A5.13 ECoCr-A or AWS A5.21 ERCoCr-A	18Cr-10Ni-Cb	ASTM A276 347 UNS S34700	Note ^d	Note ⁿ
			Ni-Cr Alloy	NA	NA	MFG Standard				
18	Alloy 20 and Full Hardfaced	350 ^e	Co-Cr Alloy ^g	NA	NA	AWS A5.13 ECoCr-A or AWS A5.21 ERCoCr-A	19Cr-29Ni	ASTM B473 UNS N08020	Note ^d	Note ⁿ
			Ni-Cr Alloy	NA	NA	MFG Standard				
19 ^q	Nickel Alloy	Note ^d	Ni Alloy	MFG Standard	MFG Standard	MFG Standard	Ni Alloy	MFG Standard	Note ^d	Note ⁿ
20 ^q	Nickel Alloy and Hardfaced	Note ^d	Ni Alloy	MFG Standard	MFG Standard	MFG Standard	Ni Alloy	MFG Standard	Note ^d	Note ⁿ
		350 ⁱ	Co-Cr Alloy ^g	NA	NA	AWS A5.13 ECoCr-A or AWS A5.21 ERCoCr-A				
20A ^q		Note ^d	Ni Alloy	MFG Standard	MFG Standard	MFG Standard				
		350 ⁱ	Ni-Cr Alloy	NA	NA	MFG Standard				
21 ^q	Alloy 625	Note ^d	Ni-Cr Alloy	ASTM A494 CW6MC UNS N26625	ASTM B564 UNS N06625	AWS A5.14 ERNiCrMo-3	Ni-Cr Alloy	ASTM B564 UNS N06625	Note ^d	Note ⁿ
22 ^q		Note ^d	Ni-Cr Alloy	ASTM A494 CW6MC UNS N26625	ASTM B564 UNS N06625	AWS A5.14 ERNiCrMo-3	Ni-Cr Alloy	ASTM B564 UNS N06625	Note ^d	Note ⁿ

	Alloy 625 and Hardfaced	350 ⁱ	Co-Cr Alloy ^g	NA	NA	AWS A5.13 ECoCr-A or AWS A5.21 ERCoCr-A				
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Table 6—Nominal Seating Surface, Stem and Backseat Bushing or Weld-deposit Materials and Hardness (Continued)

Trim	Seating Trim	Seating Surface Hardness (HB) Minimum ^a	Seating Surface Material Type	Seating Surface Typical Specifications Grade			Stem/Backseat Bushing ^p		Stem Hardness (HB)	Backseat Bushing Hardness (HB)
				Cast (Integral)	Forged (Integral)	Welded ^m	Material Type	Typical Specifications Type		
22A ^q	Alloy 625 and Hardfaced	Note ^d	Ni-Cr Alloy	ASTM A494 CW6MC UNS N26625	ASTM B564 UNS N06625	AWS A5.14 ERNiCrMo-3	Ni-Cr Alloy	ASTM B564 UNS N06625	Note ^d	Note ⁿ
		350 ⁱ	Ni-Cr Alloy	NA	NA	MFG Standard				
23 ^q	Alloy C276	Note ^d	Ni-Cr Alloy	ASTM A494 CW2M UNS N26455	ASTM B564 UNS N10276	AWS A5.14 ERNiCrMo-4	Ni-Cr Alloy	ASTM B564 UNS N10276	Note ^d	Note ⁿ
24 ^q	Alloy C276 and Hardfaced	Note ^d	Ni-Cr Alloy	ASTM A494 CW2M UNS N26455	ASTM B564 UNS N10276	AWS A5.14 ERNiCrMo-4	Ni-Cr Alloy	ASTM B564 UNS N10276	Note ^d	Note ⁿ
		350 ⁱ	Co-Cr Alloy ^g	NA	NA	AWS A5.13 ECoCr-A or AWS A5.21 ERCrCo-A				
24A ^q		Note ^d	Ni-Cr Alloy	ASTM A494 CW2M UNS N26455	ASTM B564 UNS N10276	AWS A5.14 ERNiCrMo-4				
		350 ⁱ	Ni-Cr Alloy	NA	NA	MFG Standard				
25 ^q	Alloy 825	Note ^d	Ni-Cr Alloy	ASTM A494 CU5MCuC UNS N08826	ASTM B564 UNS N08825	AWS A5.14 ERNiCrMo-3	Ni-Cr Alloy	ASTM B564 UNS N08825	Note ^d	Note ⁿ
26 ^q	Alloy 825 and Hardfaced	Note ^d	Ni-Cr Alloy	ASTM A494 CU5MCuC UNS N08826	ASTM B564 UNS N08825	AWS A5.14 ERNiCrMo-3	Ni-Cr Alloy	ASTM B564 UNS N08825	Note ^d	Note ⁿ
		350 ⁱ	Co-Cr Alloy ^g	NA	NA	AWS 5.13 ECoCr-A or AWS 5.21 ECoCr-A				
26A ^q		Note ^d	Ni-Cr Alloy	ASTM A494 CU5MCuC UNS N08826	ASTM B564 UNS N08825	AWS A5.14 ERNiCrMo-3				
		350 ⁱ	Ni-Cr Alloy	NA	NA	MFG Standard				
27	Nickel Alloy and Full Hardfaced	350 ⁱ	Co-Cr Alloy ^g	NA	NA	AWS 5.13 ECoCr-A or AWS 5.21 ECoCr-A	Ni Alloy	MFG Standard	Note ^d	Note ⁿ
			Ni-Cr Alloy	NA	NA	MFG Standard				
28 ^q	Duplex (F51) and Hardfaced	Note ^d	22Cr-5Ni-3Mo-N	ASTM A995 CD3MN (4A) UNS J92205	ASTM A182 F 51 UNS S31803 ^c	AWS A5.9 ER2209	22Cr-5Ni-3Mo-N	ASTM A276 UNS S31803 ^c	Note ^d	Note ⁿ
		350 ⁱ	Co-Cr Alloy ^g	NA	NA	AWS 5.13 ECoCr-A or AWS 5.21 ECoCr-A				

