# INTERNATIONAL STANDARD

# ISO 15761

Second edition
2020-08

# 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*



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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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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.

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 | | NPS |
|---|---|---|---|---|---|---|
| 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) | | | | | |
| 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 | NPS |
|---|---|---|---|---|---|---|
| Class designation | 150, 300, 600, 800 | 1 500 | – | 2 500 | – | |
| DN | Minimum wall thickness (mm) | | | | | |
| 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;

— the tolerances for all face-to-face dimensions shall be ±1,5 mm (as stated in the note of Table 7).

### 5.4.5 Butt-welding ends

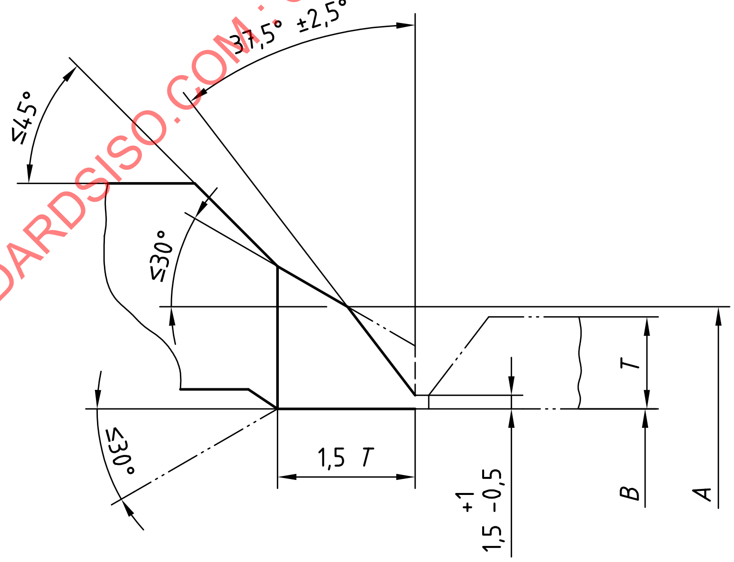
**5.4.5.1** Unless otherwise specified by the purchaser, butt-welding ends shall be in accordance with Figure 1 and Table 8. The inside and outside surfaces of valve welding ends shall be machine-finished overall. The contour within the envelope is at the option of the manufacturer unless specifically ordered otherwise. Intersections should be slightly rounded. For nominal outside diameters and wall thickness of standard steel pipe, see ISO 4200.

**5.4.5.2** End-to-end dimensions for butt-welding end valves shall be established by the manufacturer.

**Table 7 — Face-to-face dimensions for Class 1 500 and 2 500**

| DN | Class 1 500<br>(mm) | Class 2 500<br>(mm) | NPS |
|---|---|---|---|
| **15** | 216 | 264 | ½ |
| **20** | 229 | 273 | ¾ |
| **25** | 254 | 308 | 1 |
| **32** | 279 | 349 | 1¼ |
| **40** | 305 | 384 | 1½ |
| **50** | 368 | 451 | 2 |
| **65** | 419 | — | 2½ |
| **80** | 470 | — | 3 |
| **100** | 546 | — | 4 |

NOTE The applicable length tolerance is ±1,5 mm (see 5.4.4.3).




**Key**

*A* nominal outside diameter of welding end

*B* nominal inside diameter of pipe

*T* nominal wall thickness of pipe

**Figure 1 — Butt–welding ends**



**Table 8 — Butt-welding end diameters**

| DN | 8 | 10 | 15 | 20 | 25 | 32 | 40 | 50 | 65 | 80 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *A* (mm) | 14 | 17 | 21 | 27 | 33 | 42 | 48 | 60 | 73 | 89 | 114 |

NOTE 1 The tolerance for diameter A is ±1 mm for DN ≤ 20 and $^{+2,5}_{-1}$ mm for DN ≥ 25.

NOTE 2 The tolerance for diameter B is ±1 mm (see Figure 1).

### 5.4.6 Body seats

**5.4.6.1** Integral body seats are permitted in austenitic stainless-steel bodies. An austenitic stainless steel or a hardfacing material may be weld deposited either directly on a valve body or on a separate body seat ring.

For gate valve seat rings where the hard facing is applied by a plasma arc or a laser process, seating surfaces shall have a minimum finished facing material thickness of 0,5 mm.

All other weld deposited seating surfaces shall have a minimum finished facing material thickness of 1 mm.

Body seating surfaces shall not have sharp corners, e.g. corners with an edge disposed to cause damage in conjunction with gate or disc seating surfaces, at either the inner or outer seat circumference.

**5.4.6.2** Except as provided in 5.4.6.1, valve bodies shall have separate removable seat rings that are threaded, rolled or pressed in place, however rolled or pressed seat rings shall not be used with globe valves or lift check valves unless they are seal welded.

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 when assembling mating surfaces.

**5.4.6.3** The inside diameter of the body seat flow passageway shall not be less than the value specified in Tables 1 and 2.

## 5.5 Valve bonnet or cover

**5.5.1** The bonnet of a gate or globe valve or the cover of a check valve shall be secured to the body, subject to requirements detailed below, by one of the following methods:

— bolting;

— welding;

— threaded with a seal weld;

— threaded-union nut, provided for the Class ≤ 800.

**5.5.2** Gasketed joints shall be of a design that confines the gasket and prevents its over-compression. 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. The gasket, unless otherwise specified by the purchaser, shall be suitable for a valve operating temperature range of −29 °C to 540 °C.

**5.5.3** Bonnet flange gaskets, unless otherwise specified by the purchaser, shall be spiral wound metal with a flexible graphite filler. The wound metal shall be a type 18Cr-8Ni or 18Cr-8Ni-Mo of either a regular or low carbon grade.

**5.5.4** Bonnet and body flange bolting bearing surfaces shall be parallel to the flange face within 1°. Spot facing or back facing required to meet this requirement shall be in accordance with ASME B16.5.

**5.5.5** A bonnet or cover bolted to the body shall be secured by a minimum of 4 cap screws, studs or stud bolts. Internal socket head cap screws shall not be used. The minimum bolt size permitted is M10 (or 3/8 inch). Standard inch series bolting in accordance with ASME B1.1 shall be used except if the purchaser specifies metric series bolting.

