INTERNATIONAL STANDARD

ISO 10434

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1998-10-15

Bolted bonnet steel gate valves for petroleum and natural gas industries

Robinets-vannes en acier à chapeau boulonné pour les industries du pétrole et du gaz naturel

Reference number
ISO 10434:1998(E)

Contents

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet iso@iso.ch
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 10434 was prepared jointly by Technical Committees ISO/TC 153, *Valves*, Subcommittee SC 1, *Design, manufacture, marking and testing*, and ISO/TC 67, *Materials, equipment and offshore structures for petroleum and natural gas industries*, Subcommittee SC 6, *Processing equipment and systems.*

Annexes A, B and C of this International Standard are for information only.

Introduction

The purpose of this International Standard is to establish, in ISO format, the basic requirements and practices for flanged and butt-welding end steel gate valves of bolted bonnet construction which parallel those given in American Petroleum Institute Standard API 600. In order to maintain compatibility with the flanges defined in ISO 7005-1 and the flanges in the American National Standard ASME B16.5, valves have been designated to be PN-marked for the former and Class-marked for the latter. It is not the purpose of this International Standard to replace ISO 6002 or any other International Standard which is not identified with petroleum refinery or natural gas industry applications.

Bolted bonnet steel gate valves for petroleum and natural gas industries

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 indicate a need for full port openings, heavy wall sections and extra large stem diameters.

This specification 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.

It covers valves of the nominal sizes DN:

25; 32; 40; 50; 65; 80; 100; 150; 200; 250; 300; 350; 400; 450; 500; 600

and is applicable for nominal pressures PN:

20; 50; 110; 150; 260; 420

when metric sized bolt holes are provided in end flanges and PN designations are marked on the valve body.

It also covers valves of the corresponding nominal pipe sizes NPS:

1; 1¼; 1½; 2; 2½; 3; 4; 6; 8; 10; 12; 14; 16; 18; 20; 24

and applies for equivalent nominal Class ratings:

150; 300; 600; 900; 1 500; 2 500

when inch-sized bolt holes are provided in end flanges and Class designations are marked on the valve body.

It also covers additional marking requirements for valves that are PN (or Class) designated but have flanges drilled for inch (or metric) bolt holes.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of the publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 7-1:1994, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation.*

ISO 4200:1991, *Plain end steel tubes, welded and seamless — Dimensions.*

ISO 5208:1993, *Industrial valves — Pressure testing of valves.*

ISO 5209:1977, *General purpose industrial valves — Marking.*

ISO 5210:1991, *Industrial valves — Multi-turn valve actuator attachments.*

ISO 5752:—[1], *Metal valves for use in flanged pipe systems — Face-to-face and centre-to-face dimensions.*

ISO 6708:1995, *Pipework components — Definition and selection of DN (nominal size).*

ISO 7005-1:1992, *Metallic flanges — Part 1: Steel flanges.*

ISO 7268:1983, *Pipe components — Definition of nominal pressure.*

ANSI/ASME B1.1:1989, *Unified inch screw threads (UN and UNR thread form).*

ANSI/ASME B1.5:1988 (R1994), *Acme screw threads.*

ANSI/ASME B1.8:1988 (R1994), *Stub Acme screw threads.*

ANSI/ASME B1.12:1987 (R1992), *Screw threads — Class 5 interference — Fit thread.*

ANSI/ASME B1.20.1:1983 (R1992), *Pipe threads, general purpose (inch).*

ANSI/ASME B16.5:1996, *Pipe flanges and flanged fittings.*

ANSI/ASME B16.34:1996, *Valves — Flanged, threaded and welding end.*

ANSI/ASME B18.2.2:1987 (R1993), *Square and hex nuts (inch series).*

ANSI/ASTM A193:1996, *Specification for alloy steel and stainless steel bolting materials for high-temperature service.*

ANSI/ASTM A194:1996, *Specification for carbon and alloy steel nuts for bolts for high-pressure and high-temperature service.*

ANSI/ASTM A307:1994, *Specification for carbon steel bolts and studs, 60 000 psi tensile strength.*

3 Definitions

For the purposes of this International Standard, the definition of nominal size given in ISO 6708 and of nominal pressure given in ISO 7268 apply. Alternatively, the definitions of pressure Class and Nominal Pipe Size given in ANSI/ASME B16.34 apply.

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[1] To be published. (Revision of ISO 5752:1982)

4 Pressure/temperature ratings

4.1 The pressure/temperature ratings applicable to the valves specified in this International Standard shall be in accordance with those specified in the tables of ANSI/ASME B16.34 for Standard Class for the applicable material specification and the applicable Class (PN). Restrictions on temperature and pressure conditions, for example those imposed by special soft seals or special trim materials shall be marked on the valve identification plate (see 8.4).

