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

Downstream Segment

API STANDARD 600
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Steel Gate Valves—Flanged and Butt-welding Ends, Bolted Bonnets

1 Scope

This International standard specifies the requirements for a heavy-duty series of bolted bonnet steel gate valves for petroleum refinery and related applications where corrosion, erosion and other service conditions would indicate a need for full port openings, heavy wall sections and large stem diameters.

This International standard sets forth the requirements for the following gate valve features:

— bolted bonnet,

— outside screw and yoke,

— rising stems,

— non-rising handwheels,

— single or double gate,

— wedge or parallel seating,

— metallic seating surfaces,

— flanged or butt-welding ends.

This International standard covers valves of the nominal pipe sizes DN:

corresponding to nominal pipe sizes NPS:

— 1; 1 1/4; 1 1/2; 2; 2 1/2; 3; 4; 6; 8; 10; 12; 14; 16; 18; 20; 24; 26; 28; 30; 32; 34; 36; 38; 40; 42,

and applies to pressure class designations:

— 150; 300; 600; 900; 1500; 2500.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API Specification 6D, *Specification for Pipeline Valves*

API Standard 598, *Valve Inspection and Testing*

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*

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

ASME B1.20.1, *Pipe Threads, General Purpose (Inch)*

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

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, Square, Hex Flange, and Coupling Nuts (Inch Series)*

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

ASME B36.10M, *Welded and Seamless Wrought Steel Pipe*

ASME B31.3, Process Piping

ASME B31T, Standard Toughness Requirements for Piping

ASME *Boiler and Pressure Vessel Code* (*BPVC*), *Section IX: Welding and Brazing Qualifications*

ASTM A193 [2], *Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature of High Pressure Service and Other Special Purpose Applications*

ASTM A194, *Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both*

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

ASTM A320, *Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service*

EN 1092-1 [3], *Flanges and their joints—Circular flanges for pipes, valves, fittings and accessories, PN designated—Part 1: Steel flanges*

ISO 7-1 [4], *Pipe threads where pressure-tight joints are made on the threads—Part 1: Dimensions, tolerances and designation*

ISO 5210, *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*

ISO 6708, *Pipework components—Definition and selection of DN (nominal size)*

ISO 9606-1, *Approval testing of welders—Fusion welding—Part 1: Steels*

ISO 15607, *Specification and qualification of welding procedures for metallic materials—General rules*

ISO 15649, *Petroleum and natural gas industries—Piping*

MSS SP-55 [5], *Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components — Visual Method for Evaluation of Surface Irregularities*

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[2] ASTM International, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428, www.astm.org.
[3] European Committee for Standardization, Avenue Marnix 17, B-1000, Brussels, Belgium, www.cen.eu.
[4] International Organization for Standardization, 1, ch. de la Voie-Creuse, Case postale 56, CH-1211, Geneva 20, Switzerland, www.iso.org.
[5] Manufacturers Standard Society of the Valve and Fittings Industry, Inc., 127 Park Street, N.E., Vienna, Virginia 22180-4602, www.mss-hq.com.

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

MSS SP-144, *Pressure Seal Bonnet Valves*

NACE MR 0103 [6], *Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments*

3 Definitions

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 International 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 alpha numeric 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 alpha numeric 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, bonnet, and body-bonnet bolting which constitute the pressure boundary of an API 600 valve.

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 soft 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 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.

[6] NACE International (formerly the National Association of Corrosion Engineers), 1440 South Creek Drive, Houston, Texas 77218-8340, www.nace.org.

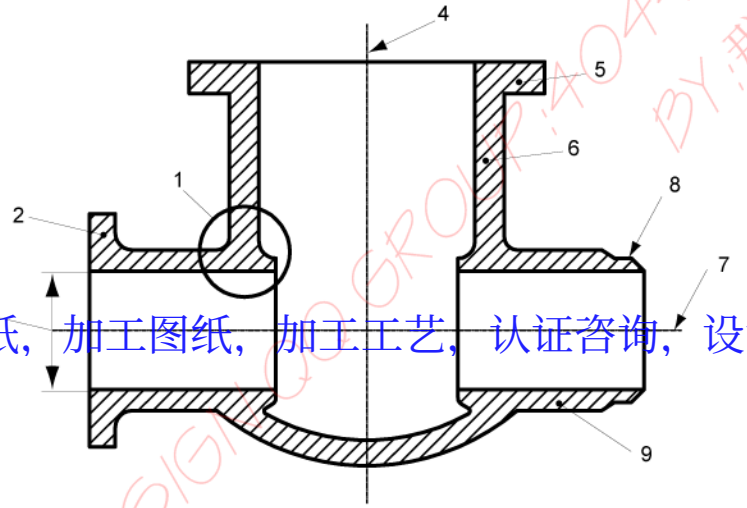
Note: Consideration should be given to the loss of ductility and impact strength of many materials at low temperature, ASME B31.3 Appendix A and ASME B31T may be used as guidance.

4.5 Double seated valves, in some design configurations, may be capable of trapping liquid in the center cavity of the valve when in the closed position. If subjected to an increase in temperature, an excessive build-up of pressure can occur, which may result in a pressure boundary failure. Where such a condition is possible, it is the responsibility of the user to provide or require to be provided, means in design, installation, or operating procedure, to assure that the pressure in the valve does not exceed that allowed by this International standard for the resultant temperature.

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, except as indicated in 5.1.2 for butt-welding valve ends. Additional metal thickness needed for assembly stresses, stress concentrations, and shapes other than circular shall be determined by individual manufacturers, since these factors vary widely.



Key

1 junction of body run and body neck
2 body end flange
3 body end port inside diameter
4 axis of body neck
5 body/bonnet flange
6 body neck
7 axis of body run
8 butt-welding end
9 body run

Figure 1—Identification of Terms

Table 1—Minimum Wall Thickness for Body and Bonnet

Class Designation	150	300	600	900	1500	2500	
Nominal Size DN	Minimum Wall Thickness t_m mm (in.)						Nominal Pipe Size NPS
25	6.4 (0.25)	6.4 (0.25)	7.9 (0.31)	12.7 (0.50)	12.7 (0.50)	15.0 (0.59)	1
32	6.4 (0.25)	6.4 (0.25)	8.6 (0.34)	14.2 (0.56)	14.2 (0.56)	17.5 (0.69)	1 1/4
40	6.4 (0.25)	7.9 (0.31)	9.4 (0.37)	15.0 (0.59)	15.0 (0.59)	19.1 (0.75)	1 1/2
50	8.6 (0.34)	9.7 (0.38)	11.2 (0.44)	19.1 (0.75)	19.1 (0.75)	22.4 (0.88)	2
65	9.7 (0.38)	11.2 (0.44)	11.9 (0.47)	22.4 (0.88)	22.4 (0.88)	25.4 (1.00)	2 1/2
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
650	21.4 (0.84)	31.6 (1.24)	—	—	—	—	26
700	22.2 (0.87)	33.3 (1.31)	—	—	—	—	28
750	23.0 (0.91)	35.0 (1.38)	—	—	—	—	30
800	23.8 (0.94)	36.5 (1.44)	—	—	—	—	32
850	24.6 (0.97)	38.1 (1.50)	—	—	—	—	34
900	25.3 (1.00)	39.6 (1.56)	—	—	—	—	36
950	26.1 (1.03)	41.3 (1.63)	—	—	—	—	38
1000	27.0 (1.06)	43.0 (1.69)	—	—	—	—	40
1050	27.7 (1.09)	44.4 (1.75)	—	—	—	—	42

5.1.2 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 be gradual and the section shall be essentially circular through the entire length of the transition. Sharp discontinuities or abrupt changes in section in areas that infringe into the transition shall be avoided, except that test collars or bands, either welded or integral, are allowed. In no case shall the thickness be less than $0.77t_m$ at a distance of $2t_m$ from the weld end.

