INTERNATIONAL STANDARD

ISO 15761

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Steel gate, globe and check valves for sizes DN 100 and smaller, for the petroleum and natural gas industries

Robinets-vannes, robinets à soupape et clapets de non-retour en acier de dimensions DN 100 et inférieures, pour les industries du pétrole et du gaz naturel

Reference number
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15761 was prepared by Technical Committee ISO/TC 153, *Valves*, Subcommittee SC 1, *Design, manufacture, marking and testing*.

Annexes A, B and C form a normative part of this International Standard. Annexes D and E are for information only.

Introduction

The purpose of this International Standard is to establish basic requirements and practices for socket-welding, butt-welding, threaded and flanged end, steel gate, globe and check valves with reduced body seat openings, whose general construction parallels that specified by the American Petroleum Institute standard API 602[1] and the British Standard BS 5352[2].

The form of this International Standard corresponds to ISO 6002[3] and ISO 10434[4]. However, it is not the purpose of this International Standard to replace ISO 6002, ISO 10434 or any other International Standard not identified with petroleum or natural gas industry applications.

Steel gate, globe and check valves for sizes DN 100 and smaller, for the petroleum and natural gas industries

1 Scope

This International Standard specifies the requirements for a series of compact steel gate, globe and check valves for petroleum and natural gas industry applications.

It is applicable to valves of

— nominal sizes DN 8, 10, 15, 20, 25, 32, 40, 50, 65, 80 and 100,

— corresponding to nominal pipe sizes NPS 1/4, 3/8, 1/2, 3/4, 1, 1 1/4, 1 1/2, 2, 2 1/2, 3 and 4,

and to pressure designations of Class 150, Class 300, Class 600, Class 800 and Class 1500.

Class 800 is not a listed class designation, but is an intermediate class number widely used for socket welding and threaded end compact valves.

It includes provisions for the following valve characteristics:

— outside screw with rising stems (OS & Y), in sizes $8 \leqslant DN \leqslant 100$ and pressure designations $150 \leqslant Class \leqslant 1500$ including Class 800;

— inside screw with rising stems (ISRS), in sizes $8 \leqslant DN \leqslant 65$ and pressure designations of $Class \leqslant 800$;

— socket welding or threaded ends, in sizes $8 \leqslant DN \leqslant 65$ and pressure designations of Class 800 and Class 1500;

— flanged or butt-welding ends, in sizes $15 \leqslant DN \leqslant 100$ and pressure designations of $150 \leqslant Class \leqslant 1500$, excluding flanged end Class 800;

— bonnet joint construction — bolted, welded, threaded with seal weld, and union nut for nominal pressure rating $Class \leqslant 800$;

— body seat openings;

— materials, as specified;

— testing and inspection.

This International Standard is applicable to valve end flanges in accordance with ASME B16.5 and valve body ends having tapered pipe threads to ISO 7-1 or ASME B1.20.1. It is applicable to extended body construction in sizes $15 \leqslant DN \leqslant 50$ and pressure designations of Class 800 and Class 1500, and to bellows and bellows assembly construction as may be adaptable to gate or globe valves in sizes $8 \leqslant DN \leqslant 50$. It covers bellows stem seal type testing requirements.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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

ISO 7-2, *Pipe threads where pressure-tight joints are made on the threads — Part 2: Verification by means of limit gauges*

ISO 2902, *ISO metric trapezoidal screw threads — General plan*

ISO 2903, *ISO metric trapezoidal screw threads — Tolerances*

ISO 2904, *ISO metric trapezoidal screw threads — Basic dimensions*

ISO 5208, *Industrial valves — Pressure testing of valves*

ISO 5209, *General purpose industrial valves — Marking*

ISO 5752, *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 9606-1, *Approval testing of welders — Fusion welding — Part 1: Steels*

ISO 9956-1, *Specification and approval of welding procedures for metallic materials — Part 1: General rules for fusion welding*