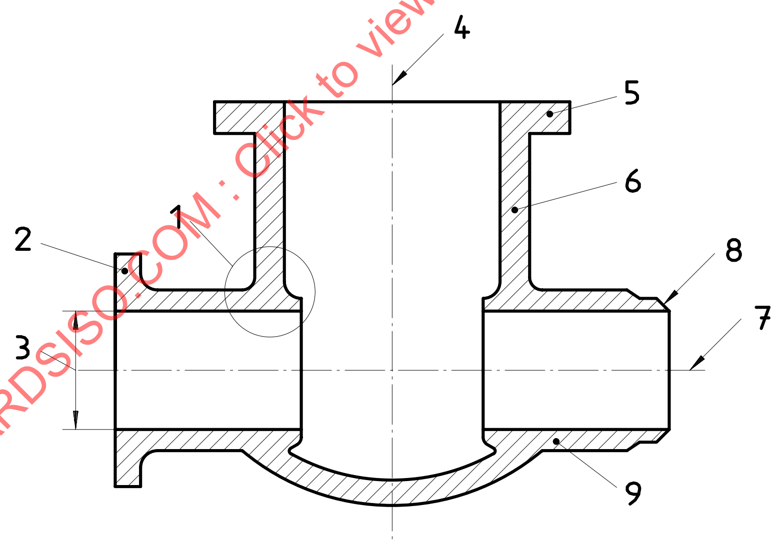
4.2 The temperature for a corresponding pressure rating is the maximum temperature of the pressure-containing shell of the valve. In general, this temperature is the same as that of the contained fluid. The use of a pressure rating corresponding to a temperature other than that of the contained fluid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

4.3 For temperatures below the lowest temperature listed in the pressure/temperature tables (see 4.1), the service pressure shall be no greater than the pressure for the lowest listed temperature. The use of valves at lower temperatures is the responsibility of the user. Consideration should be given to the loss of ductility and impact strength of many materials at low temperature.

5 Design

5.1 Body wall thickness

5.1.1 A valve body schematic is shown in 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

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 to the outside surface of the body neck than t_m 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 for test collars or bands, either welded or integral. In no case shall the thickness be less than 0,77 t_m at a distance of 1,33 t_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 which forms the stem and packing entry-way, shall be t_m as given in table 1. For the stem and packing entry-way the local minimum wall thickness shall be based on the local diameter, e.g. the diameter of the stem bore or packing box bore, and shall be in accordance with table 2.

Table 1 — Minimum wall thickness for body and bonnet

Nominal size DN	**PN designation**						**Nominal pipe size NPS**
	20	50	110	150	260	420	
	Class designation						
	150	300	600	900	1 500	2 500	
	Minimum wall thickness, t_m mm						
25	6,4	6,4	7,9	12,7	12,7	15	1
32	6,4	6,4	8,6	14,2	14,2	17,5	1¼
40	6,4	7,9	9,4	15	15	19,1	1½
50	8,6	9,7	11,2	19,1	19,1	22,4	2
65	9,7	11,2	11,9	22,4	22,4	25,4	2½
80	10,4	11,9	12,7	19,1	23,9	30,2	3
100	11,2	12,7	16	21,3	28,7	35,8	4
150	11,9	16	19,1	26,2	38,1	48,5	6
200	12,7	17,5	25,4	31,8	47,8	62	8
250	14,2	19,1	28,7	36,6	57,2	67,6	10
300	16	20,6	31,8	42,2	66,8	86,6	12
350	16,8	22,4	35,1	46	69,9	—	14
400	17,5	23,9	38,1	52,3	79,5	—	16
450	18,3	25,4	41,4	57,2	88,9	—	18
500	19,1	26,9	44,5	63,5	98,6	—	20
600	20,6	30,2	50,8	73,2	114,3	—	24

Table 2 — Minimum wall thickness for bonnet neck

Stem or packing entryway diameter mm	PN designation					
	20	50	110	150	260	420
	Class designation					
	150	300	600	900	1 500	2 500
	Minimum wall thickness, t_m mm					
15	2,8	3	3,6	4,2	5,3	7,6
16	2,8	3,1	3,6	4,4	5,6	7,9
17	2,8	3,2	3,7	4,5	5,8	8,2
18	2,9	3,5	3,9	4,7	5,9	8,5
19	3	3,8	4,1	5,1	6,1	8,9
20	3,3	4	4,2	5,2	6,3	9,2
25	4	4,8	4,8	6,3	7,1	11
30	4,6	4,8	4,8	6,5	8,2	13,1
35	4,8	4,8	5,1	7,1	9,7	14,6
40	4,9	5	5,7	7,5	10,2	16,4
50	5,5	6,2	6,3	7,9	11,6	19,8
60	5,6	6,4	6,8	8,9	13,4	23,2
70	5,6	6,9	7,4	9,9	15,8	26,5
80	5,8	7,2	8,1	11	17,4	30,1
90	6,4	7,4	8,8	12	19,1	33,2
100	6,4	7,7	9,5	12,8	20,8	36,7
110	6,4	8,1	10,3	14,1	22,9	40,1
120	6,6	8,6	10,9	14,9	24,8	43,5
130	7,1	8,8	11,3	16,2	26,5	46,9
140	7,1	9,2	12	17,3	28,3	50,2

5.3 Body dimensions

5.3.1 Flanged ends

5.3.1.1 Body end flanges PN 20 through 420 shall comply with the requirements of series 1 of ISO 7005-1, except that Class-designated valves shall have inch bolt holes in accordance with ANSI/ASME B16.5. Unless otherwise specified, raised face end flanges shall be provided.