Table 6—Nominal Seating Surface, Stem and Backseat Bushing or Weld-deposit Materials and Hardness (Continued)

Trim	Seating Trim	Seating Surface Hardness (HB) Minimum ^a	Seating Surface Material Type	Seating Surface Typical Specifications Grade			Stem/Backseat Bushing ^p		Stem Hardness (HB)	Backseat Bushing Hardness (HB)
				Cast (Integral)	Forged (Integral)	Welded ^m	Material Type	Typical Specifications Type		
28A ^q	Duplex (F51) and Hardfaced	Note ^d	22Cr-5Ni-3Mo-N	ASTM A995 CD3MN (4A) UNS J92205	ASTM A182 F 51 UNS S31803 ^c	AWS A5.9 ER2209	22Cr-5Ni-3Mo-N	ASTM A276 UNS S31803 ^c	Note ^d	Note ⁿ
		350 ⁱ	Ni-Cr Alloy	NA	NA	MFG Standard				
29	Duplex (F51) and Full Hardfaced	350 ^e	Co-Cr Alloy ^g	NA	NA	AWS 5.13 ECoCr-A or AWS 5.21 ECoCr-A	22Cr-5Ni-3Mo-N	ASTM A276 UNS S31803 ^c	Note ^d	Note ⁿ
			Ni-Cr Alloy	NA	NA	MFG Standard				
30 ^q	Super Duplex (F53) and Hardfaced	Note ^d	25Cr-5Ni-Mo-Cu-N	ASTM A995 CD4MCuN (1B) UNS J93372	ASTM A182 F 53 UNS S32750	AWS A5.9 ER2594	25Cr-5Ni-Mo-Cu-N	ASTM A276 UNS S32750	Note ^d	Note ⁿ
		350 ⁱ	Co-Cr Alloy ^g	NA	NA	AWS 5.13 ECoCr-A or AWS 5.21 ECoCr-A				
30A ^q		Note ^d	25Cr-5Ni-Mo-Cu-N	ASTM A995 CD4MCuN (1B) UNS J93372	ASTM A182 F 53 UNS S32750	AWS A5.9 ER2594				
		350 ⁱ	Ni-Cr Alloy	NA	NA	MFG Standard				
31	Super Duplex (F53) and Full Hardfaced	350 ^e	Co-Cr Alloy ^g	NA	NA	AWS 5.13 ECoCr-A or AWS 5.21 ECoCr-A	25Cr-5Ni-Mo-Cu-N	ASTM A276 UNS S32750	Note ^d	Note ⁿ
			Ni-Cr Alloy	NA	NA	MFG Standard				
32 ^q	Super Duplex (F55) and Hardfaced	Note ^d	25Cr-7Ni-Mo-N	ASTM A995 CD3MWCuN (6A) UNS J93380	ASTM A182 UNS S32760	AWS A5.9 ER2594	25Cr-7Ni-Mo-N	ASTM A276 UNS S32760	Note ^d	Note ⁿ
		350 ⁱ	Co-Cr Alloy ^g	NA	NA	AWS 5.13 ECoCr-A or AWS 5.21 ECoCr-A				
32A ^q		Note ^d	25Cr-7Ni-Mo-N	ASTM A995 CD3MWCuN (6A) UNS J93380	ASTM A182 UNS S32760	AWS A5.9 ER2594				
		350 ⁱ	Ni-Cr Alloy	NA	NA	MFG Standard				
33	Super Duplex (F55) and Full Hardfaced	350 ^e	Co-Cr Alloy ^g	NA	NA	AWS 5.13 ECoCr-A or AWS 5.21 ECoCr-A	25Cr-7Ni-Mo-N	ASTM A276 UNS S32760	Note ^d	Note ⁿ
			Ni-Cr Alloy	NA	NA	MFG Standard				

Table 6—Nominal Seating Surface, Stem and Backseat Bushing or Weld-deposit Materials and Hardness (Continued)