ISO 9956-2, *Specification and approval of welding procedures for metallic materials — Part 2: Welding procedure specification for arc welding*

ISO 9956-3, *Specification and approval of welding procedures for metallic materials — Part 3: Welding procedure tests for arc welding of steels*

ISO 9956-4, *Specification and approval of welding procedures for metallic materials — Part 4: Welding procedure tests for the arc welding of aluminium and its alloys*

ISO 9956-5, *Specification and approval of welding procedures for metallic materials — Part 5: Approval by using approved welding consumables for arc welding*

EN 10269, *Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties*

ASME[1)] B1.5, *Acme screw threads*

ASME B1.8, *Stub Acme screw threads*

ASME B1.20.1, *Pipe threads, general purpose (inch)*

ASME B16.5, *Pipe flanges and flanged fittings*

ASME B16.10, *Face-to-face and end-to-end dimensions of valves*

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

ASME, *Boiler and Pressure Vessel Code, Section IX, Qualification standard for welding and brazing procedures, welders, brazers, and welding and brazing operators*

ASTM A193, *Standard specification for alloy-steel and stainless steel bolting materials for high-temperature service*

1) American Society of Mechanical Engineers

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*

3 Terms and definitions

For the purposes of this International Standard, the terms and definitions of class and nominal pipe size given in ASME B16.34 and the following term and definition apply.[2)]

3.1
nominal size
DN
alphanumeric designation of size for components of a pipe work system, used for reference purposes, comprising the letters “DN” followed by a dimensionless whole number indirectly related to the physical size, in millimetres, of the bore or outside diameter of the end connections

NOTE 1 The number following “DN” does not represent a measurable value and should not be used for calculation purposes except where specified in the relevant standard.

NOTE 2 In those standards which use the DN designation system, any relationship between DN and component dimensions should be given, e.g. DN/OD or DN/ID.

(Adapted from ISO 6708:1995, definition 2.1.)

4 Pressure/temperature ratings

4.1 Valve ratings

4.1.1 Applicability

The pressure/temperature ratings applicable to valves specified in this International Standard shall be in accordance with those specified in the tables of ASME B16.34 for standard class for the applicable material specification and class designation.

4.1.2 Interpolated ratings

Pressure/temperature ratings for Class 800 shall be determined by the equation:

$$p_8 = \frac{1}{3} p_6 + \frac{2}{3} p_9$$

where

p_8 is the pressure at the specified temperature, expressed in bars[3)], for Class 800 rounded to the nearest 0,1 bar (= 10 kPa);

p_6 is the listed pressure, at the specified temperature, for Class 600, expressed in bars;

p_9 is the listed pressure, at the specified temperature, for Class 900, expressed in bars.

2) Pressure designation Class 800 has been added in order to identify widely used socket welding and threaded end valves having intermediate pressure/temperature ratings. It is not available for flanged end valves.

3) 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2

NOTE Pressure designation Class 900 is not specifically referenced in this International Standard because this designation is seldom used for the compact valves described herein. However, pressure/temperature ratings for this designation are included in the reference given in 4.1.1.

4.2 Temperature constraints

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

4.2.2 Restrictions of temperature and pressure, for example those imposed by special soft seals, special trim materials, packing or bellows stem seals, shall be marked on the valve identification plate (see 7.4).

4.2.3 For temperatures below the lowest temperature listed in the pressure/temperature rating 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 than the lowest listed temperature is the responsibility of the user. Consideration shall be given to the loss of ductility and toughness of many materials at low temperature.

5 Design

5.1 Reference design

5.1.1 The reference design (the design to be provided when the purchaser does not specify otherwise or does not use annex E) for sizes DN $\leqslant$ 100 is for bolted-bonnet or cover construction, an outside stem thread for gate and globe valves and, for globe valves, has a conical disc. The reference design for threaded-end valves uses taper pipe threads in accordance with ASME B1.20.1. In addition, for valves DN $\leqslant$ 50, the reference design is to have a body and bonnet or cover of forged material. Valve parts are identified in annex D.