5.3.1.2 Face-to-face dimensions for flanged end valves PN 20, PN 50, and PN 110 shall be in accordance with ISO 5752, basic series 3, 4 and 5, except that the applicable tolerance shall be in accordance with the note in table 3. For PN > 110, the face-to-face dimensions shall be the same as the end-to-end dimensions given in table 3.

5.3.1.3 Body end flanges and bonnet flanges shall be cast or forged integral with the body. However, when specified by the purchaser, forged flanges may be attached by welding by a qualified welding operator using a qualified welding procedure; in this case all flanges attached by welding shall use a butt-welded joint. Heat treatment to ensure that the material is suitable for the full range of service conditions shall be performed in accordance with the material specifications.

Table 3 — End-to-end dimensions for butt-welding end valves

Nominal size DN	PN designation 20 / Class designation 150	PN 50 / Class 300	PN 110 / Class 600	PN 150 / Class 900	PN 260 / Class 1 500	PN 420 / Class 2 500	Nominal pipe size NPS
	End-to-end dimensions mm						
25	127	165	216	254	254	308	1
32	140	178	229	279	279	349	1¼
40	165	190	241	305	305	384	1½
50	216	216	292	368	368	451	2
65	241	241	330	419	419	508	2½
80	283	283	356	381	470	578	3
100	305	305	432	457	546	673	4
150	403	403	559	610	705	914	6
200	419	419	660	737	832	1 022	8
250	457	457	787	838	991	1 270	10
300	502	502	838	965	1 130	1 422	12
350	572	762	889	1 029	1 257	—	14
400	610	838	991	1 130	1 384	—	16
450	660	914	1 092	1 219	1 537	—	18
500	711	991	1 194	1 321	1 664	—	20
600	813	1 143	1 397	1 549	1 943	—	24

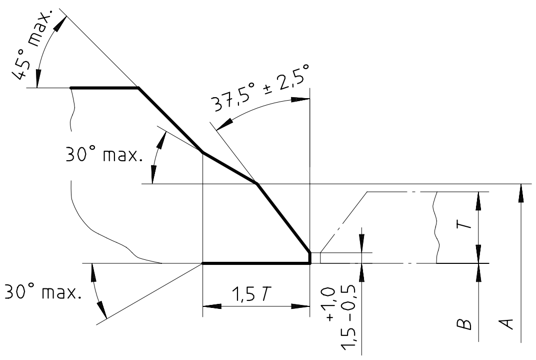
NOTE — The tolerance applicable to the above dimensions is:
— for DN ⩽ 250: ± 2 mm
— for DN ⩾ 300: ± 3 mm

5.3.2 Butt-welding ends

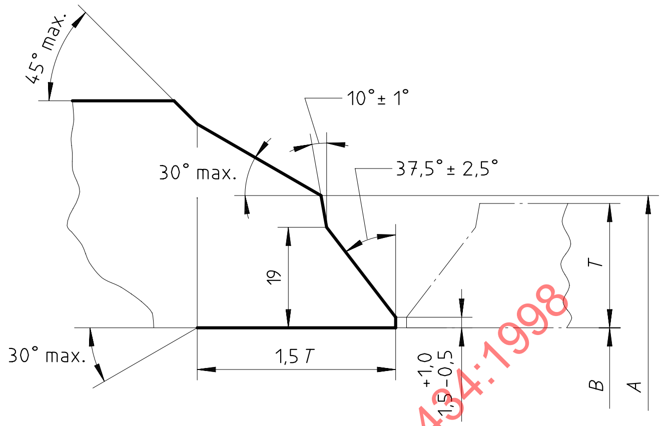
5.3.2.1 Butt-welding ends shall be in accordance with the details shown in figure 2, unless otherwise specified by the purchaser.

5.3.2.2 End-to-end dimensions for butt-welding end valves shall be in accordance with table 3, unless otherwise specified by the purchaser.