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. Unless otherwise specified, raised face end flanges shall be provided. The purchaser 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 when approved by the purchaser.

5.3.1.2.1 Welding a flange to a valve body shall be by full penetration butt-welding. Unless otherwise specified, attachment weld shall conform to ASME B31.3 or ISO 15649 for normal fluid service, including weld quality

acceptance criteria and qualifications for the weld procedure and welder or welding operator. Heat treatment shall be performed in accordance with Table 3.

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.

Table 3—Post Weld Heat Treatment for Flange to Body Weld

Material	Thickness *t* mm (in.)	Temperature Range °C (°F)	Holding Time min./mm (hr./in.)	Weld Hardness HBN Max
Carbon steels	$t > 19$ (0.75)	593 to 649 (1100 to 1200)	2.4 (1) (minimum 1 hr.)	—
Alloy steels:				
$^1/_2$ % < Cr ≤ 2 %	$t > 13$ (0.50)	704 to 746 (1300 to 1375)	2.4 (1) (minimum 2 hr.)	225
2 $^1/_4$ % ≤ Cr ≤ 10 %	All	704 to 760 (1300 to 1400)	2.4 (1) (minimum 2 hr.)	241
Nickel alloy steels	$t > 19$ (0.75)	593 to 635 (1100 to 1175)	1.2 ($^1/_2$) (minimum 1 hr.)	—
Austenitic steels [a] [b]	All	solution anneal per the material specification		
Other materials	All	per the material specification		

[a] Thickness, *t*, is the greater thickness of the pieces being joined by welding.
[b] Except when materials being welded are L-Grades or stabilized grades.

5.3.2 Butt-welding Ends

5.3.2.1 Butt-welding ends for valve sizes greater than NPS 2 shall conform to the requirements of ASME B16.25 for the bore specified for use without backing rings. Butt-welding ends for valves DN 50 (NPS 2) and smaller shall conform to the requirement of API 602. Conversion of a flanged end valve to a butt-welding valve is not permitted except by agreement between the purchaser and manufacturer.

The chemical composition of carbon steel welding ends shall meet the following requirements unless otherwise agreed.

-The carbon content shall not exceed 0.23% by mass

-The carbon equivalent, CE, shall not exceed 0.43%

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 by the purchaser.

5.3.3 Body Seats

5.3.3.1 The inside diameter of the seat opening shall not be less than that specified in Appendix A of ASME B16.34 for sizes up to DN 600 (NPS 24), and API Standard 6D for sizes DN 650 and higher (NPS 26 and higher) for the nominal pipe size and pressure class.

5.3.3.2 When hardfacing is furnished, it shall be applied as a weld overlay of AWS A5.13 ECoCr-A or AWS A5.21 ERCoCr-A, except as provided in 6.2.2, and shall have a minimum finished thickness of 1.6 MM (0.06 in.).

5.3.3.2 Integral body seats are permitted in austenitic stainless steel valves. When an austenitic stainless steel or a hardfacing material is used for the body seat, this material may be weld-deposited directly on the valve body.

5.3.3.3 Where separate seat rings are provided, they shall be shoulder or bottom seated, and either threaded or seal welded in place, except that for DN ≤ 50 (NPS < 2) (rolled or pressed in seat rings may be used. Threaded seat rings in ASME Class 600 or higher pressure class valves shall be seal welded

5.3.3.4 Body seat rings shall have adequate seating area surface and shall have edges equipped with a radius or chamfer as necessary, to prevent galling or any other damage to the disc when the valve is operated against pressure.

5.3.3.5 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.

5.4 Bonnet Dimensions

5.4.1 When designing the stem, gland, lantern ring (if supplied) and backseat the manufacturer shall take into account stem guiding and the prevention of packing extrusion.

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

— a bushing positively secured against coming loose, i.e. not relying on friction;

— an integral surface in the case of an austenitic stainless steel valve;

— an austenitic stainless steel or hardfaced weld deposit that is a minimum of 1.6 mm (0.06 in.) thick.

5.4.3 Bonnets shall be one-piece castings or forgings.

5.4.4 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.

5.4.5 Tapped test openings shall only be provided only if specified in the purchase order

5.5 Bonnet-to-body Joint

5.5.1 The bonnet-to-body joint shall be a flange and gasket type and the gasket shall not extend beyond the inner edge of the bolt holes.

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

— flat face,

— raised face,

— tongue and groove,

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

— ring joint.

5.5.3 For valves having pressure class designation Class > 150, the bonnet-to-body joint shall be as in 5.5.2, except that the flat face joint is not permitted.

5.5.4 The bonnet flange gasket shall be suitable for the temperature range –29 °C (–20 °F) to 538 °C (1000 °F) and 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, to be used only in a body-to-bonnet 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, flexible graphite sheet, reinforced with a stainless steel flat, perforated, tanged, or corrugated insert equipped with annular containment rings;

— when approved by the purchaser, other suitable facings may be used

5.5.5 Except for PN 16 and Class 150 valves and valves in sizes DN 65 (NPS 2.5) and smaller, bonnet-to-body flanges shall be circular.

5.5.6 Bonnet and body flange nut bearing surfaces shall be parallel to the flange face within ±1°. Spot facing or back-facing required to meet the parallelism requirement shall be in accordance with ASME B16.5.

5.5.7 The bonnet-to-body joint shall be secured by a minimum of four through type stud bolts that provide uniform spading and load distribution. The minimum stud bolt size for each valve size shall be as follows:

— M10 or $^{3}/_{8}$ when $25 \leq DN \leq 65$ ($1 \leq NPS \leq 2\ ^{1}/_{2}$);

— M12 or $^{1}/_{2}$ when $80 \leq DN \leq 200$ ($3 \leq NPS \leq 8$);

— M16 or $^{5}/_{8}$ when $DN \geq 250$ ($NPS \geq 10$).

5.5.8 The total cross-sectional area of the bolts in valve bonnet bolting shall be in accordance with the requirements of ASME B16.34, Paragraph 6.4.