Trim	Seating Trim	Seating Surface Hardness (HB) Minimum ^a	Seating Surface Material Type	Seating Surface Typical Specifications Grade			Stem/Backseat Bushing ^p		Stem Hardness (HB)	Backseat Bushing Hardness (HB)
				Cast (Integral)	Forged (Integral)	Welded ^m	Material Type	Typical Specifications Type		
34	Super Duplex (Ferralium 255) and Full Hardfaced	350 ^e	Co-Cr Alloy ^g	NA	NA	AWS 5.13 ECoCr-A or AWS 5.21 ECoCr-A	Cr-Ni-Mo-Cu Alloy	ASTM A276 UNS S32550	Note ^d	Note ⁿ
			Ni-Cr Alloy	NA	NA	MFG Standard				
35	Hardfaced UNS R31233	350 ^e	Co-Cr-Ni-Mo ^j	NA	NA	UNS R31233	MFG Standard	MFG Standard	Note ^d	Note ⁿ

NOTE: Cr = Chromium; Ni = Nickel; Co = Cobalt; Cu = Copper; Mo = Molybdenum; N = Nitrogen; MFG Standard = Manufacturer Standard ; NA = Not Applicable.

a HB (formerly BHN) is the symbol for the Brinell hardness per ASTM E10.

b Free machining grades of 13Cr are prohibited.

c Seating material UNS S32205 (F60) can be used as an alternative to UNS S31803 (F51).

d Manufacturer's standard hardness.

e Differential hardness between the body and disc seating surfaces is not required.

f Case hardness by nitriding to a thickness of 0.13 mm (0.005 in.) minimum.

g AWS A5.13 ECoCr-A or AWS A5.21 ERCrCo-A: This classification includes such trademark materials as Stellite 6™ *, Stoddy 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 and typical CoCr-E alloys include AWS A5.13 ECoCr-E or AWS A5.21 ERCrCo-E. * Trademarks are examples only and do not constitute an endorsement of this product by API.

h **Not used.**

i Hardness differential between the body and disc seating surfaces shall be the manufacturer's standard.

j This classification includes trademark material Ultimet™.

k Manufacturer's standard with 30 Ni minimum.

l Not used.

- m Typical backseat seating surface hardfacing or overlay, when specified.
- n Per manufacturer's standard if not hardfaced, 250 HB minimum if hardfaced.
- o Not used.
- p For weld deposit on an integral backseat, the same nominal material and typical specification shall apply.
- q This trim shall not be used for Class 900 and higher per paragraph 6.2.2.e.
- r Trim materials, including the base material for Hardfaced trim items, shall have a corrosion resistance at least equal to the valve body's corrosion resistance and pressure temperature rating.

Table 7—Trim Numbers and Alternative Trim Numbers

Specified Trim Number	Alternative Trim Number
2 (F304)	2A (304 and Hardfaced) or 2B (304 and Hardfaced) or 15 (304 and Full Hardfaced)
5A (F6 and Full Hardfaced)	5 (F6 and Full Hardfaced)
8 (F6 and Hardfaced)	5 (F6 and Full Hardfaced)
8A (F6 and Hardfaced)	8 (F6 and Hardfaced) or 5 (F6 and Full Hardfaced) or 5A (F6 and Full Hardfaced)
10 (316)	12 (316 and Hardfaced) or 12A (316 and Hardfaced) 16 (316 and Full Hardfaced)
12 (316 and Hardfaced) or 12A (316 and Hardfaced)	16 (316 and Full Hardfaced)
13 (Alloy 20)	14 (Alloy 20 and Hardfaced) or 14A (Alloy 20 and Hardfaced) or 18 (Alloy 20 and Full Hardfaced)
14 (Alloy 20 and Hardfaced)	18 (Alloy 20 and Full Hardfaced)
15 (304 and Full Hardfaced)	16 (316 and Full Hardfaced)
21 (Alloy 625)	22 (Alloy 625 and Hardfaced) or 22A (Alloy 625 and Hardfaced) or 27 (Nickel Alloy and Full Hardfaced)
23 (Alloy C276)	24 (Alloy C276 and Hardfaced) or 24A (Alloy C276 and Hardfaced) or 27 (Nickel Alloy and Full Hardfaced)
25 (Alloy 825)	26 (Alloy 825 and Hardfaced) or 26A (Alloy 825 and Hardfaced) or 27 (Nickel Alloy and Full Hardfaced)
22 (Alloy 625 and Hardfaced)) or 22A (Alloy 625 and Hardfaced)	27 (Nickel Alloy and Full Hardfaced)
24 (Alloy C276 and Hardfaced) or 24A (Alloy C276 and Hardfaced)	27 (Nickel Alloy and Full Hardfaced)
26 (Alloy 825 and Hardfaced) or 26A (Alloy 825 and Hardfaced)	27 (Nickel Alloy and Full Hardfaced)

28 (Duplex (F51) and Hardfaced) or 28A (Duplex (F51) and Hardfaced)	29 (Duplex (F51) and Full Hardfaced)
30 (Super Duplex (F53) and Hardfaced) or 30A (Super Duplex (F53) and Hardfaced)	31 (Super Duplex (F53) and Full Hardfaced)
32 (Super Duplex (F55) and Hardfaced) or 32A (Super Duplex (F55) and Hardfaced)	33 (Super Duplex (F55) and Full Hardfaced)

7 Testing, Inspection, and Examination

7.1 Inspection and Examination

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

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

7.1.3 If additional inspection and/or examination are specified in the purchase order, the inspection and/or examination shall be in accordance with those requirements.

