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 Pipe Size NPS
25	6.4 (0.25)	6.4 (0.25)	7.9 (0.31)	12.7 (0.50)[a]	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)[a]	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)[a]	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)[a]	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)[a]	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)	34.9 (1.37)	—	—	—	—	30
800	23.8 (0.94)	36.0 (1.41)	—	—	—	—	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

[a] Wall thicknesses match class 1500 to correspond to B16.5 flange dimensions for class 900.

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 for normal fluid service, including required NDE and weld quality acceptance criteria and qualifications for the weld procedure and welder or welding operator. Heat treatment shall be performed in accordance with ASME B31.3 or Purchaser specification.

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 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 except by agreement between the purchaser and manufacturer.

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.

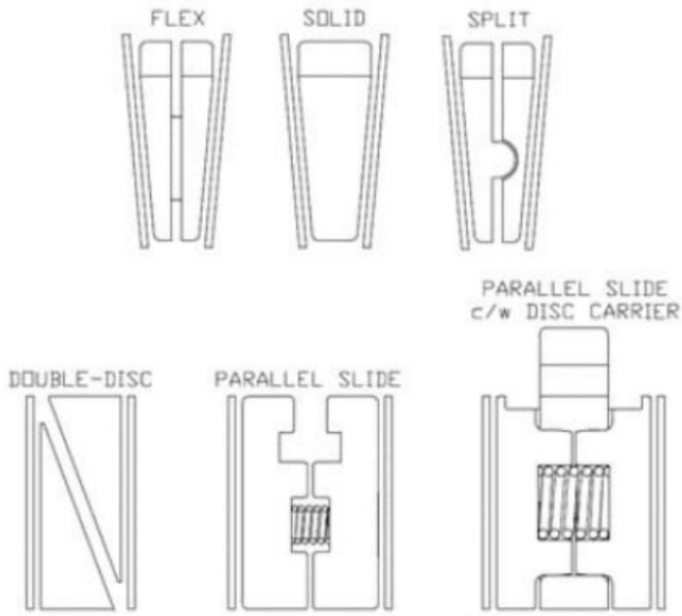


Figure 2—Types of Valve Gates

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, including any valve orientation placing the stem in the horizontal position. Methods to improve disc guiding include but are not limited to the following, where applicable:

— surface hardened guide surfaces;

— hardness differential between body and disc guides;

— clearances between body and disc guides;

— total guide length;

— radii and chamfers of components.

NOTE The above methods are not intended as inspection requirements.

For sizes DN 650 (NPS 26) and above, at a minimum, wedge guides and body guides shall be surface hardened, unless otherwise agreed by the purchaser, and provided with appropriate surface finish and clearances to allow for proper valve operation in any orientation.

5.6.4 Wedge guides and/or body guides shall not protrude beyond the seat rings into the port area of the valve. The manufacturer shall provide in their installation and operation manual any operational limitations as a result of stem and valve orientation

5.6.5 Gate 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.).

5.6.6 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 seating surface (see Figure 3). The required minimum wear travel varies with valve size in accordance with Table 3. For purposes of inspection of wear travel, see details in Annex E.

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.

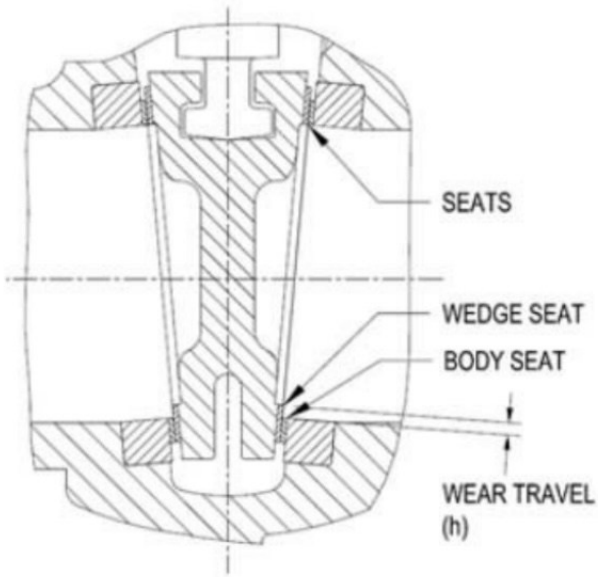


Figure 3—Wear Travel Detail

Table 3—Minimum Wear Travel and Maximum Stem Projection

Valve Size Range, DN (NPS)	Minimum Wear Travel, *h* mm (in.)	Maximum Stem Projection mm (in.)
DN ≤ 50 (NPS ≤ 2)	2.3 (0.09)	11.5 (0.45)
65 ≤ DN ≤ 150 ($2^1/_2$ ≤ NPS ≤ 6)	3.3 (0.13)	16.5 (0.65)
200 ≤ DN ≤ 300 (8 ≤ NPS ≤ 12)	6.4 (0.25)	19.2 (0.75)

5.6.4 Wedge guides and/or body guides shall not protrude beyond the seat rings into the port area of the valve. The manufacturer shall provide in their installation and operation manual any operational limitations as a result of stem and valve orientation

5.6.5 Gate 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.).

5.6.6 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 seating surface (see Figure 3). The required minimum wear travel varies with valve size in accordance with Table 3. For purposes of inspection of wear travel, see details in Annex E.