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

5.5.10 If pressure seal bonnet design is specified, the bonnet joint construction shall be in accordance with MSS SP-144 Style B.

5.6 Gate

5.6.1 Gate configurations are categorized as illustrated in Figure 2.

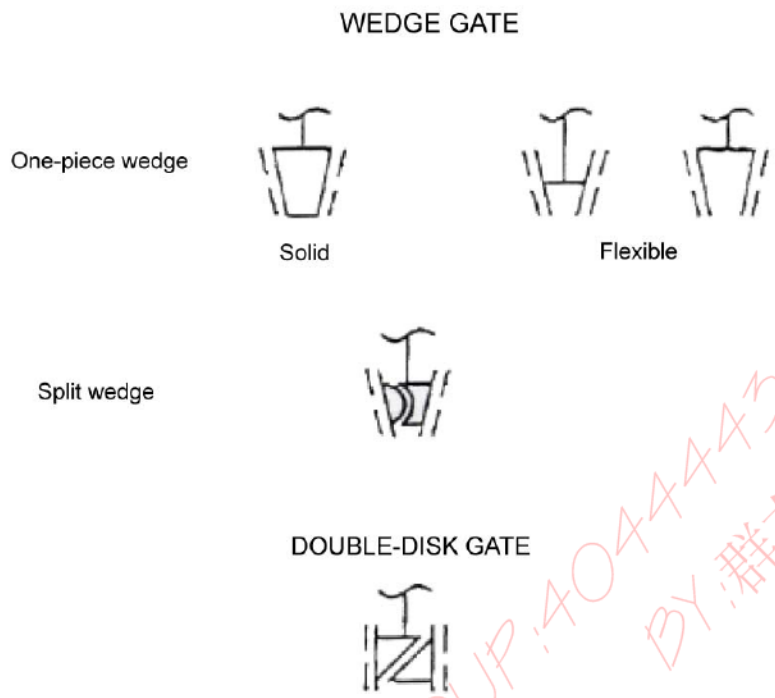


Figure 2—Types of Valve Gates

5.6.1.1 A one-piece wedge gate—as either a solid or flexible wedge design—shall be furnished, unless otherwise specified by the purchaser.

5.6.1.2 A two-piece split wedge gate or parallel seat double-disc gate may be furnished when specified by the purchaser. A split wedge gate consists of two independent seating parts that conform to the body seats when closed. The split wedge shall be designed so that the pieces cannot become separated, regardless of the gate position or valve orientation. A double-disc gate has a spreading mechanism (i.e., a wedging device or spring) that forces the two parallel discs to the body seats when closed.

5.6.2 Except for a double-disc gate, in the open position, the gate shall completely clear the valve seat openings.

5.6.3 The body and gate shall have guide surfaces to minimize wear of the gate seats during operation of the valve, to accurately position the gate throughout the travel distance to its seat, and to ensure the alignment of the gate and stem in all orientations without gate binding or galling. The possible loss of metal due to corrosion, erosion, abrasive wear, or a combination of these factors shall be considered in the design of the body and gate guide surfaces. Wedge guides and/or body guides need not be hardfaced unless specified in the purchase order, or when required to allow for proper valve operation in any orientation, including effects of wear or galling.

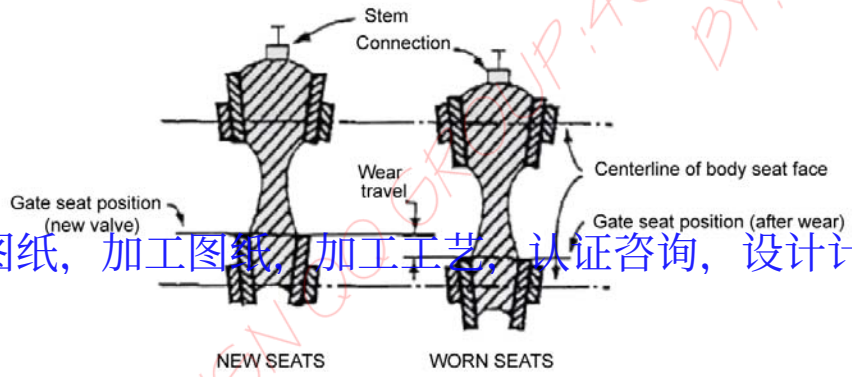
5.6.4 Gate seating surfaces shall be integral or faced with weld metal. Unless specified, hardfaced seating surfaces are not required. Finished thickness of any facing material shall be not less than 1.6 mm (0.06 in.).

5.6.5 Wedge gates shall be designed to account for seat wear. The dimensions that fix the position of the gate seats relative to the body seats shall be such that the gate, starting from the time of manufacture, can, as a result of seat wear, move into the seats by a distance, h, defined as wear travel. Wear travel is in a direction that is parallel with the valve stem. The required minimum wear travel varies with valve size in accordance with Table 4.

Table 4—Minimum Wear Travel

Valve Size Range DN (NPS)	Wear Travel h mm (in.)

25 ≤ DN ≤ 50 (1 ≤ NPS ≤ 2)	2.3 (0.09)
65 ≤ DN ≤ 150 (2 1/2 ≤ NPS ≤ 6)	3.3 (0.13)
200 ≤ DN ≤ 300 (8 ≤ NPS ≤ 12)	6.4 (0.25)
350 ≤ DN ≤ 450 (14 ≤ NPS ≤ 18)	9.7 (0.38)
500 ≤ DN ≤ 600 (20 ≤ NPS ≤ 24)	12.7 (0.50)
600 ≤ DN ≤ 700 (24 ≤ NPS ≤ 28)	16.0 (0.62)
700 ≤ DN ≤ 800 (28 ≤ NPS ≤ 32)	19.1 (0.75)
800 ≤ DN ≤ 900 (32 ≤ NPS ≤ 36)	22.4 (0.88)
900 ≤ DN ≤ 1000 (36 ≤ NPS 40)	25.4 (1.00)
1000 ≤ DN ≤ 1050 (40 ≤ NPS ≤ 42)	28.7 (1.13)



5.7 Yoke

5.7.1 The yoke may be either an integral part of the bonnet or a separate part. The yoke shall retain the stem nut which links the handwheel to the stem.

5.7.2 The yoke and stem nut assembly design shall permit stem nut removal while the valve is under pressure and backseated.

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

5.7.4 The yoke-to-stem nut bearing surfaces shall be machined flat and parallel. A lubricating fitting shall be provided for the bearing surfaces.

5.8 Stem and Stem Nut

5.8.1 The minimum stem diameter, d_s, shall be as given in Table 5. To allow the use of standard diameter round bars, an undertolerance is permitted in accordance with Table 5A. 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 then 1.6 mm (0.06 in.). The stem surface area in contact with the packing shall have a surface finish, Ra, of 0.80 µm (32 µin.) or smoother. The actual stem diameter shall take into account the valve design details and the stem material

strength characteristics. Note that the stem strength shall be considered when calculating the maximum input force from the handwheel and gear box (if equipped) in accordance with MSS SP 91 or in accordance with maximum rim pull when specified by the Purchaser.