7.2 Pressure Tests

Each valve shall be pressure tested by the manufacturer as specified in API 598. When specified in purchase order, the additional testing shall be performed.

7.3 Inspection of Castings

Body and bonnet castings shall meet the inspection criteria of MSS SP-55.

7.4 Repairs of Casting Defects

Defects in the shell of a cast valve that are revealed by inspection or testing shall be repaired as permitted per the applicable ASTM cast material specification listed in ASME B16.34.

8 Marking

8.1 General

Valves shall be marked in accordance with the requirements of ASME B16.34, except that the nameplate shall include the designation "API 623" in addition to the designation "ASME B16.34."

8.2 Specific Markings

8.2.1 The direction of flow shall be marked with a flow direction arrow that is cast, forged, or stamped into the valve body outer wall, or with a separate identification plate permanently attached to the valve body that indicates flow direction.

8.2.2 Valves equipped with packing complying with API 624 shall be marked in accordance with API 624.

8.2.3 Valves equipped with packing not complying with API 624 shall not be marked in accordance with API 624. Such valves shall have a tag attached indicating the packing material (e.g. "PTFE Packing" or "Graphite Packing").

9 Preparation for Shipment

9.1 Coatings

9.1.1 Unmachined exterior surfaces of the shell shall be coated per the manufacturer's standard coating with an aluminum or silver color unless otherwise specified in the purchase order.

9.1.2 Painting of ASME B16.34 Group 2 and Group 3 shell materials are not required unless otherwise specified in the purchase order.

9.1.3 Machined or threaded surfaces, except those of ASME B16.34 Group 2 and Group 3 materials, shall be coated with an easily removable rust preventative. The stem does not need to be coated if the stem packing contains a corrosion inhibitor.

9.2 Openings

9.2.1 Valve end flanges and welding ends shall be blanked to protect the gasket contact surfaces or welding ends and the valve internals during shipment and storage.

9.2.1.1 The protective covers shall be made of wood, wood fiber, plastic, or metal and shall be securely attached to the valve ends by bolts, steel, straps, steel clips, or suitable friction-locking devices.

9.2.1.2 Covers shall be designed so that the valve cannot be installed without removal of protective cover.

9.2.2 Tapped connections shall be fitted with securely tightened, leak-tight threaded plugs. Use of anti-galling compounds is permissible. Thread sealants are not permitted unless allowed by the purchaser. The material used for plugs for tapped connections shall have the same nominal chemical composition as the shell material (see 5.13 and Table 5).

9.3 Disc Position

The valve shall be shipped with the disc closed.

9.4 Stem Packing

The valve shall be shipped with the lantern ring, if specified, and the packing installed and tightened to the manufacturer's specified gland load.

9.5 Packaging

9.5.1 Unless export packaging is specified in the purchase order, valves may be shipped loose, palletized, or packed in a box or crate.

9.5.2 When export packaging is specified in the purchase order, valves shall be shipped individually or collectively in wooden boxes or crates in a manner that will prevent shifting within the package.

10 Special Services

10.1 NACE Requirements

When specified in the purchase order, valves shall additionally meet the requirements of NACE MR0103/ISO 17945. The purchaser shall specify either exposed bolting or non-exposed bolting as defined in NACE MR0103/ISO 17945. The purchaser may specify NACE MR0175/ISO 15156 in lieu of NACE MR0103/ISO 17945.

10.2 Cryogenic Service

When specified in the purchase order, valves in cryogenic service shall additionally meet the requirements of MSS SP-134. Optional low temperature cryogenic testing may also be specified by the purchaser.

10.3 Hydrogen Fluoride (HF) Alkylation Service

When specified in the purchase order, valves in Hydrogen Fluoride (HF) Alkylation Service shall additionally meet the requirements of MSS SP-160.

Annex A

(normative)

Information to be Specified by the Purchaser

- 1) Supplemental requirements of this standard shall be specifically stated in the purchase order. Annex D contains a datasheet which may be used for this purpose.
- 2) If no supplemental requirements are to be taken, the purchase order just needs to refer to API 623 and to specify the items listed below:
 - a) Nominal Pipe Size [1]
 - b) Pressure class [1.4]
 - c) End connection type [1.3, 5.3.1, 5.3.2]
 - d) Body configuration/pattern type [1.3]
 - e) Shell material [6.1]
 - f) Trim material [6.2 and Table 6]
- 3) Optional items that can be specified by the purchaser
 - a) Flanged end facing finish [5.3.1.1]
 - b) Applicable code to flanges attached by welding [5.3.1.2.1]
 - c) Conversion of a flanged end valve to a butt-welding valve [5.3.2.1]
 - d) Non-standard chemical composition of carbon steel welding ends [5.3.2.1]
 - e) End-to-end butt-welding ends [5.3.2.2]
 - f) NDE for butt-welding ends above those listed in ASME B16.34 [5.3.2.3]
 - g) Seat diameter (unlisted) [5.3.3.1]
 - h) Pressure seal bonnet [5.5.9]
 - i) Disc design [5.6.1]
 - j) Hardfacing of disc guides [5.6.3]
 - k) Full rated pressure over the disc [5.8.11]
 - l) Lantern ring [5.9.6]
 - m) Metric series bolting [5.10.1]
 - n) Handwheel and gearbox sizing [5.11.1]
 - o) Operator type [5.11.1]
 - p) Operator handwheel diameter [5.11.1]
 - q) Handwheel construction and material [5.11.2, Table 5]
 - r) Operation requirement [5.11.5]
 - s) Actuator flange mating dimensions [5.11.6]
 - t) Stop Check [5.12]