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.

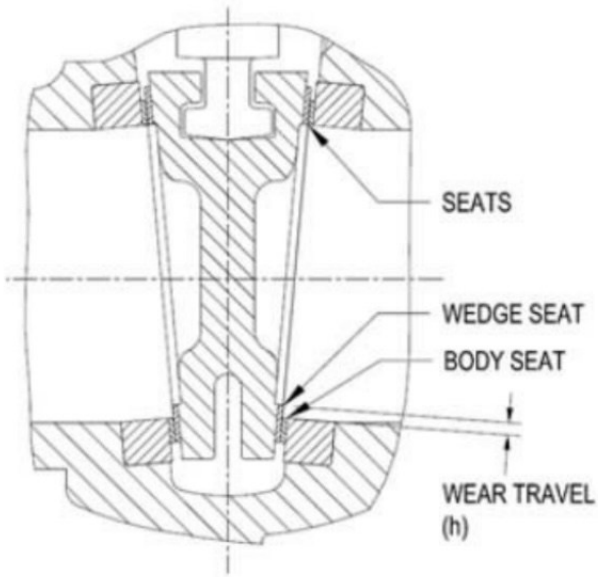


Figure 3—Wear Travel Detail

Table 3—Minimum Wear Travel and Maximum Stem Projection

Valve Size Range, DN (NPS)	Minimum Wear Travel, *h* mm (in.)	Maximum Stem Projection mm (in.)
DN ≤ 50 (NPS ≤ 2)	2.3 (0.09)	11.5 (0.45)
65 ≤ DN ≤ 150 ($2^1/_2$ ≤ NPS ≤ 6)	3.3 (0.13)	16.5 (0.65)
200 ≤ DN ≤ 300 (8 ≤ NPS ≤ 12)	6.4 (0.25)	19.2 (0.75)

Table 3—Minimum Wear Travel and Maximum Stem Projection (Continued)

Valve Size Range, DN (NPS)	Minimum Wear Travel, *h* mm (in.)	Maximum Stem Projection mm (in.)
350 ≤ DN ≤ 450 (14 ≤ NPS ≤ 18)	9.7 (0.38)	29.1 (1.14)
500 ≤ DN ≤ 600 (20 ≤ NPS ≤ 24)	12.7 (0.50)	38.1 (1.50)
650 ≤ DN ≤ 700 (26 ≤ NPS ≤ 28)	16.0 (0.62)	48.0 (1.86)
750 ≤ DN ≤ 900 (30 ≤ NPS ≤ 36)	19.1 (0.75)	57.3 (2.25)
950 ≤ DN ≤ 1050 (38 ≤ NPS ≤ 42)	25.4 (1.00)	76.2 (3.00)

5.7.4 The yoke-to-stem nut bearing surfaces shall be machined flat and parallel to yoke-bonnet mating surface. 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 4. To allow the use of standard diameter round bars, an undertolerance is permitted in accordance with Table 4a. 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. At the manufacturer's option, the minimum major thread diameter of the stem may be reduced from the values shown in Table 4 by no more than 1.6 mm (0.063 in.). There are no limitations in the diameter difference between the stem diameter and major thread diameter. 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 4—Minimum Stem Diameter

Class	150	300	600	900	1500	2500	Class
Nominal Size DN	Minimum Stem Diameter d_s mm (in.)						Nominal Pipe 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

Table 4—Minimum Stem Diameter (Continued)

Class	150	300	600	900	1500	2500	Class
Nominal Size DN	Minimum Stem Diameter d_s mm (in.)						Nominal Pipe Size NPS
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)	85.73 (3 3/8)	—	—	—	—	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 1/4)	101.6 (4)	—	—	—	—	42

Table 4—a—Permitted Undertolerance

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

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 the 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. For manually operated valves, the minimum thread engagement length between the stem and the stem nut shall be 1½ 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 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.

5.8.6 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.

5.8.7 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.

