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Second edition
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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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Contents

Page

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 153, *Valves*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 12, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 15761:2002), which has been technically revised:

— Clause 2 "Normative references" was updated;

— addition of ASME Class 2 500 designation and relevant dimensions;

— addition of higher PN Class designations, including PN 63, 250 and 400, and relevant dimensions.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The purpose of this document is to establish basic requirements and practices for steel gate, globe and check valves which can be socket welded, butt welded or flanged ended with reduced body seat openings, whose general construction parallels that described in API 602 and BS 5352.

The form of this document corresponds to ISO 6002 and ISO 10434.

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

1 Scope

This document 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 ¼, ⅜, ½, ¾, 1, 1¼, 1½, 2, 2½, 3 and 4,

— pressure designations PN 16, 25, 40, 63, 100, 250 and 400, and

— pressure designations Class 150, 300, 600, 800, 1 500 and 2 500.

Class 800 is not a listed class designation, but is an intermediate Class number widely used for socket welding and threaded end compact valves covered by this document. There is no equivalent PN designation.

This document includes provisions for the following valve characteristics:

— outside screw with rising stems (OS & Y): in sizes 8 ≤ DN ≤ 100;

— inside screw with rising stems (ISRS): in sizes 8 ≤ DN ≤ 65 with a pressure designation PN ≤ 100 or Class ≤ 800;

— socket welding or threaded ends: in sizes 8 ≤ DN ≤ 65;

— flanged or butt-welding ends excluding flanged end Class 800;

— bonnet joint construction that is bolted, welded or threaded with seal weld;

— bonnet joint construction that uses a union nut with a pressure designation PN ≤ 45 or Class ≤ 800;

— body seat openings;

— materials: as specified;

— testing and inspection.

This document covers valve end flanges in accordance with EN 1092-1 and ASME B16.5 and valve body ends having tapered pipe threads in accordance with ISO 7-1 or ASME B1.20.1. It is applicable to extended body construction in sizes 15 ≤ DN ≤ 50 with pressure designations Class 800 and Class 1 500 and to bellows and bellows assembly construction adaptable to gate or globe valves in sizes 8 ≤ DN ≤ 50. Also covered are requirements for bellows stem seal type testing.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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 metallic 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 9606-1, *Qualification testing of welders — Fusion welding — Part 1: Steels*

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

ISO 15609-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding*

ISO 15610, *Specification and qualification of welding procedures for metallic materials — Qualification based on tested welding consumables*

ISO 15614-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys*

ISO 15614-2, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 2: Arc welding of aluminium and its alloys*

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

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

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

EN 12516-1:2014+A1:2018, *Industrial valves — Shell design strength — Part 1: Tabulation method for steel valve shells*

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

ASME B1.5, *Acme Screw Threads*

ASME B1.8, *Stub Acme Screw Threads*

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

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

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

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

ASME B16.34:2017, *Valves Flanged, Threaded and Welding End*

ASME BPVC-IX, *Boiler and Pressure Vessel Code — Section IX — Welding, Brazing, and fusing Qualifications*

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
PN
Class
alphanumeric designation for pressure-temperature rating that is common for components used in a piping system, used for reference purposes, comprising the letters "PN" or "Class" followed by a dimensionless number indirectly related to the pressure retaining capability as a function of temperature of the component

Note 1 to entry: The number following the letters PN or Class does not represent a measurable value and is not used for calculation purposes except where specified in the relevant standard. There is no definitive correlation that links PN designations to Class designations.

Note 2 to entry: The allowable pressure for a valve having a PN or Class number depends on the valve material and its application temperature and is to be found in tables of pressure/temperature ratings. PN or Class usage is applicable to steel valves bearing DN or NPS *nominal size* (3.2) designations.

Note 3 to entry: See ISO 7268 and ASME B16.34.

3.2
nominal size
DN
NPS

alphanumeric designation of size for components of a pipework system, which is used for reference purposes, comprising the letters DN or NPS followed by a dimensionless number indirectly related to the physical size, in millimetres, of the bore or outside diameter of the end connections

Note 1 to entry: The number following the letters DN or NPS does not represent a measurable value and is not used for calculation purposes except where specified in the relevant standard. Prefix DN or NPS usage is applicable to steel valves bearing *PN* or *Class* (3.1) designations.

Note 2 to entry: See ISO 6708 and ASME B16.34.

4 Pressure/temperature ratings

4.1 Valve ratings

4.1.1 For Class designated valves the applicable 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.

4.1.2 For PN designated valves the applicable pressure/temperature ratings shall be in accordance with those specified in the tables of EN 12516-1:2014+A1:2018 for the applicable material specification and the applicable PN number.