Table 5—Minimum Stem Diameter

Class Designation	150	300	600	900	1500	2500	
Nominal Size DN	Minimum Stem Diameter d_s mm (in.)						Nominal Size NPS
25	15.89 (5/8)	15.89 (5/8)	15.89 (5/8)	19.05 (3/4)	19.05 (3/4)	19.05 (3/4)	1
32	15.89 (5/8)	15.89 (5/8)	15.89 (5/8)	19.05 (3/4)	19.05 (3/4)	19.05 (3/4)	1 1/4
40	17.46 (11/16)	19.05 (3/4)	19.05 (3/4)	22.23 (7/8)	22.23 (7/8)	22.23 (7/8)	1 1/2
50	19.05 (3/4)	19.05 (3/4)	19.05 (3/4)	25.40 (1)	25.40 (1)	25.40 (1)	2
65	19.05 (3/4)	19.05 (3/4)	22.23 (7/8)	28.58 (1 1/8)	28.58 (1 1/8)	31.75 (1 1/4)	2 1/2
80	22.23 (7/8)	22.23 (7/8)	25.40 (1)	28.58 (1 1/8)	31.75 (1 1/4)	31.75 (1 1/4)	3
100	25.40 (1)	25.40 (1)	28.58 (1 1/8)	31.75 (1 1/4)	34.93 (1 3/8)	34.93 (1 3/8)	4
150	28.58 (1 1/8)	31.75 (1 1/4)	38.10 (1 1/2)	41.28 (1 5/8)	44.45 (1 3/4)	47.63 (1 7/8)	6
200	31.75 (1 1/4)	34.93 (1 3/8)	41.28 (1 5/8)	47.63 (1 7/8)	53.98 (2 1/8)	60.33 (2 3/8)	8
250	34.93 (1 3/8)	38.10 (1 1/2)	47.63 (1 7/8)	53.98 (2 1/8)	63.50 (2 1/2)	73.03 (2 7/8)	10
300	38.10 (1 1/2)	41.28 (1 5/8)	50.80 (2)	57.15 (2 1/4)	69.85 (2 3/4)	82.55 (3 1/4)	12
350	41.28 (1 5/8)	44.45 (1 3/4)	57.15 (2 1/4)	60.33 (2 3/8)	76.20 (3)	—	14
400	44.45 (1 3/4)	47.63 (1 7/8)	60.33 (2 3/8)	63.50 (2 1/2)	76.20 (3)	—	16
450	47.63 (1 7/8)	50.80 (2)	63.50 (2 1/2)	69.85 (2 3/4)	—	—	18
500	50.80 (2)	53.98 (2 1/8)	69.85 (2 3/4)	76.20 (3)	—	—	20
600	57.15 (2 1/4)	63.50 (2 1/2)	76.20 (3)	—	—	—	24
650	60.33 (2 3/8)	69.85 (2 3/4)	—	—	—	—	26
700	63.50 (2 1/2)	76.20 (3)	—	—	—	—	28
750	63.50 (2 1/2)	82.60 (3 1/4)	—	—	—	—	30
800	66.68 (2 5/8)	85.73 (3 3/8)	—	—	—	—	32
850	69.85 (2 3/4)	88.90 (3 1/2)	—	—	—	—	34
900	69.85 (2 3/4)	88.90 (3 1/2)	—	—	—	—	36
950	76.20 (3)	95.25 (3 3/4)	—	—	—	—	38
1000	79.38 (3 1/8)	98.43 (3 7/8)	—	—	—	—	40

1050	82.60 (3 ¼)	101.6 (4)	—	—	—	—	42

Note: See paragraph 5.8.1.

Table 5A—Permitted Undertolerance

Minimum (in.)		Minimum (mm)	
Diameter	**Undertolerance**	**Diameter**	**Undertolerance**
≤ 5/8	0.012	≤ 15.9	0.31
> 5/8 to 7/8	0.013	> 15.0 to 22.2	0.33
> 7/8 to 1	0.014	> 22.2 to 25.4	0.36
> 1 to 1 1/8	0.015	> 25.4 to 28.6	0.38
> 1 1/8 to 1 1/4	0.016	> 28.6 to 31.8	0.41
> 1 1/4 to 1 3/8	0.017	> 31.8 to 34.9	0.43
> 1 3/8 to 1 1/2	0.019	> 34.9 to 38.1	0.48
> 1 1/2 to 1 5/8	0.021	> 38.1 to 41.3	0.53
> 1 5/8 to 2	0.026	> 41.3 to 50.8	0.66
> 2 to 3 1/4	0.030	> 50.8 to 82.6	0.76
> 3 ¼ to 4	0.032	> 82.6 to 101.6	0.81

5.8.2 Stems shall have a gate attachment means at one end and an external trapezoidal style thread form at the other. Stem nuts shall be used for handwheel attachment and to drive the operating stem thread.

5.8.3 The 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 left-handed so that a direct operated handwheel rotated in a clockwise direction closes the valve. The minimum thread engagement length between the stem and the stem nut shall be between one-and-one-half and two times the stem diameter.

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

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

5.8.6 The stem end that connects to a gate shall be in the form of a "T," except that for a double-disc gate, the end connection may be threaded.

5.8.7 The stem connection shall be designed to prevent the stem from turning or from becoming disengaged from the gate while the valve is in service.

5.8.8 The stem design shall be such that the strength of the stem to gate connection and the part of the stem within the valve pressure boundary shall, under axial load, exceed the strength of the stem at the root of the operating thread.

5.8.9 The one-piece stem shall include a conical or spherical raised surface that seats against the bonnet backseat when the gate is at its full open position. A stem-bonnet backseat is a requirement of this International 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.

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

5.8.11 The stem-nut-to-handwheel attachment shall be through a hexagonal interface, a round interface having a keyway or another means of equivalent strength.

5.8.12 When the stem nut is retained in the yoke by means of a threaded bushing, 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.

5.8.13 The closed-position stem thread projection beyond the stem nut, on a new manual handwheel-operated valve, shall be a distance having a minimum equal to the valve wear travel and a maximum of five times the wear travel for valves DN ≤ 150 (NPS ≤ 6), and three times the wear travel for valves DN > 150 (NPS > 6).

5.8.14 Valves DN ≥ 150 (NPS ≥ 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 or rectangular or trapezoidal in cross-section. The nominal radial width of the packing, w, shall be in accordance with Table 6.

5.9.2 The nominal depth of the packing box shall accommodate a minimum of five uncompressed rings of packing. Unless otherwise specified by the purchaser, the packing box surface area in contact with the packing material shall have a surface finish, Ra, of 4.5 µm (175 µin.) or smoother.