**5.5.6** The bonnet bolting shall, as a minimum, meet the bolt cross-sectional area requirements of Formula (2):

$$P_c \frac{A_g}{A_b} \leq 65{,}25\, S_b \leq 9\,000 \quad (2)$$

where

$P_c$ is the pressure Class designation number, e.g. 800 for Class 800;

$S_b$ is the allowable bolt stress at 38 °C, expressed in megapascals, MPa: when its value is >138 MPa, use 138 MPa;

$A_g$ is the area bounded by the effective outside periphery of the gasket, expressed in the same unit as $A_b$;

$A_b$ is the total effective bolt tensile stress area, expressed in the same unit as $A_g$.

The value of $A_b$ is a minimum tensile cross-sectional area requirement for bonnet bolting. The manufacturer is responsible for providing additional bolting area as may be required for valve design details such as gasket compression essentials or specified service conditions.

For PN designated valves, the cross-sectional area of the valve bonnet bolting shall, as a minimum, meet the requirements above with the substitution of $P_c$ = 150 for PN 16, $P_c$ = 300 for PN 25, $P_c$ = 300 for PN 40 and $P_c$ = 600 for PN 100.

**5.5.7** Threaded pressure retaining joints shall, as a minimum, meet the thread shear area requirements of Formula (3):

$$P_c \frac{A_g}{A_s} \leq 4\,200 \quad (3)$$

where $A_s$ is the total effective thread shear stress area, expressed in the same units as $A_g$.

The value of $A_s$ is a minimum requirement for thread shear area for all pressure retaining joints including threaded bonnet joints. The manufacturer is responsible for providing additional thread engagement as may be required for valve design details such as gasket compression essentials or specified conditions.

**5.5.8** Bonnets welded directly to valve bodies shall be secured by a full penetration weld having two or more welding passes (layers). The welding operator and welding procedure qualifications, heat treatment and examination requirements shall be in accordance with 5.4.4.2.

**5.5.9** Bonnet to body structural welds and seal welds shall be post-weld heat treated in accordance with the provisions of 5.4.4.2, except that:

a) seal welds of P4 and P5 materials are exempt when a procedure is used that provides a weld hardness that is equal to or less than 235 HB; and

b) all welds are exempt from solution annealing requirements.



NOTE For materials designated P4 and P5, see ISO 15649.

## 5.6 Obturator

### 5.6.1 Seating surfaces

Obturator seating surfaces shall be integral or a facing of weld metal. Weld deposited seating surfaces shall have a minimum facing material thickness of 1 mm.

### 5.6.2 Gate valve obturators

**5.6.2.1** Gate valves shall be provided with a one-piece wedge gate. The installed wedge gate outer seating surfaces shall be free of sharp edges so as not to score or gouge the body seating surfaces during opening or closing.

**5.6.2.2** A slot near the top of the wedge gate shall be provided to receive the tee-head or button stem connection. The wedge gate shall be guided in the body in a manner that prevents rotation and leads the gate re-entry between the seats.

**5.6.2.3** The wedge gate shall be designed to account for seat wear. The dimensions that fix the position of the wedge gate seats relative to the body seats shall be such that the wedge gate, starting from the time when the valve is new, can move into the seats, should the seats wear, a distance defined as wear travel, $h_w$. Wear travel is in a direction that is parallel with the valve stem. The required minimum wear travel, $h_w$, varies with valve size as shown in Table 9.

### 5.6.3 Globe valve obturators

**5.6.3.1** Globe valves shall be provided with disks that are non-integral with the stem. The disk shall have a conical (plug) seating face or, when specified by the purchaser, a flat seating face.

**5.6.3.2** When assembled, the globe valve disk to stem retaining design shall be one that will not allow the disk to become detached from the stem as a result of vibration emanating from either flow through the valve or attached piping movement. The disk to stem retaining means shall be a design that allows the disk to align with the valve seat.



**Table 9 — Wear travel distance for wedge gates**

| DN | Minimum wear travel distance<br>$h_w$<br>(mm) | NPS |
|---|---|---|
| 8 ≤ DN ≤ 20 | 1 | ¼ ≤ NPS ≤ ¾ |
| 25 ≤ DN ≤ 32 | 1,5 | 1 ≤ NPS ≤ 1¼ |
| 40 ≤ DN ≤ 65 | 2 | 1½ ≤ NPS ≤ 2½ |
| 80 ≤ DN ≤ 100 | 3 | 3 ≤ NPS ≤ 4 |

### 5.6.4 Check valve obturators

**5.6.4.1** Check valves shall be provided with either piston, ball, or swing type obturators.

**5.6.4.2** Piston type and ball type check valve obturators shall be guided over the full length of their travel. The guide and disk combination shall be designed so that a damping of the movement occurs towards the top end of the disk travel.

**5.6.4.3** Piston check and ball check valves shall be designed so that, when in the fully opened position, the net flow area between the obturator and the body seat is equal to or greater than that of the seat opening corresponding to the seat diameter shown in Table 1.

**5.6.4.4** Obturator-to-hinge retaining nuts shall be positively secured by mechanical means.

## 5.7 Stem

**5.7.1** Stems are designated as either inside screw (ISRS) or outside screw (OS&Y). The reference standard design is OS&Y. Stems with inside screw shall be limited to gate and globe valves having pressure designation Class ≤ 800 and nominal size range 8 ≤ DN ≤ 65.

**5.7.2** The minimum stem diameter, $D_s$, for gate and globe valves, measured where the stem passes through the packing, shall be as specified in Tables 10 and 11. These are specified minimum values, not design minimum values. The manufacturer, taking into account the stem material, the valve design and the specified operating conditions, is responsible for determining if a larger diameter stem is required.