4.1.3 Interpolated ratings: pressure/temperature ratings for Class 800 shall be determined by Formula (1):

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

where

p_8 is the pressure, at the specified temperature, expressed in bar[1)], 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 bar;

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

1) 1 bar = 0,1 MPa = 100 KPa and 1 MPa = 1 N/mm^2.

NOTE Pressure designation Class 900 is not specifically referenced in this document 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 ≤ 100 is for bolted bonnet or cover construction, an outside stem thread for gate and globe valves and, for globe valves having a conical disc. The reference design for threaded end valves is to use taper pipe threads in accordance with ASME B1.20.1. In addition, for valves DN ≤ 50 the reference design is to have the body and bonnet or cover to be 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 given in Annex A and those for bellows stem seals in Annexes B and C shall be followed.

5.2 Flow passageway

5.2.1 The flow passageway includes the seat opening and the body ports leading thereto. 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 in the absence of the valve obturator. The minimum flow passageway cross-sectional area shall not be less than that obtained using the equivalent diameters shown in Table 1 for standard bore and Table 2 for full bore valves.

Table 1 — Minimum equivalent flow passageway diameter for a standard-bore valve

PN designation	16, 25, 40, 63, 100	250		400		
Class designation	150, 300, 600, 800	1 500		2 500		
	Gate, globe or check	Gate	Globe or check	Gate	Globe and check	
DN	Minimum equivalent diameter (mm)					NPS
8	6	6	5	6	5	¼
10	6	6	5	6	4	⅜
15	9	9	8	9	8	½
20	12	12	9	10	9	¾
25	17	15	14	13	13	1
32	23	22	20	18	18	1¼
40	28	27	25	25	25	1½
50	36	34	27	26	25	2
65	44	38	34	—	—	2½
80	50	47	42	—	—	3
100	69	63	58	—	—	4

Table 2 — Minimum equivalent flow passageway diameter for a full-bore valve

PN designation	16, 25, 40, 63, 100	250		400		
Class designation	150, 300, 600, 800	1 500		2 500		
	Gate, globe or check	Gate	Globe or check	Gate	Globe and check	
DN	Minimum equivalent diameter (mm)					NPS
8	6	6	4	6	4	¼
10	6	9	7	9	7	⅜
15	12	12	9	10	9	½
20	17	15	14	13	13	¾
25	22	22	19	18	18	1
32	28	26	25	25	25	1¼
40	35	34	26	26	25	1½
50	44	38	34	35	30	2
65	50	47	42	—	—	2½

Table 2 *(continued)*

PN designation	16, 25, 40, 63, 100	250		400		
Class designation	150, 300, 600, 800	1 500		2 500		
	Gate, globe or check	Gate	Globe or check	Gate	Globe and check	
DN	Minimum equivalent diameter (mm)					NPS
80	69	63	58	—	—	3
100	95	92	87	—	—	4

5.3 Wall thickness

5.3.1 Except as provided in 5.3.2 and 5.3.3, the minimum wall thickness values for valve bodies and bonnets are given in Table 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 Valve body end connection minimum wall thickness shall be in accordance with 5.4.2, 5.4.3, 5.4.4, or 5.4.5 as applicable. Valves identified as extended body valves shall have body extension minimum wall thickness in accordance with A.3. Valves having bellows stem seals with a bellows enclosure shall have a bellows enclosure extension minimum wall thickness in accordance with B.4.

5.3.3 The bonnet 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 3. The packing chamber extension shall have a local minimum wall thickness as specified in Table 4, based on the local inside diameter of the packing and stem hole.

Table 3 — Minimum wall thickness for valve bodies and bonnets

PN designation	16, 25, 40, 63, 100	—	250	—	400	
Class designation	150, 300, 600, 800	1 500	—	2 500	—	
DN	Minimum wall thickness (mm)					NPS
8	3,1	3,8	4,5	5,6	6,1	¼
10	3,3	4,3	4,7	5,9	6,5	⅜
15	4,1	4,8	5,8	7,7	8,5	½
20	4,8	6,1	7,0	9,4	10,4	¾
25	5,6	7,1	8,1	11,1	12,4	1
32	5,8	8,4	9,4	13,1	14,8	1¼
40	6,1	9,7	11,4	16,2	18,3	1½
50	7,1	11,9	13,6	19,6	22,3	2
65	8,4	14,2	16,9	—	—	2½
80	9,7	16,5	20,2	—	—	3
100	11,9	21,3	24,6	—	—	4

5.4 Valve body

5.4.1 General

Requirements for a basic valve body and associated end connections are given here. The requirement for gate valve bodies having extended end present in Annex A shall be followed.

5.4.2 Socket welding ends

5.4.2.1 Except as may be required herein, socket welding ends shall be in accordance with ASME B16.11.

5.4.2.2 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 5.