- u) Auxiliary connections, types, locations, and openings [5.13]
- v) Stem packing material [Table 5]
- w) Bolting material: body-to-bonnet, gland and yoke [Table 5]
- x) Bonnet gasket [Table 5]
- y) Inspection and/or examination [7.1.3, 7.2]
- z) Coating and/or color [9.1.1]
- aa) Coating of Group 2 & 3 materials [9.1.2]
- ab) Use of thread sealants on tapped connections [9.2.2]
- ac) Export packaging [9.5.2]
- ad) NACE requirements [10.1]
- ae) Cryogenic Service [10.2]
- af) Hydrogen Fluoride (HF) Alkylation Service [10.3]

Annex B

(informative)

Identification of Valve Terms

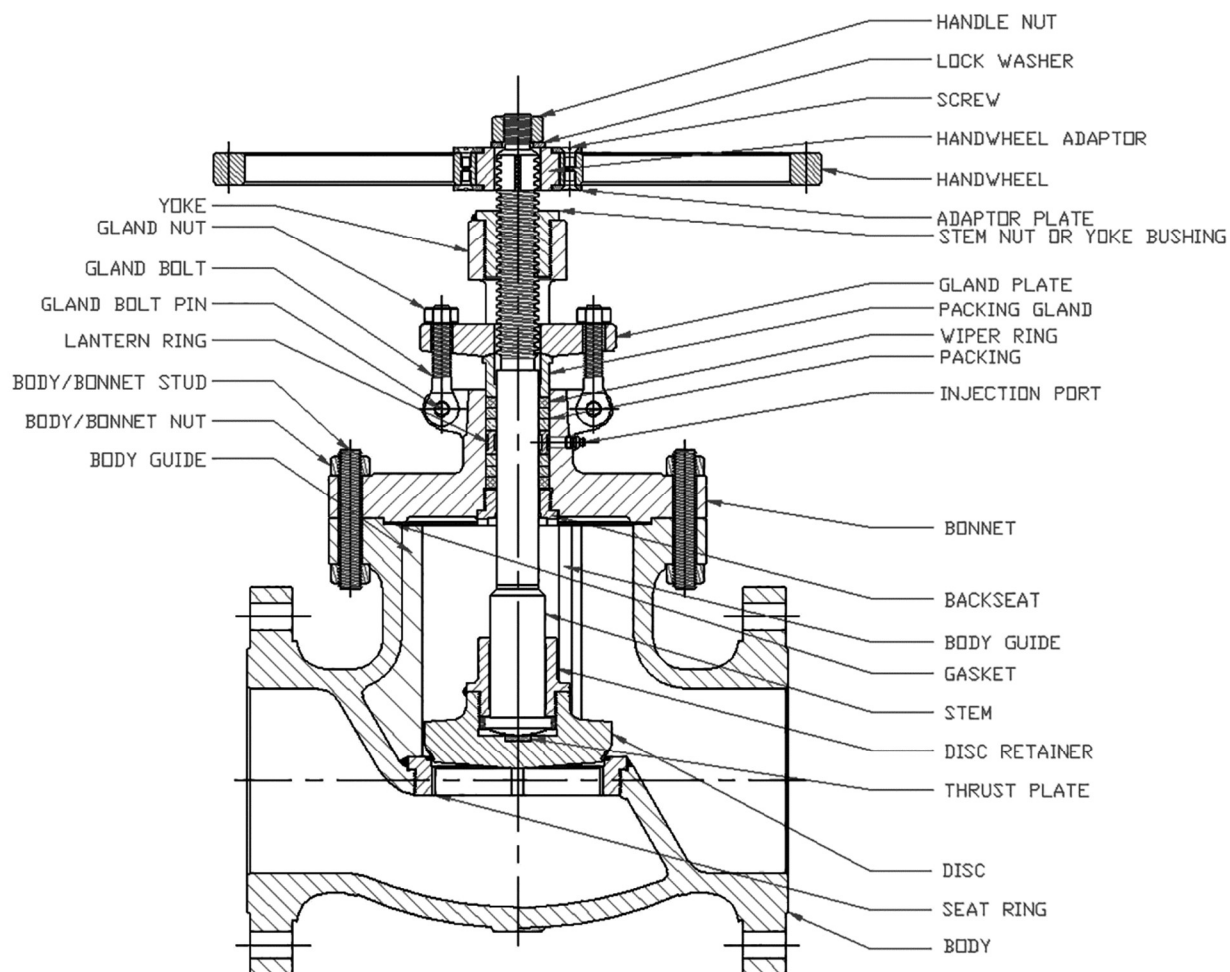


Figure B.1—Valve Nomenclature

Annex C

(informative)

Valve Material Combinations

Table C.1, Table C.2, and Table C.3 list valve body, bonnet, and cover materials (ASME B16.34, Material Groups 1, 2, and 3) along with associated valve trim materials (trim numbers, Table 6) and ASTM specification bolting materials.