Dimensions in millimetres



a) Welding end for connection to pipe of wall thickness *T* ⩽ 22 mm



b) Welding end for connection to pipe of wall thickness *T* > 22 mm

A = nominal outside diameter of welding end

B = nominal inside diameter of pipe

T = nominal wall thickness of pipe

<table>
<tr><th colspan="2">Nominal size DN</th><th>25</th><th>32</th><th>40</th><th>50</th><th>65</th><th>80</th><th>100</th><th>150</th><th>200</th><th>250</th><th>300</th><th>350</th><th>400</th><th>450</th><th>500</th><th>600</th></tr>
<tr><th colspan="2">Nominal pipe size NPS</th><th>1</th><th>1¼</th><th>1½</th><th>2</th><th>2½</th><th>3</th><th>4</th><th>6</th><th>8</th><th>10</th><th>12</th><th>14</th><th>16</th><th>18</th><th>20</th><th>24</th></tr>
<tr><td rowspan="2">A mm</td><td>nom.</td><td>35</td><td>44</td><td>50</td><td>62</td><td>78</td><td>91</td><td>117</td><td>172</td><td>223</td><td>278</td><td>329</td><td>362</td><td>413</td><td>464</td><td>516</td><td>619</td></tr>
<tr><td>tol.</td><td colspan="7">+ 2,5
− 1,0</td><td colspan="9">+ 4
− 1</td></tr>
<tr><td>B mm</td><td>tol.</td><td colspan="10">+ 1
− 1</td><td colspan="4">+ 2
− 2</td><td colspan="2">+ 3
− 2</td></tr>
</table>

NOTES

1 The inside and outside surfaces of valve welding ends shall be machine finished overall. The contour within the envelope is at the option of the manufacturer unless specifically ordered otherwise.

2 Intersections should be slightly rounded.

3 Valves with minimum wall thickness equal to 3 mm or less may have ends cut square or slightly chamfered.

4 For nominal outside diameters and wall thickness of standard steel pipe, see ISO 4200.

Figure 2 — Weld ends

5.3.3 Body seats

5.3.3.1 The inside diameter of the body seat, except for assembly drive lugs on threaded seat rings, shall not be less than the values specified in table 4.

Table 4 — Body port diameter

Nominal size DN	PN designation						Nominal pipe size NPS
	20	50	110	150	260	420	
	Class designation						
	150	300	600	900	1 500	2 500	
	Minimum port diameter mm						
25	25	25	25	22	22	19	1
32	31	31	31	28	28	25	1¼
40	38	38	38	34	34	28	1½
50	50	50	50	47	47	38	2
65	63	63	63	57	57	47	2½
80	76	76	76	72	69	57	3
100	100	100	100	98	92	72	4
150	150	150	150	146	136	111	6
200	200	200	199	190	177	146	8
250	250	250	247	238	222	184	10
300	300	300	298	282	263	218	12
350	336	336	326	311	288	241	14
400	387	387	374	355	330	276	16
450	438	431	419	400	371	311	18
500	488	482	463	444	415	342	20
600	590	584	558	533	498	412	24

5.3.3.2 Integral body seats are permitted in austenitic stainless steel valves. When an austenitic stainless steel or a hard-facing material is used for the body seat, this material may be weld deposited directly on the valve body. Otherwise, valve bodies shall have separate shoulder or bottom seated seat rings that are either threaded or welded in place except that for DN $\leqslant$ 50, rolled or pressed in seat rings may be used.

5.3.3.3 Body seating surfaces shall not have sharp corners at either the inner or outer seat circumference.

5.3.3.4 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.

5.3.4 Openings

Tapped openings are prohibited unless specified by the purchaser. All openings shall be in accordance with 5.12. When tapped openings are permitted for testing, they shall not be larger than DN 15.

5.4 Bonnet dimensions

5.4.1 The bonnet stem hole shall be designed to leave enough clearance for stem guiding and packing extrusion.

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

— a bushing;

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

— an austenitic stainless steel or hardface weld deposit with a minimum thickness of 1,6 mm.

5.4.3 The restrictions of 5.3.4 on openings also apply to the bonnet.

5.4.4 Bonnets shall be one piece castings or forgings subject to the same requirements and exceptions as specified in 5.3.1.3.

5.4.5 The gland bolting shall not be anchored to the bonnet or yoke through a fillet welded attachment or stud welded pins. The anchor design shall not include slotted holes or brackets which do not shackle gland bolting during repacking.

5.5 Bonnet-to-body joint

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

5.5.2 For PN 20 valves, the bonnet-to-body joint shall be one of the following types which are illustrated in figure 5 of ISO 7005-1:1992:

— Type A, flat face;

— Type B, raised face;

— Types C and D, tongue and groove;

— Types E and F, spigot and recess;

— Type J, ring joint.

5.5.3 For valves having nominal pressure greater than PN 20 the bonnet-to-body joint shall be in accordance with 5.5.2, except that the Type A, flat face, joint is not permitted.

5.5.4 The bonnet flange gasket shall be suitable for the temperature range – 29 °C to 538 °C and shall be one of the following:

— solid metal, corrugated or flat;

— filled metal jacketed, corrugated or flat;

— metal ring joint;

— spiral wound metal gasket with filler and a centring/compression ring;

— spiral wound metal gasket with filler to be used only in a bonnet-to-body joint design that provides gasket compression control.