Table 4 — Minimum wall thickness for bonnet and bellows extensions

PN designation	16	25 and 40	63, 100	—	250	400
Class designation	150	300	600	800	1 500	2 500
Extension inside diameter (mm)	Minimum wall thickness (mm)					
15	3,1	3,3	3,6	4,0	4,8	7,7
16	3,2	3,4	3,8	4,3	5,1	8,0
17	3,2	3,4	3,8	4,3	5,1	8,4
18	3,3	3,5	3,9	4,4	5,3	8,7
19	3,4	3,6	4,0	4,6	5,5	9,0
20	3,4	3,6	4,1	4,7	5,7	9,4
25	3,8	4,1	4,5	5,4	6,7	11,0
30	4,2	4,6	5,0	6,0	7,9	12,8
35	4,6	5,1	5,4	6,4	9,0	14,5
40	4,9	5,5	5,7	6,7	9,9	16,2
50	5,5	6,3	6,3	7,3	11,8	19,6
60	5,7	6,6	6,6	8,1	13,6	23,0
70	5,9	6,9	7,3	9,0	15,5	26,4
80	6,1	7,2	8,0	9,9	17,3	29,8
90	6,3	7,5	8,6	10,8	19,1	33,2
100	6,5	7,8	9,3	11,8	21,0	36,6
110	6,5	8,0	10,0	12,7	22,8	40,0
120	6,7	8,3	10,7	13,6	24,7	43,4
130	6,8	8,7	11,4	14,5	26,5	46,9
140	7,0	9,0	12,0	15,5	28,4	50,3

NOTE For bellows enclosures see B.4.

Table 5 — Socket diameter and depth

DN	Diameter[a] (mm)	Depth[b] (mm)	NPS
8	14,2	10	¼
10	17,6	10	⅜
15	21,8	10	½
20	27,2	13	¾
25	33,9	13	1
32	42,7	13	1¼
40	48,8	13	1½
50	61,2	16	2
65	73,9	16	2½

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

[b] The depth dimension is a minimum value.

5.4.2.3 The minimum socket wall thickness, socket diameter, extending over the full socket depth shall be in accordance with Tables 5 and 6.

5.4.2.4 End-to-end dimensions for socket welding end valves are to 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 6. 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 that, for PN designated valves shall be in accordance with ISO 7-1 and for Class designated valves shall be in accordance with ASME B1.20.1. However, when specified in purchase documentation ISO 7-1 threads may be used with Class designated valves or ASME B1.20.1 threads may be used with PN designated valves provided that this variation is identified on the valve identification plate.

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

5.4.3.4 The minimum wall thickness of the threaded ends, measured at the outermost full thread crest, shall be in accordance with Table 6.

5.4.3.5 End to end dimensions for threaded end valves are to be established by the manufacturer.

Table 6 — Socket and threaded end minimum wall thickness

PN designation	16, 25, 40, 63 and 100	250	400	
Class designation	**150, 300, 600 and 800**	**1 500**	**2 500**	
DN	**Minimum wall thickness** (mm)			**NPS**
8	3,3	4,1	6,6	¼
10	3,6	4,3	7,1	⅜
15	4,1	5,3	8,1	½
20	4,3	6,1	8,6	¾
25	5,1	6,9	9,9	1
32	5,3	8,1	11,7	1¼
40	5,8	8,9	13,0	1½
50	6,9	10,7	15,7	2
65	7,9	12,4	18,5	2½

5.4.4 Flanged ends

5.4.4.1 Body end flanges for PN designated valves shall comply with the dimensional requirements of EN 1092-1 and body end flanges for Class designated valves shall comply with the dimensional requirements of ASME B16.5. This document does not cover dimensional requirements of flanged ends for Class 800 valves. If valve end flange bolt holes are specified by the purchaser to be other than those of the respective PN or Class flange standard, the manufacturer shall ensure that the substitute flange bolt hole drillings will accommodate bolting having a total flange bolting cross sectional area that is at least as great as that of the bolting being replaced.

5.4.4.2 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.

a) Welding a flange to a valve body shall be by full penetration butt-welding. The welding operator and welding procedure shall be qualified in accordance with the rules of ISO 9606-1 or the rules of ASME BPVC, Section IX.

b) Integral or other types of alignment rings (cantering backing rings) used to facilitate welding shall be removed after the weld is completed, taking care that the minimum wall thickness is maintained.

c) 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 Table A.4.

d) The weld quality shall be in accordance with the examination acceptance requirements of ISO 15649 as specified for normal fluid service.

e) The finished end flange facings shall be parallel to each other within 2°.

5.4.4.3 Face-to-face dimensions for flanged end valves shall be as follows:

— for PN designated valves in accordance with ISO 5752, basic series 3, 4 ,5, 10 and 21 as applicable;

— for Class designated valves, Class ≤ 600 in accordance with ASME B16.10;

— for Class designated valves, Class > 600 the same as the end-to-end dimensions given in Table 7;