**Table 10 — Minimum stem diameter for standard bore valves**

| **PN designation** | **16, 25, 40, 63 and 100** | **250** | | **400** | | **NPS** |
|---|---|---|---|---|---|---|
| **Class designation** | **150, 300, 600 and 800** | **1 500** | | **2 500** | | |
| **DN** | **Minimum stem diameter** $D_s$ (mm) | | | | | |
| | **Gate or globe** | **Gate** | **Globe** | **Gate** | **Globe** | |
| 8 | 7,0 | 10,0 | 10,0 | 14 | 14 | ¼ |
| 10 | 7,0 | 10,0 | 10,0 | 14 | 14 | ⅜ |
| 15 | 8,5 | 10,0 | 10,0 | 14 | 14 | ½ |
| 20 | 9,5 | 11,0 | 11,0 | 14 | 15,5 | ¾ |
| 25 | 11,0 | 14,0 | 14,0 | 19 | 19 | 1 |
| 32 | 12,5 | 15,5 | 15,5 | 22 | 22 | 1¼ |
| 40 | 14,0 | 15,5 | 15,5 | 22 | 22 | 1½ |
| 50 | 15,5 | 16,5 | 16,5 | 25 | 25 | 2 |
| 65 | 17,5 | 19,0 | — | — | — | 2½ |
| 80 | 19,0 | 25,0 | — | — | — | 3 |
| 100 | 22,0 | 28,5 | — | — | — | 4 |

**Table 11 — Minimum stem diameter for full bore valves**

| PN designation | 16, 25, 40, 63 and 100 | 250 | | 400 | | NPS |
|---|---|---|---|---|---|---|
| Class designation | 150, 300, 600 and 800 | 1 500 | | 2 500 | | |
| DN | Minimum stem diameter $D_s$ (mm) | | | | | |
| | Gate or globe | Gate | Globe | Gate | Globe | |
| 8 | 7 | 10 | 10 | 14 | 14 | ¼ |
| 10 | 8,5 | 10 | 10 | 14 | 14 | ⅜ |
| 15 | 9,5 | 11 | 11 | 14 | 14 | ½ |
| 20 | 11 | 14 | 14 | 14 | 15,5 | ¾ |
| 25 | 12,5 | 15,5 | 15,5 | 19 | 19 | 1 |
| 32 | 14 | 15,5 | 15,5 | 22 | 22 | 1¼ |
| 40 | 15,5 | 16,5 | 16,5 | 22 | 22 | 1½ |
| 50 | 17,5 | 19 | 19 | 25 | 25 | 2 |
| 65 | 19 | 25 | — | — | — | 2½ |
| 80 | 22 | 28,5 | — | — | — | 3 |
| 100 | 25,4 | 28,5 | — | — | — | 4 |

**5.7.3** The stem shall be one piece wrought material. Stems fabricated by welding are not permitted. The stem surface that passes through the packing shall have a surface finish value of $R_a \leq 0{,}80$ µm.

**5.7.4** The stem threads shall be of trapezoidal form as specified in ISO 2902, ISO 2903, and ISO 2904 or ASME B1.5, ASME B1.8 with nominal dimensional variations allowed. Stem threads shall be such that a direct operated handwheel rotated in a clockwise direction will close the valve. The major diameter of the stem threads shall not be less than 1,5 mm below that of the actual stem diameter. See 5.7.2.

**5.7.5** The stem-to-obturator attachment means shall be designed so as to prevent the stem from becoming disengaged from the obturator while the valve is in service. For attaching to the obturator, the stem shall have an integral tee for outside stem thread gate valves and an integral cylindrical button for inside stem thread gate valves and for all globe valves. Threaded or pinned stem attachment means shall not be used.

**5.7.6** Valve stems, except those used in globe valves where the backseat function is with a disk component, shall include a conical or spherical raised surface that will seat against the bonnet backseat when the obturator is at its full open position. A back-seating arrangement is a requirement for all gate and globe valves and, as such, is not meant to imply a manufacturer's recommendation that it be used for the purpose of adding or replacing packing while the valve is under pressure.

**5.7.7** Gate valve stem design shall be such that, for valves with outside screw stems, the strength of the stem to wedge 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. For both outside screw and inside screw valves, the design of the stem, wedge gate, and stem connection to the wedge gate shall be such that, should mechanical failure occur, it would occur at a stem section that is outside the valve pressure boundary.

**5.7.8** The stem disk attachment means in globe valves shall be such that the disk articulates in order to permit alignment with the seat. The stem thrust point against the disk shall be rounded and the disk components making up the means of disk-to-stem assembly attachment shall be positively secured to prevent loosening due to fluid or piping induced vibration.

**5.7.9** The closed position stem thread projection beyond the stem nut on a new rising stem nut of a new rising stem valve shall be a distance having a minimum equal to the valve wear travel and a maximum of five times the wear travel specified in Table 9.

## 5.8 Stem nut or stem bushing

**5.8.1** The internal thread in the stem nut (yoke sleeve or stem bushing) shall be of trapezoidal form in accordance with ISO 2902, ISO 2903 and ISO 2904 or ASME B1.5 and ASME B1.8, with nominal dimensional variations permitted.

**5.8.2** The fixed stem nut used in globe valves shall be threaded or otherwise fitted onto the yoke and positively locked in position.

## 5.9 Packing, packing chamber, and gland

**5.9.1** The minimum uncompressed total height of the installed packing, $h_p$, shall be as shown in Table 12. The packing height values in Table 12 are directly related to the stem diameters shown in Tables 10 and 11. When a stem diameter greater than that of Table 10 is used, the manufacturer shall determine if the uncompressed packing height needs to be increased.

**Table 12 — Minimum uncompressed packing height**

| PN designation | 16, 25, 40, 63, and 100 | 250 and 400 | NPS |
|---|---|---|---|
| Class designation | 150, 300, 600 and 800 | 1 500 and 2 500 | |
| DN | Minimum uncompressed packing height $h_p$ (mm) | | |
| 8 | 12 | 22 | ¼ |
| 10 | 12 | 22 | ⅜ |
| 15 | 15 | 22 | ½ |
| 20 | 15 | 25 | ¾ |
| 25 | 25 | 30 | 1 |
| 32 | 25 | 38 | 1¼ |
| 40 | 28 | 38 | 1½ |
| 50 | 28 | 38 | 2 |
| 65 | 31 | 44 | 2½ |
| 80 | 38 | 47 | 3 |
| 100 | 44 | 50 | 4 |

**5.9.2** The packing chamber bore shall have a surface finish, $R_a$, of 3,2 µm or smoother. The bottom of the packing chamber shall be flat.