5.1.2 Other configurations and types of material may be provided when specified in accordance with annex E. Requirements for extended body valves are given in annex A and those for bellows stem seals in annexes B and C.

5.2 Flow passageway

5.2.1 The flow passageway includes the seat opening and the body ports leading to that opening. The body ports are the intervening elements that link the seat opening to the end connection, e.g. socket or flange.

5.2.2 The minimum cross-sectional area requirement for the flow passageway applies for both the valve body ports and the seat opening. The minimum equivalent flow passageway cross-sectional area shall not be less than that obtained using the equivalent diameters in Table 1.

5.3 Wall thickness

5.3.1 Minimum wall thickness values for valve bodies and bonnets are given in Tables 2 and 3. The manufacturer, taking into account such factors as bonnet bolting loads, rigidity needed for stem alignment, valve design details and the specified operating conditions, is responsible for determining if a larger wall thickness is required.

5.3.2 The valve-body specified minimum wall thickness, except for the valve end connections and body extensions for bellows enclosures, shall be in accordance with Table 2.

5.3.3 The bonnet specified minimum wall thickness for gate or globe valves, except for the neck extension that forms the packing chamber entryway, shall be in accordance with Table 2. The packing chamber extension shall have a local minimum wall thickness as specified in Table 3, based on the local inside diameter of the packing and stem hole.

Table 1 — Minimum diameter of equivalent flow passageway

DN	Minimum diameter mm			NPS
	Class 150, Class 300, Class 600, Class 800	Class 1500		
	Gate, globe or check	Gate	Globe	
8	6	6	5	1/4
10	6	6	5	3/8
15	9	9	8	1/2
20	12	12	9	3/4
25	17	15	14	1
32	23	22	20	1 1/4
40	28	27	25	1 1/2
50	36	34	27	2
65	44	38		2 1/2
80	50	47		3
100	70	63		4

Table 2 — Minimum wall thickness for valve bodies

DN	Minimum wall thickness mm		NPS
	Class 150, Class 300, Class 600, Class 800	Class 1500	
8	3,1	3,8	1/4
10	3,3	4,3	3/8
15	4,1	4,8	1/2
20	4,8	6,1	3/4
25	5,6	7,1	1
32	5,8	8,4	1 1/4
40	6,1	9,7	1 1/2
50	7,1	11,9	2
65	8,4	14,2	2 1/2
80	9,7	16,5	3
100	11,9	21,3	4

NOTE Wall thickness values listed for Class 150, Class 300, and Class 600 are those required for Class 800 on the assumption that flanged end and butt-welding end valve bodies of these lower nominal pressures would have extensions added (integral or welded) to Class 800 valve bodies. See ISO 6002, ISO 10434, or ASME B16.34 for flanged end or butt-welding end valves having wall thickness requirements aligned to these lower nominal pressures.

5.4 Valve body

5.4.1 General

Requirements for a basic valve body and associated end connections are given here. See annex A for requirements for gate valve bodies having extended ends.

Table 3 — Minimum wall thickness for bonnet and bellows extensions

Extension	Class 150	Class 300	Class 600	Class 800	Class 1500
Inside diameter	Minimum wall thickness				
mm	mm				
15	2,8	3,0	3,6	4,0	5,3
16	2,8	3,1	3,6	4,1	5,6
17	2,8	3,2	3,7	4,3	5,8
18	2,9	3,5	3,9	4,4	5,9
19	3,0	3,8	4,1	4,8	6,1
20	3,3	4,0	4,2	4,9	6,3
25	4,0	4,8	4,8	5,8	7,1
30	4,6	4,8	4,8	5,9	8,2
35	4,8	4,8	5,1	6,4	9,7
40	4,9	5,0	5,7	6,9	10,2
50	5,5	6,2	6,3	7,4	11,6
60	5,6	6,4	6,8	8,2	13,4
70	5,6	6,9	7,4	9,1	15,8
80	5,8	7,2	8,1	10,0	17,4
90	6,4	7,4	8,8	10,4	19,1
100	6,4	7,7	9,5	11,7	20,8
110	6,4	8,1	10,3	12,8	22,9
120	6,6	8,6	10,9	13,6	24,8
130	7,1	8,8	11,3	14,6	26,5
140	7,1	9,2	12,0	15,5	28,3
NOTE For bellows extension, see B.4.					