5.9.3 The nominal bore (inside diameter) of the packing box shall be the sum of the nominal valve stem diameter plus twice the nominal packing width, i.e. equal to $d_n + 2w$. See Table 6 for the required values.

5.9.4 A 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.

Table 6—Nominal Radial Width of Packing

Nominal Stem Diameter d_n mm (in.)	Nominal Radial Width of the Packing w mm (in.)
15 < d ≤ 25 ($^{5}/_{8}$ < d ≤ 1)	6.4 ($^{1}/_{4}$)
25 < d ≤ 35 (1 < d ≤ 1 $^{3}/_{8}$)	7.9 ($^{5}/_{16}$)
35 < d ≤ 48 (1 $^{3}/_{8}$ < d ≤ 1 $^{7}/_{8}$)	9.5 ($^{3}/_{8}$)
48 < d ≤ 54 (1 $^{7}/_{8}$ < d ≤ 2 $^{1}/_{8}$)	11.1 ($^{7}/_{16}$)

$54 < d \leq 73$ ($2\,^{1}/_{8} < d \leq 2\,^{7}/_{8}$)	12.7 ($^{1}/_{2}$)
$73 < d \leq 102$ ($2\,^{7}/_{8} < d \leq 4$)	14.3 ($^{9}/_{16}$)

5.9.5 A lantern ring shall be provided only if so specified by the purchaser. In 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.

5.9.6 The clearance between the packing box bore (inside diameter) and the outside diameter of the gland (see Figure B.1) shall be nominally less than the diametrical clearance between the inside diameter of the gland and the stem diameter.

5.10 Bolting

5.10.1 Bolting shall be standard inch series bolting, except if the purchaser specifies metric series bolting. Bolting for the bonnet-to-body joint shall be continuously threaded stud bolts with heavy, semi-finished hexagon nuts that are in accordance with ASME B18.2.2 or ASME B18.2.4.6M.

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

5.10.3 Gland bolts shall be hinged eyebolts, headed bolts, stud bolts or studs. Hexagon nuts shall be used.

5.10.4 Bolting with diameters M24 (1 in.) and smaller shall have coarse (UNC) threads or the most nearly corresponding metric threads. Bolting with diameters larger than M24 (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. Studs used for gland bolting shall use a Class 5 interference fit, conforming to ASME B1.12. 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 Unless otherwise specified by the purchaser, the valve shall be supplied with a direct operated handwheel that opens the valve when turned in a counter-clockwise direction.

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. Unless otherwise specified, the handwheel shall be a one-piece casting or forging or a multi-piece carbon steel fabrication that includes other carbon steel product forms. Fabricated handwheels shall have strength and toughness characteristics comparable 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, except when the handwheel size makes such marking impractical.

5.11.4 The handwheel shall be retained on the 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, as applicable:

— for chainwheel operation, the dimension from the centerline of the valve stem to the bottom of the chain loop;

— 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.

5.11.6 Valve-to-gear-box or power actuator flange mating dimensions shall be according to ISO 5210 or shall comply with the purchaser's specifications.

5.12 Bypasses and Other Auxiliary Connections

Auxiliary connections to the body and/or bonnet, such as drains shall be furnished only if specified on 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 for valve DN 50 (NPS 2) or larger, auxiliary connections shall be sized and located as specified in ASME B16.34. The size and location of auxiliary connections shall be indicated on the purchase order.

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 7.

Table 7—Materials for Parts

Part	Material
Body and bonnet	As selected from ASME B16.34, Group 1 and Group 2.
Gate	Steel, at least equal in corrosion resistance to that of the body material.
Yoke, separate	Carbon steel or same material group 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. 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	The metallic portion exposed to the service environment shall be of a material that has a corrosion resistance at least equal to that of the body material.
Bolting: gland and yoke	Bolting material at least equal to ASTM A307—Grade B.
Seat ring	As in Table 8, except that where seal welds, strength welds or weld deposit facings are used, the base weld material shall have a corrosion resistance at least equal to that of the body material.
Gland flange	Steel.
Gland	Material with melting point above 955 °C (1750 °F).
Packing	Suitable for steam and petroleum fluids for temperature range from –29 °C (- 20 °F) to 538 °C (1000 °F). Shall contain a corrosion inhibitor.
Lantern ring	Material having corrosion resistance at least equal to that of the body material.
Stem nut	Austenitic ductile iron or copper alloy with melting point above 955 °C (1750 °F).
Handwheel	Malleable iron, carbon steel, or ductile iron.
Handwheel nut (retaining)	Steel, malleable iron, ductile iron, or non-ferrous copper alloy
Pipe plugs	Nominal composition shall be the same as the shell material. Cast iron plugs shall not be used.
Bypass piping and valves	Nominal composition shall be the same as the shell material.

Pin, double disk stem to gate	Austenitic stainless steel.
Identification plate	Austenitic stainless steel or nickel alloy attached to the valve by corrosion-resistant fasteners or by welding.

6.2 Trim

6.2.1 The trim is comprised of the following:

a) stem;

b) body seating surface;

c) gate seating surface;

d) bushing, or a deposited weld, for the backseat and stem hole guide;

e) small internal parts that normally contact the service fluid, excluding the pin that is used to make a stem-to-gate connection (this pin shall be made of an austenitic stainless steel material).

6.2.2 The trim material, except as stated in Items a) through d) below, shall be the manufacturer's standard material for the type listed in Table 8 for the trim number specified in the purchase order. The typical specifications include in Table 7 represent some acceptable grades.

a) If a trim number listed in Table 8 is specified, then an alternative trim number as shown in Table 9 may be furnished.

b) If a single trim (e.g. trim 5) is furnished, both the seating surface of the body seat ring and the seating surface of the gate shall be made of the type of material shown in Table 8.

c) If a combination trim (e.g. trim 8) is furnished, the seating surface of the body seat ring shall be made of one of the two types of material shown in Table 8, and the seating surface of the gate 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, Item e)] shall be of the type of material and hardness listed in Table 8. The stem shall be a wrought material.

e) The base material of the valve wedge/disc and separate body seat ring, when used, shall be of a nominal material composition equal to the body or to that of the stem material; except for wedge or disc material made of solid trim material.

7 Testing, Inspection and Examination

7.1 Inspection and Examination

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

7.1.2 If inspection by the purchaser is specified in the purchase order, inspection shall be in accordance with API 598. Examination by the manufacturer shall be as specified in API 598.

7.2 Pressure Tests

Each valve shall be pressure tested as specified in API 598.

7.3 Repairs of Defects

Defects in the shell of a cast or forged, carbon or alloy steel valve that are revealed by inspection or testing may be repaired as permitted by the most nearly applicable ASTM cast or forged 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 600” in addition to the designation ASME B16.34.

8.2 Marking for Unidirectional Valves

Valves designed for, or modified to have unidirectional flow capability, i.e. capability to block flow in only one direction, 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 body that indicates the direction for which flow is permitted.