For PN 20, the following may also be used:

— flexible graphite sheet having a perforated stainless steel reinforcement.

5.5.5 Except for all PN 20 valves and all valves in sizes DN 65 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 backfacing required to meet the parallelism requirement shall be in accordance with ISO 7005-1:1992, 2.6.

5.5.7 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, in accordance with its PN or Class designation, shall be as follows:

— M10 or 3/8 when $25 \leqslant \mathrm{DN} \leqslant 65$;

— M12 or 1/2 when $80 \leqslant \mathrm{DN} \leqslant 200$;

— M16 or 5/8 when $250 \leqslant \mathrm{DN}$.

5.5.8 Valve bonnet bolting shall, as a minimum, meet the following bolt cross-sectional area requirements:

$$k(\mathrm{PN})\frac{A_g}{A_b} \leqslant 11{,}25\ S_b \leqslant 1\ 552$$

where

S_b is the allowable bolt stress at 38 °C, in megapascals (when greater than 138 MPa, use 138 MPa);

PN is the nominal pressure rating number;

A_g is the area bounded by the effective outside periphery of the gasket in square millimetres, except that in the case of a ring joint the bounded area is defined by the pitch diameter of the ring;

A_b is the total effective bolt tensile stress area, in square millimetres;

k is a coefficient having the following value:

k = 1,25 when PN20;

k = 1 when PN50;

k = 0,91 when PN110;

k = 1 when PN150;

k = 0,97 when PN260;

k = 1 when PN420.

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

5.6 Gate

5.6.1 A one-piece wedge gate, as either a solid or flexible wedge design, shall be furnished, unless otherwise specified by the purchaser. In the open position, the wedge shall completely clear the valve seat openings.

5.6.2 A two-piece split wedge gate or a 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. A double disc gate has a spreading mechanism that forces the two parallel discs to the body seats when closed.

5.6.3 Gates shall be designed so that all parts can function properly independent of the installed valve orientation.

5.6.4 Guides shall be provided in the gate and the shell and shall be designed so as to minimise seat wear and maintain gate to stem alignment in all valve orientations. Gate-to-shell design shall consider wear that may be caused by corrosion, erosion and abrasion.

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.

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 move into the seats, as a result of seat wear, a distance defined as wear travel. The required minimum wear travel varies with valve size, as given in table 5.

Table 5 — Minimum wear travel

Valve size range **DN**	**Minimum wear travel** mm
25 ⩽ DN ⩽ 50	2,3
65 ⩽ DN ⩽ 150	3,3
200 ⩽ DN ⩽ 300	6,4
350 ⩽ DN ⩽ 450	9,7
500 ⩽ DN ⩽ 600	12,7

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 Yokes shall be designed so as to allow the stem nut to be removed (when the valve is not under pressure) without removing the bonnet from the valve body.

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 unless permanently lubricated bearings are used.

5.8 Stem and stem nut

5.8.1 The minimum stem diameter at the time of manufacture shall be in accordance with table 6. The minimum stem diameter applies to the stem in the packing area and to the major diameter of the trapezoidal stem thread.

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 ANSI/ASME B1.5 or ANSI/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 will close the valve.

5.8.4 The stem shall be one-piece wrought material. Welded fabrication is not permitted.

5.8.5 The stem end that connects to a gate shall be in the form of a tee. However, 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.

Table 6 — Minimum stem diameter

Nominal size DN	PN designation 20	50	110	150	260	420	Nominal pipe size NPS
	Class designation 150	300	600	900	1 500	2 500	
	Minimum stem diameter mm						
25	15,59	15,59	15,59	18,77	18,77	18,77	1
32	15,59	15,59	15,59	18,77	18,77	18,77	1¼
40	17,17	18,77	18,77	21,87	21,87	21,87	1½
50	18,77	18,77	18,77	25,04	25,04	25,04	2
65	18,77	18,77	21,87	28,22	28,22	28,22	2½
80	21,87	21,87	25,04	28,22	31,39	31,39	3
100	25,04	25,04	28,22	31,39	34,47	34,47	4
150	28,22	31,39	37,62	40,77	43,84	46,94	6
200	31,39	34,47	40,77	46,94	53,49	59,79	8
250	34,47	37,62	46,94	53,49	62,99	72,49	10
300	37,62	40,77	50,14	56,69	69,39	82,09	12
350	40,77	43,84	56,69	59,79	75,69	—	14
400	43,84	46,94	59,79	62,99	75,69	—	16
450	46,94	50,14	62,99	75,69	—	—	18
500	50,14	53,49	69,39	—	—	—	20
600	56,69	62,99	75,69	—	—	—	24

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.

5.8.8 The one-piece stem shall include a conical or spherical raised surface that will seat 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 that it may be used for the purpose of adding or replacing packing while the valve is under pressure.

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

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

5.8.11 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.