**5.9.3** A gland shall be provided for packing compression. The gland may be either a self-aligning gland or be an integral part of the gland flange. The outer end of a separate gland shall have a lip whose outer diameter exceeds the diameter of the packing chamber bore so as to block its entry into the bore.

**5.9.4** Packing in the form of a single piece spiral shall not be used.

### 5.10 Packing retention

**5.10.1** Packing and packing gland retention for valves with outside screw stems shall be by bolting through two holes in a gland flange that is either separate from or integral with the gland. Open gland flange bolt slots shall not be used.

**5.10.2** Gland flange bolts shall be hinged eyebolts, headed bolts, stud bolts or studs. Hexagon nuts shall be used.

**5.10.3** The gland bolting for gate and globe valves shall not be anchored to the bonnet or yoke through a fillet welded attachment or stud welded pins.

**5.10.4** Packing and packing gland retention for valves with inside screw stems shall be by a packing nut threaded directly onto the valve bonnet or by means described in 5.10.1, 5.10.2 and 5.10.3. Application restrictions applying to inside screw stem threads are given in 5.7.

### 5.11 Handwheel

**5.11.1** Gate and globe valves shall be supplied with direct operated handwheels that close the valve when turned in a clockwise direction.

**5.11.2** The handwheel shall be a spoke and rim design that makes an effective grip possible.

**5.11.3** The handwheel shall be secured to the stem or stem nut by a threaded handwheel nut.

**5.11.4** The handwheel shall be without burrs or sharp edges.



## 6 Materials

### 6.1 Trim materials

**6.1.1** Trim items include the stem, the obturator seat surfaces and the body or seat ring seat surfaces. The trim combination number (CN) identifies both the stem material and the associated seating surface material. Except as noted in 6.1.2 and 6.1.3 or when otherwise agreed between the purchaser and manufacturer, the trim material combinations shall be in accordance with Table 12. Trim material usage is specific to the associated valve body and body to bonnet or cover bolting material. These associative requirements are given in Annex F.

**6.1.2** Trims of free machining grades, e.g. 13Cr steel grades containing additions of elements such as lead, selenium or sulfur to enhance machinability are intentionally not listed in Table 13. They may be used only when specified by the purchaser in which case they shall be identified by the appropriate trim number of Table 13 plus 100. The affected trim CN numbers would thus be identified as CN101, 104, 105, 105A, 106, 107, 108, and 108A. Correspondingly, hardfacing or other material overlays shall not be applied to free machining grades of base materials unless so specified by the purchaser.

**6.1.3** The trim material shall correspond to a listed CN, see Annex F for the requirements, except if an alternative CN may be furnished in accordance with Table 14. When an alternative CN from Table 14 is specified by a purchaser, a Table 13 listed CN shall not be substituted.

### 6.2 Materials other than trim

**6.2.1** Materials for valve parts other than trim items shall be in accordance with Table 15.

**6.2.2** 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. All repair welding shall be in accordance with a written procedure. Filler rods used for repairs shall be such as to produce a repair weld having characteristics similar to the parent metal. Repairs shall be heat treated after repair welding in accordance with the material specification.

# 7 Marking

## 7.1 Legibility

Each valve identified as being in accordance with this document shall be clearly marked on the body and on an identification plate in accordance with ISO 5209 and the requirements herein. In the event of conflict, the requirements of this clause shall apply.

## 7.2 Body marking

**7.2.1** Valve bodies shall be marked with the following information:

— manufacturer’s name or trade mark;

— body material identification;

— pressure rating designation using the Class number, e.g. 1 500;

— nominal size, as either DN followed by the appropriate size number, e.g. DN 50 or the NPS number, e.g. 2;

— an arrow on check valve bodies to indicate the flow direction for which the valve is intended to be installed.

**Table 13 — Basic trim materials**

| Part | Combination number | Trim material description | Brinell hardness, HB |
|---|---|---|---|
| **Stem**[a] | 1, 4, 5, 5A, 6, 7, 8, or 8A | 13Cr | 200 min, 275 max |
| | 2 or 15 | 18Cr-8Ni | [c] |
| | 3 | 25Cr-20Ni | [c] |
| | 9, 11 or 11A | NiCu alloy | [c] |
| | 10, 12, 12A or 16 | 18Cr-8Ni-Mo | [c] |
| | 13, 14, 14A or 18 | 19Cr-29Ni | [c] |
| | 17 | 18Cr-10Ni-Cb | [c] |

NOTE Abbreviations: Cr = chromium; Ni = nickel; Co = cobalt; Mo = molybdenum; Cb = columbium; Cu = copper; HF = hard facing using CoCr welding alloy; HFA = hard facing using NiCr welding alloy.

[a] Stems shall be of wrought material.

[b] A differential hardness of at least 50 Brinell points is required between mating surfaces.

[c] Not specified.

**Table 13** *(continued)*

| Part | Combination number | Trim material description | Brinell hardness, HB |
|---|---|---|---|
| **Seating surfaces** | 1 | 13Cr | 250 min[b] |
| | 2 | 18Cr8Ni | [c] |
| | 3 | 25Cr20Ni | [c] |
| | 4 | 13Cr | 750 min |
| | 5 | HF HFA | 350 min |
| | 5A | | 350 min |
| | 6 | 13Cr/CuNi | 250 min/175 min |
| | 7 | 13Cr/13Cr | 250 min/750 min |
| | 8 | 13Cr/HF | 250 min/350 min |
| | 8A | 13Cr/HFA | 250 min/350 min |
| | 9 | NiCu alloy | [c] |
| | 10 | 18Cr-8NiMo | [c] |
| | 11 | NiCu alloy/HF | 350 min[c] |
| | 11A | NiCu alloy/HFA | 350 min[c] |
| | 12 | 18Cr-8Ni-Mo/HF | 350 min[c] |
| | 12A | 18Cr-8Ni-Mo/HFA | 350 min[c] |
| | 13 | 19Cr-29Ni | [c] |
| | 14 | 19Cr-29Ni/HF | 350 min[c] |
| | 14A | 19Cr-29Ni/HFA | 350 min[c] |
| | 15,16,17 or 18 | HF | 350 min |

NOTE Abbreviations: Cr = chromium; Ni = nickel; Co = cobalt; Mo = molybdenum; Cb = columbium; Cu = copper; HF = hard facing using CoCr welding alloy; HFA = hard facing using NiCr welding alloy.