Table 8—Nominal Seating Surface, Stem and Backseat Bushing or Weld-deposit Materials and Hardness

Trim Number	Nominal Trim	Seat Surface Hardness (HB) Minimum [a]	Seat Surface Material Type [b]	Seat Surface Typical Specifications Grade			Stem/Bushing			Backseat Bushing Hardness (HB)
				Cast	Forged	Welded [m]	Material Type [b]	Typical Specifications Type	Stem Hardness (HB)	
1	F6	Note [c]	13Cr	ASTM A217(CA15)	ASTM A182 (F6a)	AWS A5.9 ER410	13Cr	ASTM A276-T410 or T420	200 min 275 max 250 min	
2	304	Note [d]	18Cr-8Ni	ASTM A351 (CF8)	ASTM A182 (F304)	AWS A5.9 ER308	18Cr-8Ni	ASTM A276-T304	Note [d]	Note [d]
3	F310	Note [d]	25Cr-20Ni	NA	ASTM A182 (F310)	AWS A5.9 ER310	25Cr-20Ni	ASTM A276-T310	Note [d]	Note [d]
4	Hard F6	750 [e]	Hard 13Cr	NA	Note [f]	NA	13Cr	ASTM A276-T410 or T420	200 min 275 max	250 min.
5	Hardfaced	350 [e]	Co-Cr A [g]	NA	NA	AWS A5.13 E or R CoCrA	13Cr	ASTM A276 T410 or T420	200 min 275 max	250 min.
5A	Hardfaced	350 [e]	Ni-Cr	NA	NA	Note [h]	13Cr	ASTM A276 T410 or T420	200 min 275 max	250 min.
6	F6 and Cu-Ni	250 [i] 175 [i]	13Cr and Cu-Ni	ASTM A 217 (CA 15) NA	ASTM A182 (F6a) Note [k]	AWS A5.9 ER410 NA	13Cr NA	ASTM A276 T410 or T420 NA	200 min 275 max 250 min. NA	NA
7	F6 and Hard F6	250 [i] 750 [i]	13Cr and Hard 13Cr	ASTM A 217 (CA 15) NA	ASTM A182 (F6a) Note [f]	AWS A5.9 ER410 NA	13Cr NA	ASTM A276 T410 or T420 NA	200 min 275 max 250 min. NA	NA
8	F6 and Hardfaced	250 [i] 350 [i]	13Cr and Co-Cr A [g]	ASTM A 217 (CA 15) NA	ASTM A182 (F6a) NA	AWS A5.9 ER410 AWS A5.13 E or R CoCrA	13Cr NA	ASTM A276 T410 or T420 NA	200 min 275 max 250 min. NA	NA
8A	F6 and Hardfaced	250 [i] 350 [i]	13Cr and Ni-Cr	ASTM A 217 (CA 15) NA	ASTM A182 (F6a) NA	AWS A5.9 ER410 Note [h]	13Cr NA	ASTM A276 T410 or T420 NA	200 min 275 max 250 min. NA	NA
9	Monel	Note [d]	Ni-Cu Alloy	NA	MFG Standard	NA	Ni-Cu Alloy	MFG Standard	Note [d]	Note [d]
10	316	Note [d]	16Cr-12Ni-2Mo	ASTM A351 (CF8M)	ASTM A183 (F316)	AWS A5.9 ER316	16Cr-12Ni-2Mo	ASTM A276-T316	Note [d]	Note [d]
11	Monel and Hardfaced	Note [d] 350 [i]	Ni-Cu Alloy and Trim 5 or 5A	NA	MFG Standard	NA See Trim 5 or 5A	Ni-Cu Alloy NA	MFG Standard NA	Note [d] NA	Note [d] NA
12	316 and Hardfaced	Note [d] 350 [i]	16Cr-12Ni-2Mo Trim 5 or 5A	ASTM A351 (CF8M)	ASTM A182 (F316)	AWS A5.9 ER316 See Trim 5 or 5A	16Cr-12Ni-2Mo NA	ASTM A276-T316 NA	Note [d] NA	Note [d] NA
13	Alloy 20	Note [d]	19Cr-29Ni	ASTM A351 (CN7M)	ASTM B462	AWS A5.9 ER320	19Cr-29Ni	ASTM B462	Note [d]	Note [d]
14	Alloy 20 and Hardfaced	Note [d] 350 [i]	19Cr-29Ni and Trim 5 or 5A	ASTM A351 (CN7M)	ASTM B462 NA	AWS A5.9 ER320 See Trim 5 or 5A	19Cr-29Ni NA	ASTM B462 NA	Note [d] NA	Note [d] NA
15	Hardfaced	350 [e]	Co-Cr A [g]	NA	NA	AWS A5.13 E or R CoCrA	18Cr-8Ni	ASTM A276-T304	Note [d]	Note [n]
16	Hardfaced	350 [e]	Co-Cr A [g]	NA	NA	AWS A5.13 E or R CoCrA	18Cr-8Ni-Mo	ASTM A276-T316	Note [d]	Note [n]
17	Hardfaced	350 [e]	Co-Cr A [g]	NA	NA	AWS A5.13 E or R CoCrA	18Cr-10Ni-Cb	ASTM A276-T347	Note [d]	Note [n]
18	Hardfaced	350 [e]	Co-Cr A [g]	NA	NA	AWS A5.13 E or R CoCrA	9Cr-29Ni	ASTM B473	Note [d]	Note [n]

NOTE Cr = Chromium; Ni = Nickel; Co = Cobalt; Cu = Copper; NA = Not Applicable.

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

[b] Fee machining grades of 13Cr are prohibited.

[c] Body and gate seat surfaces should be 250 HB minimum with a 50 HB minimum differential between the body and gate seat surfac es.

[d] Manufacturer's standard hardness.

[e] Differential hardness between the body and gate seat surfaces is not required.

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

[g] This classification includes such trademark materials as Stellite 6™ *, Stoody 6™ * and Wallex 6™ *.

[h] Manufacturer's standard hardfacing with a maximum iron content of 25 %.

[i] Hardenss differential between the body and gate seat surfaces shall be the manufacturer's standard.

[j] Not used.

[k] Manufacturer's standard with 30 Ni minimum.

[l] Not used.

[m] Typical backseat weld deposit material.

[n] Per manufacturer's standard if not hardfaced, 250 HB minimum if hardfaced.

* This term is used as an example only, and does not constitute an endorsement of this product by API.

Table 9—Trim Numbers and Alternative Trim Numbers

Specified Trim Number	Alternative Trim Number
1	8 or 8A
2	10
5A	5
8A	8
10	12 or 16
13	14
12	16

9 Preparation for Shipment

9.1 Coatings

9.1.1 Unmachined exterior surfaces of the shell shall be painted per the manufacturer's standard paint with an aluminum or silver color. Austenitic stainless steel valves shall not be painted.