5.4.2 Socket-welding ends

5.4.2.1 The socket bore axis shall coincide with the end entry axis. Socket end faces shall be perpendicular to the socket bore axis. The socket bore diameter and its depth shall be in accordance with Table 4.

Table 4 — Socket diameter and depth

DN	Diameter[a]	Depth[b]	NPS
	mm		
8	14,1	10	1/4
10	17,6	10	3/8
15	21,7	10	1/2
20	27,0	13	3/4
25	33,8	13	1
32	42,5	13	1 1/4
40	48,6	13	1 1/2
50	61,1	16	2
65	73,8	16	2 1/2

[a] The applicable diametral tolerance is $^{+0,5}_{-0}$ mm.

[b] The depth dimension is a minimum value.

5.4.2.2 The minimum socket wall thickness, extending over the full socket depth, shall be in accordance with Table 5.

Table 5 — Socket and threaded end minimum wall thickness

DN	Minimum wall thickness mm		NPS
	Class 800	Class 1500	
8	3,3	4,1	1/4
10	3,6	4,3	3/8
15	4,1	5,3	1/2
20	4,3	6,1	3/4
25	5,1	6,9	1
32	5,3	8,1	1 1/4
40	5,8	8,9	1 1/2
50	6,9	10,7	2
65	7,9	12,4	2 1/2

5.4.2.3 End-to-end dimensions for socket welding end valves shall be established by the manufacturer.

5.4.3 Threaded ends

5.4.3.1 The threaded end thread axis shall coincide with the end entry axis. The minimum wall thickness at the threaded end shall be in accordance with Table 5. An approximate 45° lead-in chamfer, having an approximate depth of one-half the thread pitch, shall be applied at each threaded end.

5.4.3.2 The end threads shall be taper pipe threads meeting the requirements of ASME B1.20.1. When specified in the purchase order, taper pipe threads in accordance with ISO 7-1 may be substituted.

5.4.3.3 Threads shall be gauged in accordance with ISO 7-2 or ASME B1.20.1, as applicable.

5.4.3.4 End-to-end dimensions for threaded end valves shall be established by the manufacturer.

5.4.4 Flanged ends

5.4.4.1 End flanges shall comply with the dimensional requirements of ASME B16.5. Unless otherwise specified, raised face end flanges shall be provided.

This International Standard does not provide for flanged ends for Class 800 valves.

5.4.4.2 End flanges and bonnet flanges shall be cast or forged integral with the body, except that cast or forged flanges attached by full penetration butt-welding or by inertia welding may be used. A purchaser requiring an integral flange body shall so specify. When a flange is attached by welding, the welding operator and welding procedure shall be qualified in accordance with ISO 9606-1 and ISO 9956-1 to ISO 9956-5, or ASME-BPVC, Section IX. Alignment rings, integral or loose, used as a welding aid shall be completely removed following welding, while care shall be taken that the minimum wall thickness is maintained. Heat treatment following welding, to ensure that the valve body and flange materials are suitable for the full range of service conditions, shall be performed as required by the material specification.

5.4.4.3 Face-to-face dimensions for flanged end valves, Class 150, Class 300 and Class 600, shall be in accordance with ISO 5752 — Basic Series 3, 4 and 5 for gate valves, and 5, 10 and 21 for globe and check valves — except that the applicable tolerance shall be in accordance with Table 6. For Class 1500, the face-to-face dimensions shall be as shown in Table 6.