[a] Stems shall be of wrought material.

[b] A differential hardness of at least 50 Brinell points is required between mating surfaces.

[c] Not specified.



**Table 14 — Alternative CN numbers**

| **Specified CN** | 1 | 2 | 5A | 6 | 8A | 8 | 15 | 10 | 13 |
|---|---|---|---|---|---|---|---|---|---|
| **Alternative CN** | 5, 5A, 8 or 8A | 10 | 5 | 8 | 5, 5A, 8 | 5 | 16 | 12 or 12A | 14 or 14A |

**Table 15 — Materials for valve parts other than trim items**

| Part | Material[a] |
|---|---|
| Body and bonnet[b,c] | A forging or casting material as selected from ASME B16.34 |
| Cover plate[a,b] | A forging, casting, or plate material as selected from ASME B16.34 |
| Bonnet extension and union nut | A material of the same nominal composition as the bonnet as selected from the list of material from which the body was selected |
| Bellows | See B.6 |
| Bellows fittings | Attachment rings and other bellows fittings shall be of materials suitable for attachment welding of the bellows to the valve body, bonnet or stem as applicable |

[a] Metallic parts cannot be treated with zinc or cadmium coatings.

[b] A preference for body and bonnet or cover material form (e.g. forging or casting) requires specification by the purchaser (see Annex E).

[c] For valve sizes DN ≤ 50, the reference standard design specifies forging material for the body and bonnet, or cover, see 5.1.

**Table 15** *(continued)*

| Part | Material[a] |
|---|---|
| Obturator | Steel or base material compatible with the pressure/temperature rating and at least equal in corrosion resistance as the body material |
| Yoke, separate | Carbon steel or similar material composition as the bonnet |
| Bolting: body to bonnet and body to cover | Unless other materials are agreed between the purchaser and manufacturer, see Annex F for the bolting material requirements |
| Bolting: gland and yoke | Bolting materials of a type 300 or type 400 series stainless steel or bolting materials at least equal to either ASTM A307-Grade B or EN 10269, C35E (1.1181) |
| Seat ring | As in Table 12, except that when weld deposited facings are used, the base material shall have a corrosion resistance equal to or greater than that of the body material |
| Gland flange | Steel |
| Packing nut | Steel |
| Gland | Material with a melting point above 955 °C |
| Packing | Non-asbestos material suitable for steam and petroleum fluids over a temperature range of −29 °C to 540 °C and containing a corrosion inhibitor |
| Gaskets | See 5.5.3 |
| Stem nut or stem bushing | Austenitic ductile iron, 13Cr steel, or copper alloy having a melting point above 955 °C |
| Handwheel | Malleable iron, carbon steel, or ductile iron |
| Identification plate | A corrosion resistant material |

[a] Metallic parts cannot be treated with zinc or cadmium coatings.

[b] A preference for body and bonnet or cover material form (e.g. forging or casting) requires specification by the purchaser (see Annex E).

[c] For valve sizes DN ≤ 50, the reference standard design specifies forging material for the body and bonnet, or cover, see 5.1.

**7.2.2** For valves DN < 25, if the size or shape of the valve body precludes the inclusion of all the required markings, one or more may be omitted provided that they are shown on the identification plate. The sequence of omission shall be as follows:

a) nominal size;

b) nominal pressure;

c) body material.

## 7.3 Ring joint groove marking

Body end flanges require special marking when the end flanges are grooved for ring type joint assembly. When so grooved the ring joint gasket groove number (e.g. R25) shall be stamped on the rim of both end flanges. For ring joint gasket groove numbers, see ASME B16.5.

## 7.4 Identification plate marking

Each valve shall be provided with at least one identification plate. The identification plate marking, as applicable, shall include:

— the manufacturer's name;

— the number of this document, i.e. ISO 15761;

— pressure rating designation, e.g. Class 800;

— manufacturer's identification number, e.g. catalog number;



— trim identification for the stem, seat and disk;

— maximum pressure at 38 °C;

— limiting temperature, if applicable;

— limiting pressure, if applicable;

— any special use limitation that applies.

### 7.5 Weld fabrication marking

When extensions for stub ends, flanges, extended body ends or bellows enclosures are welded to a valve or a valve body-to-bonnet is fabricated by welding or seal welding, the identification plate, the extension, body or bonnet shall be marked as follows:

— the letters "WLD";

— the material grade designation for the extension if other than that of the body or bonnet;

— the post weld heat treatment employed using the following identification letters:

— "SR" when stress relieved;

— "SA" when solution annealed;

— "A" when annealed;

— "N" when normalized;

— "NT" when normalized and tempered;

— "QT" when quenched and tempered:

— when the aforementioned symbols do not apply, symbols consistent with the specifications for the materials joined are to be used.

These identification markings shall be located to avoid confusion with other required markings.

## 8 Testing and inspection

### 8.1 Pressure tests

#### 8.1.1 General

**8.1.1.1** Each assembled valve identified with this document shall be given a shell pressure test, a seat closure test and a stem backseat test in accordance with the requirements of ISO 5208 except as modified by the following. 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 no heavier than kerosene to be applied to prevent sealing surface galling. The manufacturer is responsible for establishing that neither the selected packing nor the bellows, if furnished, leak at the required test pressures.

**8.1.1.2** When water is used as the test fluid for pressure testing austenitic stainless-steel valves or valves having austenitic stainless-steel bellows the chloride content of the test water shall not exceed 100 mg/l (100 ppm).

### 8.1.2 Shell test

**8.1.2.1** The shell test for each valve shall be at a pressure no less than 1,5 times the pressure corresponding to the valve pressure rating at 38 °C. Over the duration of the test, the obturator shall be in a partially open position except that for a check valve it may be in a fully open position. The packing, in gate and globe valves, shall be adjusted to maintain the test pressure.

**8.1.2.2** Paint or other coating materials capable of concealing leakage during the shell test shall not be applied to valve surfaces. However, valve surfaces may be protected by chemical conversion processes such as phosphate coating, provided that such treatments do not seal porosity.

**8.1.2.3** The minimum period of time that the shell test pressure is to be sustained shall be in accordance with Table 16.