9.1.2 Machined or threaded surfaces (except those on austenitic stainless steel 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 surfaces or welding ends and the valve internals during shipment and storage. 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. 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 fully tightened and sealed threaded plugs. The material used for plugs for tapped connections shall have the same nominal chemical composition as the shell material (see 5.12).

9.3 Gate Position

The valve shall be shipped with the gate closed.

9.4 Stem Packing

The valve shall be shipped with the lantern ring, if specified, and the packing installed. The remaining adjustment length of the packing gland at the time of shipment, with the gland tight, shall be greater than one-and-one half times the packing width specified in Table 6.

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.

Annex A
(informative)

Information to be Specified by the Purchaser

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

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

2) If no supplemental requirements are to be taken to this International standard, the purchase order just needs to refer to API 600 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 *;

b) pressure class *;

c) flanged ends, including flange facing finish; or welding ends, including bore *;

d) auxiliary connections and openings;

e) valve orientation;

f) additional hard facing of body and/or wedge guides;

g) bonnet gasket and/or bonnet flange facing;

h) tapped openings;

i) wedge gate or double-disc gate; also type of wedge, if required *;

j) lantern ring;

k) chainwheel and chain;

l) gear operation, including type and arrangement, and the design maximum pressure differential across the valve;

m) power operation, including type of power and power unit, and the design maximum pressure differential across the valve;

n) bypass—specify either flanged or welded bonnet bypass valve;

o) material of the valve shell *;

p) nominal trim material *;

q) any required exceptions to manufacturer's permissible options (e.g. NACE MR 0103);

r) handwheels;

s) safety shield;

t) chainwheel and safety cables, if furnished as original equipment;

u) alternate stem packing material;

v) bonnet bolting material;

w) inspection by purchaser;

x) high pressure closure test;

y) supplementary examination and testing;

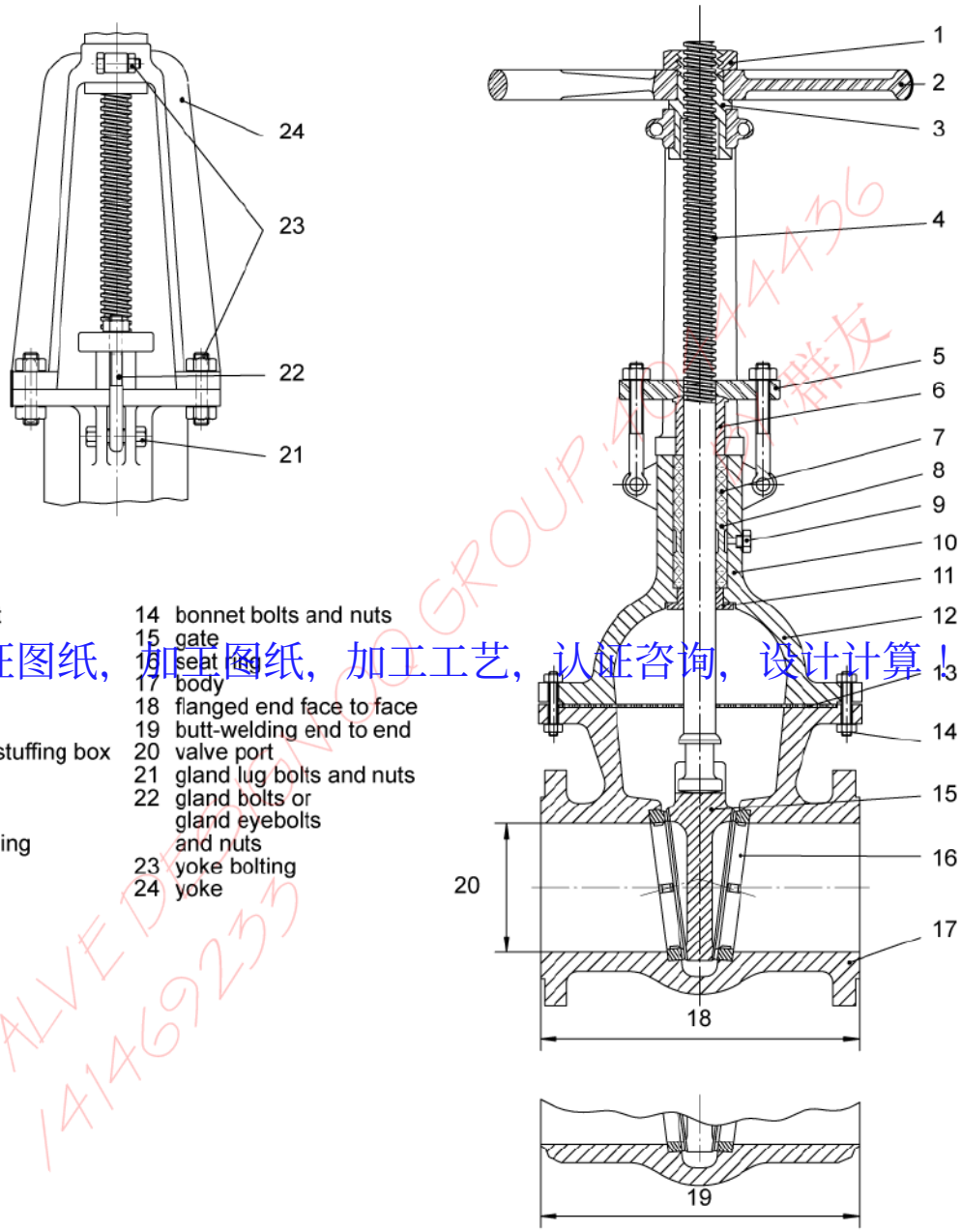
z) export packaging.

aa) pressure seal bonnet;

bb) materials from ASME B 16.34 Group 3

Annex B
(informative)

Identification of Valve Terms



Key

1 handwheel nut
2 handwheel
3 stem nut
4 stem
5 gland flange
6 gland
7 stem packing/stuffing box
8 lantern ring
9 plug
10 wiper packing
11 backseat bushing
12 bonnet
13 bonnet gasket
14 bonnet bolts and nuts
15 gate
16 seat ring
17 body
18 flanged end face to face
19 butt-welding end to end
20 valve port
21 gland lug bolts and nuts
22 gland bolts or gland eyebolts and nuts
23 yoke bolting
24 yoke

NOTE The only purpose of this figure is to identify part names. The construction of a valve is acceptable only when it complies with this standard in all respects.

Figure B.1—Valve Nomenclature

Annex C
(informative)

Valve Material Combinations

Table C.1 and Table C.2 list valve body, bonnet and cover materials (ASME B16.34, Material Groups 1 and 2) along with associated valve trim materials (trim numbers, Table 8) and ASTM A193 and ASTM A194 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.3. Materials other than those listed in Table C.1, Table C.2 or Table C.3, are outside the scope of this International standard (see 6.2).