For ASTM A193 and ASTM A194 listed bolting materials in Table C.1 and Table C.2, corresponding bolting materials listed in EN 10269 may be substituted in accordance with Table C.4.

Table C.1—Material Combinations for Group 1 Body, Bonnet, and Cover Materials

Material Group ASME B16.34	Body/Bonnet Material Abbreviation	Body, Bonnet and Cover ASTM Specification	Trim Material Designation	Body-to-Bonnet and Body-to-Cover Bolting ASTM Specification ^a
1.1	C-Si	A105 A216-WCB	8, 8A	A193 B7, B7M ^b A194 2H, 2HM
	C-Mn-Si	A350-LF2-CL1		
	C-Mn-Si-V	A350-LF6-CL1	10	A193 B8M-CL2 ^{b c d} A194 8M
	3 ¹ / ₂ Ni	A350-LF3		
1.2	C-Mn-Si	A216-WCC A352-LCC	8, 8A	A193 B7, B7M ^b A194 2H, 2HM
	C-Mn-Si-V	A350-LF6-CL2		
	21/2Ni	A352-LC2	10	A193 B8M-CL2 ^{b c d} A194 8M
	31/2Ni	A352-LC3		
1.3	C-Si	A352-LCB	8, 8A	A193 B7, B7M ^b A194 2H, 2HM
	C-1/2Mo	A217-WC1		
	C-1/2Mo	A352-LC1	10	A193 B8M-CL2 ^{b c d} A194 8M
1.4	C-Mn-Si	A350-LF1	8	A193 B7, B7M ^b A194 2H, 2HM
1.5	C-1/2Mo	A182-F1	8	A193 B7, B7M ^b A194 2H, 2HM
1.7	1/2Cr-1/2Mo	A182-F2	8	A193 B7, B7M ^b A194 2H, 2HM

	Ni- ¹ / ₂ Cr- ¹ / ₂ Mo	A217-WC4		
	³ / ₄ Ni- ³ / ₄ Cr-1Mo	A217-WC5		
1.9	1 ¹ / ₄ Cr- ¹ / ₂ Mo	A217-WC6	8	A193 B16 ^e A194 8M
	1 ¹ / ₄ Cr- ¹ / ₂ Mo-Si	A182-F11-CL2		
1.10	21/4Cr-1Mo	A182-F22-CL3 A217-WC9	8	A193 B16 ^e A194 8M
1.11	3Cr-1Mo	A182-F21	8	A193 B16 ^e A194 8M
1.13	5Cr- ¹ / ₂ Mo	A182-F5a A217-C5	8	A193 B16 ^e A194 8M
1.14	9Cr-1 Mo	A182-F9 A217-C12	8	A193 B16 ^e A194 8M
1.15	9Cr-1Mo-V	A182-F91-Type1 A217-C12A	8	A193 B16 ^e A194 8M
1.17	1Cr- ¹ / ₂ Mo	A182-F12-CL2	8	A193 B16 ^e A194 8M
	5Cr- ¹ / ₂ Mo	A182-F5		
1.18	9Cr-2W-V	A182-F92	8	A193 B16 ^e A194 8M
NOTE For bolting materials in accordance with EN 10269, see Table C.4.				
^a Temperature limitations on bolting are as follows: A193 Gr B7, Gr. B7M, 538 °C (1000 °F); A320 Gr L7, 427 °C (800 °F); A320 Gr L7M, 538 °C (1000 °F); A193 Gr B16, 595 °C (1100 °F); A193 Gr B8-CL1, Gr B8A-CL1A, Gr B8M-CL1, and Gr B8MA-CL1A, 816 °C (1500 °F); A193 Gr B8-CL2, Gr B8M-CL2, Gr B8M2-CL2B and Gr B8M3-CL2C, 538 °C (1000 °F). ^b ASTM A320, Gr L7 or Gr L7M bolts and ASTM A194, Gr 7 or Gr 7M nuts may also be used. ^c ASTM A193, Gr B8-CL1, Gr B8A-CL1A, Gr B8M-CL1, Gr B8MA-CL1A, Gr B8M2-CL2B, and Gr B8M3-CL2C bolting and ASTM A194 Gr 8 nuts are a suitable substitute, provided that the requirements of 5.5.7 are met. ^d ASTM A193, Gr B8-CL2 bolts may also be used. ^e ASTM A194, Gr 7 nuts may also be used.				