**Table 16 — Test duration**

| Valve size | Test duration (s) |
|---|---|
| DN ≤ 50 | 15 |
| DN > 50 | 60 |

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

### 8.1.3 Closure leakage test

**8.1.3.1** For each gate valve, the closure test shall be a gas test with the test gas at a pressure between 500 kPa and 700 kPa (5 bar and 7 bar). The closure test is to be applied, one direction at a time, for both seat sealing directions. The gate valve test method shall include the filling and pressurizing the bonnet cavity between the seats and the bonnet with test fluid to ensure that no seat leakage can escape detection.

**8.1.3.2** For each check valve and globe valve the closure test shall be a high-pressure liquid test with the test liquid at a pressure no less than 1,1 times the valve pressure rating at 38 °C. When a globe valve is equipped with a power actuator the closure test may be performed at 110 % of the differential pressure used for determining the size of the actuator.

**8.1.3.3** Gate and globe valve stem packing shall be adjusted so that there is no visible leakage over the duration of the closure test. Throughout the duration of the closure test there shall be no visible evidence of leakage through the obturator or from behind installed seat rings.

**8.1.3.4** The minimum period of time that the test pressure is to be sustained for the purpose of obtaining a seat leakage measurement, shall be in accordance with Table 16.

**8.1.3.5** Over the duration of the closure test, the maximum permitted seat leakage rate shall be in accordance with Table 17.

— For the gas test, zero leakage is defined as less than 1 bubble or 3 $mm^3$ over the specified test duration.

NOTE This does not define an exact relationship for determining the volume occupied by a bubble.

— For the liquid test, zero leakage is defined as no visible leakage over the specified test duration.



**8.1.3.6** When volumetric devices are used to measure seat leakage rates they shall be calibrated to yield results equivalent to those of Table 17 for the valve under test. These devices shall be calibrated with the same test fluid, at the same temperature as those of the valve closure tests. When these devices are used, the test duration specified in Table 16 shall not commence until a flow rate has been established into the device.

**8.1.3.7** Gate valves, for which only a low pressure gas test is specified, shall have valve closure structures designed to sustain pressure loads corresponding to the conditions of the optional high pressure liquid test (see 8.1.4) and shall have the capability of meeting the leakage requirements specified in Table 16 for globe valves over a test duration specified in Table 15.

**Table 17 — Seat leakage rate**

| DN | 8 | 10 | 15 | 20 | 25 | 32 | 40 | 50 | 65 | 80 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NPS | ¼ | ⅜ | ½ | ¾ | 1 | 1¼ | 1½ | 2 | 2½ | 3 | 4 |
| | Maximum permissible leakage rate[a] ($mm^3/s$) | | | | | | | | | | |
| Gate (gas) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 25 | 25 |
| Globe and gate (liquid) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12,5 | 12,5 | 12,5 |
| Check (liquid) | 12 | 18 | 25 | 37 | 50 | 62 | 75 | 100 | 125 | 150 | 200 |

[a] The closure test, as specified in 8.1.3.1 and 8.1.3.2, is a gas test for gate valves and a high pressure liquid test for globe and check valves.

### 8.1.4 Optional closure leakage test for gate valves

A closure test with the test liquid at a pressure no less than 1,1 times the valve pressure rating at 38 °C is not required for gate valves. It is an option that the purchaser may specify in the purchase order. Independent of the closure test requirement, valve closure structures shall be designed to sustain pressure loads under the conditions of this option and have the capability of meeting the leakage requirements specified in Table 17 for globe valves over a test duration specified in Table 16.

### 8.1.5 Backseat leakage test

**8.1.5.1** The backseat test for gate and globe valves shall be either a gas test at the pressure given in 8.1.3.1 or a liquid test at the pressure given in 8.1.3.2 over the duration specified in 8.1.3.4. A backseat test is not required for a valve with a bellows stem seal.

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

**8.1.5.3** The gland bolting or packing nut shall be re-tightened following the backseat test.

**8.1.5.4** An alternative test for the backseat, when approved by the purchaser, is one that combines the backseat test with the shell test. For this test, volumetric flow devices shall be provided that independently measure leakage during the combined shell and backseat test. This test method requires that the packing be loose so as not to have an effect on backseat leakage. Upon request, demonstrable substantiation shall be provided to the purchaser that shows this combined test meets the backseat leakage requirements of 8.1.5.2.

### 8.1.6 Fugitive emission testing

**8.1.6.1** The fully assembled valve shall be tested in accordance with ISO 15848-1 for type testing and ISO 15848-2 for production testing.

**8.1.6.2** The valve shall meet FE Class BH or BM as a minimum for CO1 mechanical cycling and RT temperature range. All other cycling or temperature classes, agreement should be reached between manufacturer and purchaser.

## 8.2 Inspection

For each valve, the appropriate items shall be checked by the manufacturer before release for shipment. See Annex E for the requirements.

# 9 Preparation for despatch

**9.1** After testing, the test fluid shall be drained from each valve in preparation for despatch.

**9.2** Stem packing shall be in place and the remaining packing adjustment, with the gland tight, shall be greater than one packing width.

**9.3** Except for austenitic stainless-steel valves and valve surfaces protected by a chemical conversion process (see 8.1.1.2), unmachined exterior valve body and bonnet surfaces shall have a rust preventative coating.

**9.4** Except for austenitic stainless-steel valves, machined or threaded surfaces shall be coated with an easily removed rust inhibitor.

**9.5** Protective covers or caps of wood, wood fibre, plastic or metal shall be securely affixed to valve ends of flanged and butt-welding end valves in order to safeguard the gasket surfaces and weld end preparations. The cover design shall be such that the valve cannot be installed in a pipeline with the protective cover in place.

**9.6** Protective end plugs of wood, wood fibre, plastic or metal shall be securely inserted into the valve ends of socket welding and threaded end valves. The protective plug design shall be such that the valve cannot be installed in a pipeline with the plug in place.