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 CN Designation	Body to Bonnet and Body to Cover Bolting ASTM Specification
1.1	C-Si, C-Mn-Si C-Mn-Si-V 3 1/2 Ni	A105 or A216-WCB A350-LF2-CL1 A350-LF6-CL1 A350-LF3	8, 8A 8, 8A 10 10	B7/2H, B7M/2HM B7/2Hb B8M-CL2/8M [b c d] B8M-CL2/8M [b c d]
1.2	C-Mn-Si C-Mn-Si-V 2 1/2Ni 3 1/2Ni	A216-WCC A352-LCC A350-LF6-CL2 A352-LC2 A352-LC3	8, 8A 8, 8A 10 10 10	B7/2H, B7M/2HM B7/2H, B7M/2HM B8M-CL2/8M [b c d] B8M-CL2/8M [b c d] B8M-CL2/8M [b c d]
1.3	C-Si C-1/2Mo	A352-LCB A217-WC1 A352-LC1	8, 8A 8, 8A 10	B7/2H, B7M/2HM B7/2H, B7M/2HM B8M-CL2/8M [b c d]
1.4	C-Mn-Si	A350-LF1	8	B7/2H, B7M/2HM
1.5	C-1/2Mo	A182-F1	8	B7/2H, B7M/2HM
1.7	1/2Cr-1/2Mo Nl-1/2Cr-1/2Mo 3/4Ni-3/4Cr-1Mo	A182-F2 A217-WC4 A217-WC5	8	B7/2H, B7M/2HM
1.9	1 1/4Cr-1/2Mo 1 1/4Cr-1/2Mo-Si	A217-WC6 A182-F11-CL2	8	B16/8M [e]
1.10	2 1/4Cr-1Mo	A182-F22-CL3 A217-WC9	8	B16/8M [e]
1.13	5Cr-1/2Mo	A182-F5a or A217-C5	8	B16/8M [e]
1.14	9Cr-1 Mo	A182-F9 or A217-C12	8	B16/8M [e]
1.15	9Cr-1Mo-V	A182-F91 or A217-C12A	8	B16/8M [e]
1.17	1Cr-1/2Mo 5Cr-1/2Mo	A182-F12-CL2 A182-F5	8	B16/8M [e]

NOTE 1 For Table C.1 table notes, see Table C.2.
NOTE 2 For bolting materials in accordance with EN 10269, see Table C.3.

Table C.2—Material Combinations for Group 2 Body to Bonnet 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]
2.1	18Cr-8Ni	A182-F304/A351-CF3 A182-F304H/A351-CF8	2	B8M-CL2/8M [c d]
2.2	16Cr-12Ni-2Mo 18Cr-8Ni 18CR-13Ni-3Mo 19Cr-10Ni-3Mo	A182-F316 or A351-CF3M, A182-F316H or A351-CF8M A351 CF3A A182-F317 or A182-F317H or A351 CF8A A351-CG8M	10	B8M-CL2/8M [c d]
2.3	8Cr-8Ni 16Cr-12Ni-2Mo	A182-F304L A182-F316L	10	B8M-CL2/8M [c d]
2.4	18Cr-10Ni-Ti	A182-F321 A182-F321H	10	B8M-CL2/8M [c d]
2.5	18Cr-10Ni-Cb	A182-F347H A182-F347 A182-F348 A182-F348H	10	B8M-CL2/8M [c d]
2.7	25Cr-20Ni	A182-F310	10	B8M-CL2/8M [c d]
2.8	20Cr-18Ni-6Mo 22Cr-5Ni-3Mo-N 25Cr-7Ni-4Mo-N 24Cr-10Ni-4Mo-V 25Cr-5Ni-2Mo-3Cu 25Cr-7Ni-3.5MO-W-Cb 25Cr-7Ni-3.5Mo-N-Cu-W	A182-F44 A351-CK3MCuN A182-F51 A182-F53 A351-CE8MN A351-CD4MCu A351-CD3MWCuN A182-F55	Note [f]	B8M-CL2/8M [c d]
2.10	25Cr-12Ni	A351-CH8 A351-CH20	Note [f]	B8M-CL2/8M [c d]
2.11	18Cr-10Ni-Cb	A351-CF8C	Note [f]	B8M-CL2/8M [c d]
2.12	25Cr-20Ni	A351-CK20	Note [f]	B8M-CL2/8M [c d]

NOTE For bolting materials in accordance with EN 10269, see Table C.3.

[a] Temperature limitations on bolting are as follows: Gr B7, 538 °C (1000 °F); Gr L7, 538 °C (1000 °F); Gr B16, 595 °C (1100 °F); Gr B8-CL1, Gr B8A-CL1A, Gr B8M-CL1, and Gr B8MA-CL1A, 816 °C.
(1500 °F); Gr B8-CL2, Gr B8M-CL2, Gr B8M2-CL2B and Gr B8M3-CL2C, 538 °C (1000 °F).

[b] ASTM A320, Gr L7 bolts, and ASTM A194, Gr 4 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 is a suitable substitute provided that the requirements of 5.5.8 are met.

[d] ASTM A193, Gr B8-CL2 bolts may also be used.

[e] ASTM A194, Gr 7 nuts may also be used.

[f] Trim material is not specified, however, trim material shall have corrosion resistance equal to the corrosion resistance of the valve body material.

Table C.3—Alternative Body to Bonnet Bolting Materials

As Related to Table C.1 and Table C.2		As Related to Table Notes in Table C.1 and Table C.2	
ASTM Bolting Material	**EN 10269 Bolting Material Grade**	**ASTM Bolting Material**	**EN 10269 Bolting Material Grade**
A193 B7 A193 B16	42CrMo4 (1.7225)—QT 40CrMoV4-6 (1.7711)—QT	A193 B8M2, CL 2B A193 B8M3, CL 2C	X5CrNiMo 17-12-2 (1.4401)—C700 X5CrNiMo 17-12-2 (1.4401)—C700
A193 B8M, CL 2 A194 2H	X5CrNiMo 17-12-2 (1.4401)—C700 C45E (1.1191)—QT	A193 B8M, CL 1 A193 B8MA, CL 1A	X5CrNiMo 17-12-2 (1.4401)—AT X5CrNiMo 17-12-2 (1.4401)—AT
A194 8M	X5CrNiMo 17-12-2 (1.4401)—AT	A193 B8, CL 1 A193 B8A, CL 1A	X5CrNi 18-10 (1.4301)—AT X5CrNi 18-10 (1.4301)—AT
		A193, B8 CL 2 A320, L7	X5CrNi 18-10 (1.4301)—C700 42CrMo4 (1.7225)—QT
		A194 GR 8 A194 GR 4	X5CrNi 18-10 (1.4301)—AT 42CrMo4 (1.7225)—QT
		A194 GR 7	42CrMo4 (1.7225)—QT

NOTE Temperature limitations applicable for ASTM bolting materials, table notes for Table C.2, also apply for corresponding substitute EN bolting materials.