5.8.12 The closed-position stem thread projection beyond the stem nut on a new valve shall be a distance having a minimum equal to the valve wear travel and a maximum of five times the wear travel for DN 150 valves or smaller and three times the wear travel for valves larger than DN 150.

5.8.13 Valves DN 150 or larger with PN 110 or greater, 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 in cross-section. The nominal radial width of the packing shall be in accordance with table 7.

Table 7 — Nominal radial width of the packing

Nominal stem diameter d mm	Nominal radial width of the packing w mm
$15 < d \leqslant 27$	6,4
$27 < d \leqslant 37$	7,9
$37 < d \leqslant 49$	9,5
$49 < d \leqslant 56$	11,1
$56 < d \leqslant 74$	12,7
$74 < d$	14,3

5.9.2 The nominal depth of the packing box shall accommodate a minimum of five uncompressed rings of packing.

5.9.3 The nominal bore of the packing box shall be equal to the nominal stem diameter plus twice the nominal packing width plus 0,8 mm, i.e. $d + 2w + 0,8$.

5.9.4 A gland and a separate gland flange shall be provided for packing compression. The upper end of the gland shall have a lip whose outer diameter exceeds the diameter of the packing box bore so as to block entry into the bore. The gland flange shall have two holes to receive the gland bolting. Gland flange bolt slots shall not be used.

5.9.5 The manufacturer is responsible for establishing that the selected packing, when installed in a new valve, does not leak at the rated pressure at 38 °C.

5.10 Bolting

5.10.1 Bonnet-to-body joint bolting shall be continuously threaded stud bolts with heavy, semi-finished hexagon nuts that are in accordance in with ANSI/ASME B18.2.2.

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 25 mm and smaller shall have coarse (UNC) threads or the most nearly corresponding metric threads. Bolting larger than 25 mm 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 ANSI/ASME B1.1. Studs used for gland bolting shall use a Class 5 interference fit conforming to ANSI/ASME B1.12.

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.

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 chainwheel, 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 centreline 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 mating dimensions may be according to ISO 5210 or shall comply with the purchaser's specifications.

5.12 Auxiliary connections

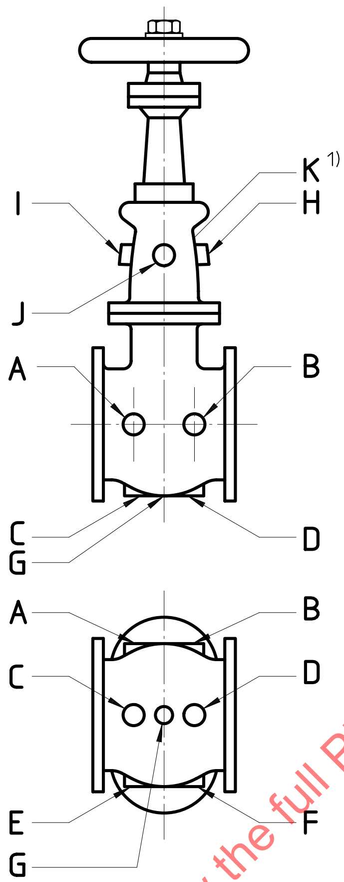
5.12.1 Auxiliary connections are not required, except when specified by the purchaser.

5.12.2 Unless the purchaser specifies otherwise, the minimum nominal pipe size for auxiliary connections shall be in accordance with table 8.

Table 8 — Auxiliary connection size

Valve size range DN	Auxiliary connection size	
	DN	NPS
50 ⩽ DN ⩽ 100	15	1/2
150 ⩽ DN ⩽ 200	20	3/4
250 ⩽ DN ⩽ 600	25	1

5.12.3 Auxiliary connections shall be identified as indicated in figure 3. Each of the 11 locations is designated by a letter.



1) On same side as E and F

Figure 3 — Location of tappings for auxiliary connections

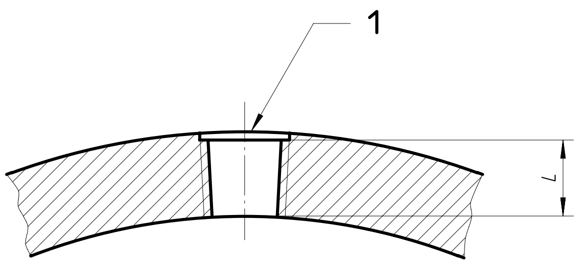
5.12.4 When bosses require additional metal thickness to obtain adequate metal wall thickness, the minimum inscribed diameter of the boss shall be in accordance with table 9.

Table 9 — Minimum boss diameter

Auxiliary connection size		Minimum boss diameter
DN	**NPS**	mm
15	1/2	38
20	3/4	44
25	1	54
32	1¼	64
40	1½	70

5.12.5 The wall of the valve may be tapped if the metal thickness is thick enough to allow the effective thread length, L, shown in figure 4 and given in table 10.