Table 5—Nominal Radial Width of Packing (Metric)

Nominal Stem Diameter d_n mm	Nominal Radial Width of the Packing w mm	Maximum Packing Box Clearance Factor y mm
$15 < d_n \leq 27$	6.4	0.4
$27 < d_n \leq 37$	7.9	0.4
$37 < d_n \leq 49$	9.5	0.4
$49 < d_n \leq 56$	11.1	0.8
$56 < d_n \leq 74$	12.7	0.8
$74 < d_n \leq 102$	14.3	0.8

Table 6—Nominal Radial Width of Packing (U.S. Customary)

Nominal Stem Diameter d_n in.	Nominal Radial Width of the Packing w in.	Maximum Packing Box Clearance Factor y in.
$^5/_8 < d_n \leq 1$	$^1/_4$	$^1/_{64}$
$1 < d_n \leq 1\,^3/_8$	$^5/_{16}$	$^1/_{64}$
$1\,^3/_8 < d_n \leq 1\,^7/_8$	$^3/_8$	$^1/_{64}$
$1\,^7/_8 < d_n \leq 2\,^1/_8$	$^7/_{16}$	$^1/_{32}$
$2\,^1/_8 < d_n \leq 2\,^7/_8$	$^1/_2$	$^1/_{32}$
$2\,^7/_8 < d_n \leq 4$	$^9/_{16}$	$^1/_{32}$

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 B18.2.6M.

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 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. 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 shall be tolerance class 6H in accordance with ASME B1.13M.

5.10.5 Full stud thread shall extend beyond the nut face to ensure full thread engagement. The chamfer at the end of the stud is not considered part of the thread.

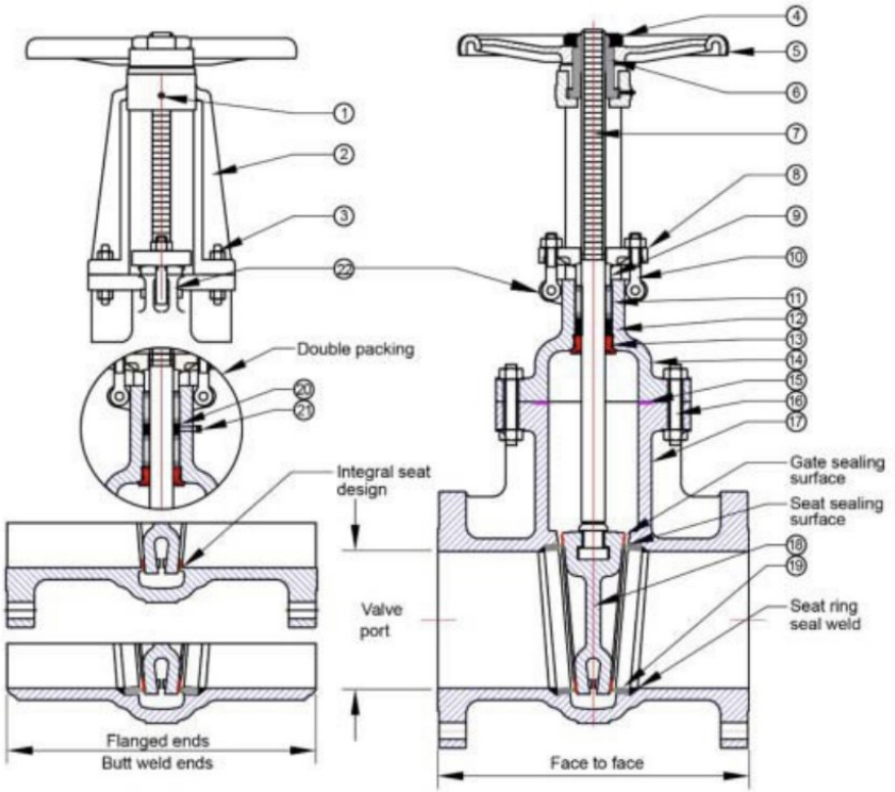
5.11 Operation

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 counterclockwise 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

Annex C
(informative)

Identification of Valve Terms



Parts List

1: Stem nut grease injector
2: Yoke
3: Bonnet/yoke bolts
4: Hand wheel nut
5: Hand wheel
6: Stem nut (stem bushing, yoke nut)
7: Stem
8: Gland flange (packing gland follower)
9: Packing gland
10: Packing bolts
11: Packing
12: Packing spacer
13: Backseat bushing
14: Bonnet
15: Bonnet gasket
16: Body/bonnet bolts
17: Body
18: Gate (wedge, disc)
19: Seat ring
20: Lantern ring
21: Plug
22: Eyebolt Anchor

Figure C.1—Valve Nomenclature