Table C.2—Material Combinations for Group 2 Body, Bonnet, and Cover Materials

Material Group ASME B16.34	Body/Bonnet Material Abbreviation	Body, Bonnet, and Cover ASTM Specification	Trim Material Designation	Body-to-Bonnet and Body-to-Cover Bolting ASTM Specification ^a
2.1	18Cr-8Ni	A182-F304 A351-CF3 A182-F304H A351-CF8	2	A193 B8M-CL2/ ^c ^d A194 8M

		A351-CF10		
2.2	16Cr-12Ni-2Mo	A182-F316 A351-CF3M A182-F316H A351-CF8M A351-CF10M	10	A193 B8M-CL2 ^{c d} A194 8M
	18Cr-8Ni	A351-CF3A A351-CF8A		
	18Cr-13Ni-3Mo	A182-F317		
	19Cr-10Ni-3Mo	A351-CG8M A351-CG3M		
2.3	8Cr-8Ni	A182-F304L	10	A193 B8M-CL2 ^{c d} A194 8M
	16Cr-12Ni-2Mo	A182-F316L		
	18Cr-13Ni-3Mo	A182-F317L		
2.4	18Cr-10Ni-Ti	A182-F321 A182-F321H	10	A193 B8M-CL2 ^{c d} A194 8M
2.5	18Cr-10Ni-Cb	A182-F347H A182-F347 A182-F348 A182-F348H	10	A193 B8M-CL2 ^{c d} A194 8M
2.7	25Cr-20Ni	A182-F310H	10	A193 B8M-CL2 ^{c d} A194 8M
2.8	20Cr-18Ni-6Mo	A182-F44 A351-CK3MCuN	Note ^b	A193 B8M- 8M ^{c d} A194 8M
2.10	25Cr-12Ni	A351-CH8 A351-CH20	Note ^b	A193 B8M-CL2 ^{c d} A194 8M
2.11	18Cr-10Ni-Cb	A351-CF8C	Note ^b	A193 B8M-CL2 ^{c d} A194 8M
2.12	25Cr-20Ni	A351-CK20	Note ^b	A193 B8M-CL2 ^{c d} A194 8M
2.13	22Cr-5Ni-3Mo-N	A182-F51 A995-CD3MN A182-F60	Note ^b	A193 B8M-CL2 ^{c d} A194 8M
	25Cr-7Ni-4Mo-N	A182-F53		
	24Cr-10Ni-4Mo-N	A995 CE8MN		
	25Cr-5Ni-3Cu-2Mo-N	A995 CD4MCuN		

	25Cr-7Ni-3.5Mo-W-N	A995 CD3MWCuN		
	25Cr-7.5Ni-3.5Mo-N-Cu-W	A182 F55		

^aTemperature limitations on bolting are as follows: A193 Gr B8-CL1, Gr B8A-CL1A, Gr B8M-CL1, and Gr B8MA-CL1A, 816 °C (1500 °F); A193 Gr B8-CL2, Gr B8M-CL2, Gr B8M2-CL2B and Gr B8M3-CL2C, 538 °C (1000 °F).

^bTrim material is not specified; however, trim material shall have corrosion resistance at least equal to the corrosion resistance of the valve body material.

^cASTM A193, Gr B8-CL1, Gr B8A-CL1A, Gr B8M-CL1, Gr B8MA-CL1A, Gr B8M2-CL2B, and Gr B8M3-CL2C bolting is a suitable substitute, provided that the requirements of 5.5.7 are met.

^dASTM A193, Gr B8-CL2 bolts may also be used unless otherwise prohibited.

Table C.3—Material Combinations for Group 3 Body, Bonnet, and Cover Materials

Material Group ASME B16.34	Body/Bonnet Material Abbreviation	Body, Bonnet, and Cover ASTM Specification	Trim Material CN Designation	Body-to-Bonnet and Body-to-Cover Bolting ASTM Specification ^a
3.1	35Ni-35Fe-20Cr-Cb	A182 N08020 B462 N08020	13, 14	B473 N08020
3.2	99Ni	B564 N02200	19, 20	B160 N02200
3.4	67Ni-30Cu	B564 N04400 A494 M-35-1	9, 11	B164 N04400
	67Ni-30Cu-S	A494 M-35-2		
3.5	72Ni-15Cr-8Fe	B564 N06600	19, 20	B166 N06600
3.6	33Ni-42Fe-21Cr	A182 N08800 B564 N08800	19, 20	B408 N08800
3.7	65Ni-28Mo-2Fe	B462 N10665 B564 N10665	19, 20	B335 N10665
	64Ni-29.5Mo-2Cr-2Fe-Mn-W	B462 N10675 B564 N10675		B335 N10675
3.8	54Ni-16Mo-15Cr	B462 N10276 B564 N10276	23, 24	B574 N10276
	60Ni-22Cr-9Mo-3.5Cb	B564 N06625	21, 22	B446 N06625
	42Ni-21.5Cr-3Mo-2.3Cu	B564 N08825	25, 26	B425 N08825
	55Ni-21Cr-13.5Mo	B462 N06022 B564 N06022	19, 20	B574 N06022
	55Ni-23Cr-16Mo-1.6Cu	B462 N06200 B564 N06200	19, 20	B574 N06200
3.10	25Ni-47Fe-21Cr-5Mo	A182 N08700	19, 20	B672 N08700