**9.7** At the time of shipment, the obturator of a gate or a globe valve shall be in the closed position.

**9.8** When special packaging is necessary, the purchaser shall specify the requirements in the purchase order.

# Annex A
(normative)

# Requirements for extended body gate valve bodies



## A.1 General

This annex specifies design, materials, fabrication and examination requirements for gate valve bodies to be used in valve assemblies identified as extended body valves. The valve body requirements stipulated in this annex, in combination with related gate valve requirements in the body of this document, constitute the requirements applicable to extended body valves. An extended valve body has one end fitted with either a conventional internal taper pipe thread connection or a conventional internal socket welding connection. The opposite body end is prolonged, i.e. it is fitted with an extension that has an external end connection that is either an external taper pipe thread or an external weld end preparation.

## A.2 Applicability

**A.2.1** Extensions with external taper pipe threads are designated only for Class 800 in nominal sizes 20 ≤ DN ≤ 50.

**A.2.2** Extensions with external weld end preparations are designated only for Class 800 and Class 1 500 in nominal sizes 15 ≤ DN ≤ 50. Weld end preparations covered include both socket welding and butt-welding types.

**A.2.3** Internal socket welding ends or internal taper pipe thread ends are designated only for Class 800 and Class 1 500 in nominal sizes 15 ≤ DN ≤ 50.

**A.2.4** Extended bodies covered by this document are for valves whose end connections have the same nominal size for both the internal and the external ends except that an extended valve body may be furnished with a DN 20 external end and a DN 15 internal end when the assembled valve otherwise meets all requirements for a DN 20 valve.

## A.3 Body configuration

### A.3.1 Extension length

The length of the extension or protrusion, identified as dimension *L*, required for an extended body is the distance from the axis of the valve stem to the outer end of the extension's external end preparation. The required values for *L* are specified in Tables A.1 and A.2. The minimum handwheel clearance, the distance between the outer end of the external end preparation and the outer diameter of the handwheel, shall be 57 mm.

### A.3.2 Extensions having threaded ends

The minimum wall thickness and maximum length for extensions having threaded ends and the dimensions for threaded end preparations for Class 800 (PN 130) extended body valves shall be in accordance with Table A.1 and Figure A.1. The external end threads shall be in accordance with 5.4.3.2 and 5.4.3.3.

**Table A.1 — Threaded end extension for Class 800**

| DN | Maximum length *L* (mm) | Maximum inside diameter *ID* (mm) | Minimum outside diameter *OD* (mm) | Minimum wall thickness $T_m$ (mm) | Maximum transition length *A* (mm) | NPS |
|---|---|---|---|---|---|---|
| 20 | 115 | 16,5 | 25,9 | 4,8 | 23,4 | ¾ |
| 25 | 180 | 21,3 | 32,5 | 5,6 | 28,2 | 1 |
| 40 | 230 | 38,1 | 47,5 | 6,1 | 29,2 | 1-½ |
| 50 | 255 | 47,5 | 59,4 | 7,1 | 30,0 | 2 |

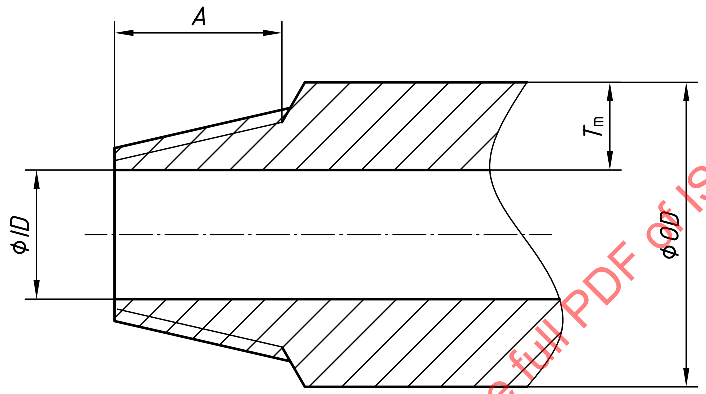



**Figure A.1 — Threaded end extension for Class 800**



### A.3.3 Extensions having welding ends

The minimum wall thickness and maximum length for extensions having either socket welding or butt-welding ends and the dimensions for butt-welding end preparations for extended body valves shall be in accordance with Table A.2 and Figure A.2.

The dimensions for socket welding end preparations shall be in accordance with Table A.3 and Figure A.3.

Integrally reinforced extensions, Figure A.2 a), shall have weld ends designed to meet the reinforcing requirements of ISO 15649.

The integral backing (cantering) ring illustrated in Table A.2 for butt-welding ends is provided at the manufacturer's option. Its length shall not be included when measuring the required length of the extension.

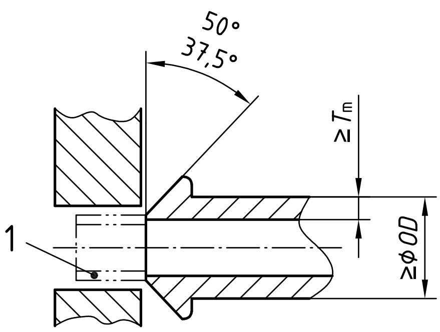
**Table A.2 — Welding end extension for Class 800 and Class 1 500**

| DN | Maximum length of welding end *L* (mm) | | Minimum outside diameter *OD* (mm) | Minimum wall thickness $T_m$ (mm) | | NPS |
|---|---|---|---|---|---|---|
| | Socket | Butt | | Class 800 | Class 1 500 | |
| 15 | 100 | 100 | 23,1 | 5,5 | 5,6 | ½ |
| 15 | 105 to165 | 105 to 165 | 26,9 | 6,3 | 6,3 | ½ |
| 15 | 165 | 170 to 205 | 31,7 | 6,3 | 6,3 | ½ |
| 20 | 140 | 140 | 25,9 | 4,8 | 6,1 | ¾ |