Where the thread length is insufficient or the tapped hole needs reinforcement, a boss shall be added as specified in 5.12.4. Pipe threads shall be of the taper style shown in figure 4.



Key

1 Pipe thread ANSI/ASME B1.20.1 or pipe thread ISO 7-1 Rc

Figure 4 — Thread length for auxiliary connections

Table 10 — Minimum boss diameter

Auxiliary connection size		Minimum boss diameter L
DN	**NPS**	mm
15	1/2	14
20	3/4	14
25	1	18
32	1¼	18
40	1½	19

5.12.6 Sockets, for socket welding connections, may be provided if the metal is thick enough to accommodate the depth of socket and remaining wall shown in figure 5 and given in table 11.

If the wall thickness is insufficient for the socket welding connection, a boss shall be added as specified in 5.12.4. The length of the leg of the connection attachment weld shall be 1,09 times the nominal pipe wall thickness of the auxiliary connection or 3 mm, whichever is the greater.

Dimensions in millimetres

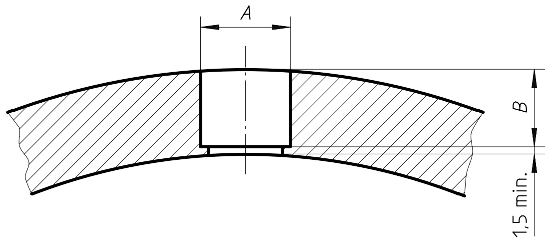


Figure 5 — Socket welding for auxiliary connections

Table 11 — Socket dimensions

Auxiliary connection size		A_{min}	B_{min}
DN	NPS	mm	mm
15	1/2	22	5
20	3/4	27	6
25	1	34	6
32	1¼	43	6
40	1½	49	6

5.12.7 Auxiliary connections may be attached by butt-welding directly to the wall of the valve as illustrated in figure 6. If the size of the opening is such that reinforcement is necessary, a boss shall be added as specified in 5.12.4.

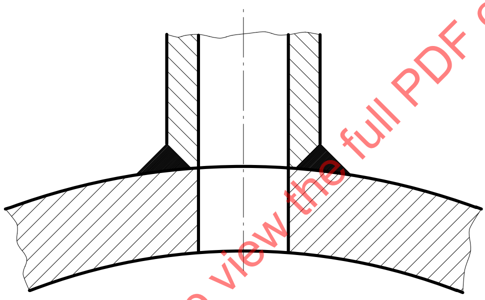


Figure 6 — Butt-welding for auxiliary connections

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 12.

6.2 Trim

6.2.1 Trim items include the stem, the gate seat surfaces, the body (or seat ring) seat surfaces and the backseat stem contact surface.

The trim materials shall be as in table 13 unless other materials are agreed upon between the purchaser and manufacturer. The trim combination number, CN, identifies both the stem material and the associated seating surfaces.

Table 12 — Materials for parts

Part	Material
Body and bonnet	To be selected from ANSI/ASME B16.34 or ISO 7005-1:1992, table D.2.
Gate	Steel, at least equal in corrosion resistance to that of the body material.
Yoke, separate	Carbon steel or same material as the bonnet.
Bolting: bonnet-to-body	Bolts shall be according to ANSI ASTM A193-87 and nuts shall be according to ANSI ASTM A194-2H. For service temperature below – 29 °C or above 454 °C, the purchase order shall specify the bolting material.
Bolting: gland and yoke	Bolting material at least equal to ANSI ASTM A307-Grade B
Seat ring	As in table 13. However, when weld deposited facings are used, the base material shall be of similar corrosion resistance as the body material.
Gland flange	Steel
Gland	Material with melting point above 955 °C.
Packing	Suitable for steam and petroleum fluids for temperature range from – 29 °C to 538 °C. Shall contain a corrosion inhibitor.
Stem nut	Austenitic ductile iron or copper alloy with melting point above 955 °C.
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 to be the same as the shell material. Cast iron plugs shall not be used.
Bypass piping and valves	Nominal composition to 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.

Table 13 — Basic trim materials

Part	Combination number	Material description	Brinell hardness
Stem 1)	1 and 4 through 8A	13Cr	200 HB min. 275 HB max.
	2	18Cr-8Ni	3)
	3	25 Cr-20Ni	3)
	9 or 11	NiCu alloy	3)
	10 or 12	18Cr-8Ni-Mo	3)
	13 or 14	19Cr-29Ni	3)
Seating surfaces 2)	1	13Cr	250 HB min.
	2	18Cr8Ni	3)
	3	25Cr20Ni	3)
	4	13Cr	750 HB min.
	5 or 5A	HF	350 HB min.
	6	13Cr/ CuNi	250 HB min. 175 HB min.
	7	13Cr/ 13Cr	250 HB min. 750 HB min.
	8 or 8A	13Cr/ HF	250 HB min. 350 HB min.
	9	NiCu alloy	3)
	10	18Cr8NiMo	3)
	11 or 11A	NiCu alloy/ HF	3) 350 HB min.
	12 or 12A	18Cr8NiMo/ HF	3) 350 HB min.
	13	19Cr29Ni	3)
	14 or 14A	19Cr29Ni/ HF	3) 350 HB min.