3.11	44Fe-25Ni-21Cr-Mo	A182 N08904	19, 20	B649 N08925
3.12	46Fe-24Ni-21Cr-6Mo-Cu-N	A182 N08367 B462 N08367 A351 CN3MN	19, 20	B691 N08367
	58Ni-33Cr-8Mo	B462 N06035 B564 N06035		B574 N06035
3.13	31Ni-33Fe-27Cr-6.6Mo-Cu- C-N	B564 N08031	19, 20	B581 N08031
3.14	40Ni-29Cr-15Fe-5Mo	B462 N06030	19, 20	B581 N06030
3.15	33Ni-42Fe-21Cr	B564 N08810	19, 20	B408 N08800
	62Ni-28Mo-5Fe	A494 N-12MV		B335 N10001
	53Ni-17Mo-16Cr-6Fe-5W	A494 CW-12MW		B574 N10276
3.17	29Ni-20.5Cr-3.5Cu- 2.5 Mo	A351 CN7M	13, 14	B473 N08020
3.19	57Ni-22Cr-14W-2Mo-La	B564 N06230	19, 20	B408 N08800

Table C.4—Alternative Body-to-Bonnet Bolting Materials

As Related to Table C.1 and Table C.2			
ASTM Bolting Material	EN 10269 Bolting Material Designation		
	Name	Number	Heat treatment condition
A193 B7	42CrMo4	1.7225	Quenched and tempered
A193 B16	40CrMoV4-6	1.7711	Quenched and tempered
A320 L7 A320 L7M	42CrMo4	1.7225	Quenched and tempered
A194 2H A194 2HM	C45E	1.1191	Quenched and tempered
A194 7	42CrMo4	1.7225	Quenched and tempered

A194 7M			
A193 B8M, CL 2 A193 B8M2, CL 2B A193 B8M3, CL 2C	X5CrNiMo 17–12–2	1.4401	Cold work hardened with a minimum tensile strength 700MPa
A193 B8M, CL 1 A193 B8MA, CL 1A	X5CrNiMo 17–12–2	1.4401	Solution Annealed
A193, B8 CL 2	X5CrNi18-10	1.4301	Cold work hardened with a minimum tensile strength 700MPa
A193 B8, CL 1 A193 B8A, CL 1A	X5CrNi 18–10	1.4301	Solution Annealed
A194 8M	X5CrNiMo 17–12–2	1.4401	Solution Annealed
A194 8	X5CrNi 18–10	1.4301	Solution Annealed
NOTE Temperature limitations applicable for ASTM bolting materials, from Table C.1 and Table C.2 superscript notes, also apply for corresponding substitute EN bolting materials.			

Annex D

(informative)

Globe Valve Data Sheet

Row	API Standard 623 Globe Valve Data Sheet			
	Reference	Description	Purchaser requirement	Purchaser remarks
1		Purchaser		
2		Owner / Operator		
3		Owner's valve code		
4		Owner's valve tag number		
5				
6	1	Nominal Pipe Size		
7	1	Pressure class		
8	1, 5.3.1, 5.3.2	End connection type		
9	1	Body configuration/pattern type		
10	6.1	Shell material		
11	Table 6, 7	Trim material		
12	5.3.1.1	Flanged end facing finish		
13	5.3.1.2.1	Flanges attached by welding		
14	5.3.2.1	Conversion of a flanged end valve to a butt-welding valve		
15	5.3.2.1	Non-standard chemical composition of carbon steel welding ends		
16	5.3.2.2	End-to-end butt-welding ends		

17	5.3.2.3	NDE for butt-welding ends above those listed in ASME B16.34		
18	5.3.3.1	Seat diameter (unlisted)		
19	5.5.9	Pressure seal bonnet		
20	5.6.1	Disc design		
21	5.6.3	Hardfacing of body and/or disc guides		
22	5.8.11	Full rated pressure over the disc		
23	5.9.6	Lantern ring		
24	5.10.1	Metric series bolting		
25	5.11.1	Handwheel and gearbox sizing		
26	5.11.1	Operator type		
27	5.11.1	Operator handwheel diameter		
28	5.11.2	Handwheel type		
29	5.11.5	Additional operation requirement		
30	5.11.6	Other actuator flange mating dimensions		
31	5.12	Stop Check		
32	5.13	Auxiliary connections, types, locations and openings		
33	Table 5	Handwheel material		
34	Table 5	Alternate stem packing material		
35	Table 5	Bolting material: Body-to-bonnet, gland and yoke		
36	Table 5	Alternate Bonnet gasket		
37	7.1.3, 7.2	Inspection by purchaser		
38	9.1.1	Alternate paint system or color		
39	9.1.2	Painting of Group 2 & 3 materials		
40	9.2.2	Use of thread sealants on tapped connections		
41	9.5.2	Export Packaging		
42	10.1	Compliance to NACE requirements		
43	10.2	Compliance to Cryogenic Service		
44	10.3	Compliance to Hydrogen Fluoride (HF) Alkylation Service		