NOTES

1 Cr = chromium; Ni = nickel; Co = cobalt; Mo = Molybdenum.

2 HF = Hard Facing using CoCr or NiCr welding alloy. The suffix A applies to NiCr.

3 Free machining grades of 13 Cr shall not be used.

4 For CN 1, a differential hardness of at least 50 Brinell points is required between mating surfaces.

1) Stems shall be wrought material.

2) Backseat surfaces for CN 1 and 4 through 8A shall have a minimum hardness of 250 HB.

3) Not specified.

6.2.2 The trim material shall be the manufacturer's standard trim material for the combination number, CN, specified in the purchase order. For a CN specified in a purchase order an alternative CN may be furnished in accordance with table 14.

Table 14 — Combination numbers

Specified CN	Alternative CN
1	8 or 8A
2	10
5A	5
6	8
8A	8

It is not permissible to furnish a Specified CN when an Alternative CN is specified in a purchase order without agreement from the purchaser.

6.3 Repair

Defects in the cast or forged valve pressure shell materials that are revealed during manufacturing operations or testing may be repaired as permitted by the most nearly applicable specification for forgings or castings.

7 Testing and inspection

7.1 Pressure tests

Each valve shall be given a shell pressure test, an obturator tightness test and a stem backseat test in accordance with the requirements of ISO 5208, except as modified herein. Sealing compounds, greases or oils shall be removed from seating surfaces prior to pressure testing. It is permissible, however, for a film of oil that is not heavier than kerosene to be applied to prevent sealing surfaces from galling.

7.1.1 Shell test

7.1.1.1 The shell test shall be at a pressure no less than 1,5 times the pressure corresponding to the valve 38 °C pressure rating. The packing gland shall be adjusted so as to maintain the test pressure.

7.1.1.2 The duration of the shell test and the minimum period of time that the shell test pressure is to be sustained, shall be in accordance with table 15.

Table 15 — Duration of the shell test

Valve size range DN	Test duration s
DN $\leqslant$ 50	15
65 $\leqslant$ DN $\leqslant$ 150	60
200 $\leqslant$ DN $\leqslant$ 300	120
350 $\leqslant$ DN	300

7.1.1.3 Over the duration of the shell test there shall be no visually detectable leakage through the shell wall or at the bonnet gasket.

7.1.2 Obturator tightness test

7.1.2.1 The obturator tightness test shall be a gas test with the test gas at a pressure between 4 bar and 7 bar (400 kPa and 700 kPa). The test method consists of filling and pressurising the body cavity between the seats and the bonnet with test gas so as to ensure that no seat leakage can escape detection.

7.1.2.2 The duration of the obturator tightness test, the minimum period of time that the test pressure is to be sustained for the purpose of obtaining a obturator tightness leakage measurement, shall be in accordance with table 16.

Table 16 — Duration of the closure test

Valve size range DN	Test duration s
DN ⩽ 50	15
65 ⩽ DN ⩽ 150	60
200 ⩽ DN ⩽ 300	120
350 ⩽ DN	120

7.1.2.3 Over the duration of the gas obturator tightness test, the maximum permitted leakage rate shall be in accordance with table 17.

Table 17 — Maximum allowable gas leakage rate

Valve size range	Maximum allowable gas leakage rate 1)	
DN	mm^3/s	bubbles/s
DN ⩽ 50	0	0
65 ⩽DN ⩽ 150	75	1,2
200 ⩽ DN ⩽ 300	125	2
350 ⩽ DN	175	2,8

1) The manufacturer may choose either method of quantifying gas leakage. It is recognised that the unit conversions are inexact.

7.1.3 Backseat test

7.1.3.1 The backseat test shall be either a gas test at the pressure given in 7.1.2.1 or a fluid test at a pressure given in 7.1.4.2.

7.1.3.2 The stem backseat shall be engaged and the packing gland bolting shall be loose during the backseat test. Visible backseat leakage is not permitted over the duration of the test.

7.1.3.3 The gland bolting shall be retightened following the backseat test.

7.1.4 Optional closure test

7.1.4.1 A high pressure closure test is not required. It is an option that the purchaser may specify. However, as a test of the valve closure structure, valves are expected to be able to pass a test under the conditions of 7.1.4.2 through 7.1.4.4.

7.1.4.2 The test fluid shall be at a pressure of 1,1 times the valve pressure rating at 38 °C.

7.1.4.3 The duration of the test shall be in accordance with 7.1.2.2.

7.1.4.4 The maximum leakage rate over the duration of the test, when the test fluid is gas, shall be in accordance with 7.1.2.3 or, when the test fluid is liquid, shall be in accordance with table 18.