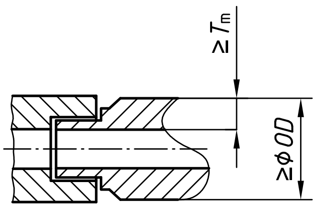
 

**Table A.2** *(continued)*

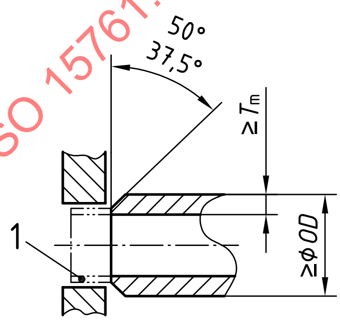
| DN | Maximum length of welding end *L* (mm) | | Minimum outside diameter *OD* (mm) | Minimum wall thickness $T_m$ (mm) | | NPS |
|---|---|---|---|---|---|---|
| | Socket | Butt | | Class 800 | Class 1 500 | |
| 20 | 145 to 205 | 145 to 205 | 31,7 | 7,5 | 7,5 | ¾ |
| 25 | 230 | 230 | 32,5 | 5,6 | 7,1 | 1 |
| 40 | 230 | 230 | 47,5 | 6,2 | 9,7 | 1½ |
| 50 | 255 | 255 | 59,4 | 7,6 | 11,9 | 2 |




a) Integrally reinforced end for welding




b) Socket welded end




c) Bevelled end for welding

**Key**

1 optional integral backing ring

**Figure A.2 — Welding end extension for Class 800 and Class 1500**



**Table A.3 — Socket welding end preparation for Class 800 and Class 1 500**

| DN | Shoulder length A (minimum mm) | Socket length B (mm) | Socket diameter C (mm) | Step diameter D (mm) | NPS |
|---|---|---|---|---|---|
| 15 | 3 | 7,9 | 21,3 | 22,9 | ½ |
| 20 | 3 | 11,2 | 26,7 | 28,2 | ¾ |
| 25 | 3 | 11,2 | 33,3 | 35,1 | 1 |
| 40 | 3 | 11,2 | 48,3 | 49,8 | 1½ |
| 50 | 3 | 14,2 | 60,2 | 62,0 | 2 |
| Tolerance for dimensions B, C, and D: $^{+0,2}_{-0,8}$ mm for 15 ≤ DN ≤ 40 and ± 0,8 mm for DN 50. | | | | | |

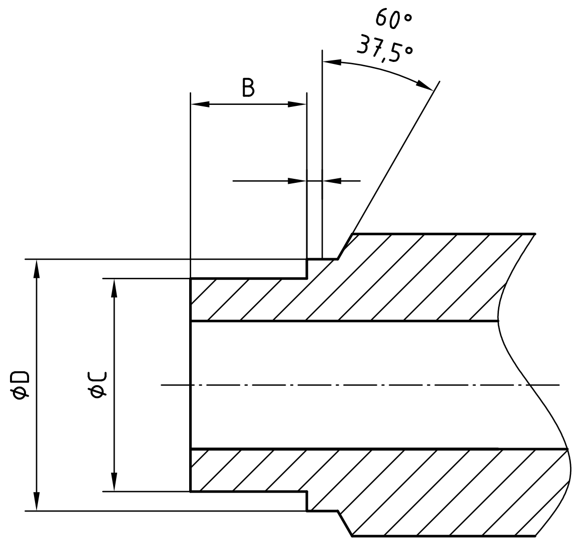



**Figure A.3 — Socket welding end preparation for Class 800 and Class 1 500**

## A.4 Materials for extensions

An extension welded to a valve body shall be of a material having a nominal chemical composition that corresponds with that of the body material and be listed in ASME B16.34. If a tubular form is used it shall be of seamless construction.

## A.5 Body extension construction

**A.5.1** An extension shall be either cast or forged integral with the valve body or a separate part attached to the valve body by welding. A purchaser requiring an integral extension shall so specify. Welding an extension to a valve body shall be either by full penetration butt-welding or inertia welding. The welding operator and welding procedure shall be qualified in accordance with ISO 9606-1, ISO 15607, ISO 15609-1, ISO 15610, ISO 15614-1, ISO 15614-2 or ASME-BPVC, Section IX. The weld quality shall meet the examination acceptance standards requirements of ISO 15649 as specified for normal fluid service.

**A.5.2** Integral alignment rings (cantering backing rings) used to facilitate welding shall be removed by machining after welding. The welded extension and attachment weld shall not have any internal tapers, or other internal discontinuities, where the taper exceeds a 4 to 1 ratio in the axial to radial directions.

**A.5.3** The final wall thickness of the extension attachment weld shall not be less than that required for the extension by Table A.1 or Table A.2 as applicable.



**A.5.4** The body to extension weld shall be given a post-weld heat treatment in accordance with Table A.4.

**Table A.4 — Post weld heat treatment**

| Material | | Thickness[a] *T* (mm) | Temperature range (°C) | Holding time (s/mm) | Maximum weld hardness HBN |
|---|---|---|---|---|---|
| Carbon steels | | $T > 19$ | 593 to 649 | 144 | — |
| Alloy steels | ½ % < Cr ≤ 2 % | All | 704 to 746 | 144 | 225 |
| | 2¼ %≤ Cr≤ 10 % | All | 704 to 760 | 144 | 241 |
| Nickel alloy steels | | $T > 19$ | 593 to 635 | 72 | |
| Austenitic steels[b] | | All | Solution anneal per material specification | | |
| Other materials | | All | Follow material specification | | |

a The thickness, *T*, is the largest thickness of the pieces being joined by welding.

b Except when materials being welded are L-grades or stabilized grades.

**A.5.5** The finished weld shall be free of cracks, show no indication of lack of fusion or incomplete penetration. The finished weld shall be ground or otherwise finished to provide a smoothly contoured surface having a surface finish of $R_a \leq 12{,}5$ µm.

## A.6 Marking

Valves that have valve bodies with welded end extensions shall be marked with the fabrication markings in accordance with 7.5. In addition, the body marking shall include the material identification for the extension if it is different than the body material.

# Annex B
(normative)

# Requirements for valves with bellows stem seals

## B.1 General

This annex specifies design, materials, fabrication, testing and examination requirements for gate and globe valves having bellows stem seals. The requirements stipulated in this annex, in combination with related gate and globe valve requirements in the body of this document, constitute the total requirements for bellows stem seal valves. These requirements are applicable for valves in nominal sizes 15 ≤ DN ≤ 50.

## B.2 Design

**B.2.1** Bellows stem seals do not eliminate the need for providing the stem packing required by 5.9 and 5.10 or the backseat required by 5.7.6. The packing shall be placed so that it functions as the stem seal in the event that bellows seal leakage occurs (see Figure D.3).

**B.2.2** One end of the bellows shall be attached to the stem just above the gate or to the disk linkage by welding. The opposite bellows end shall be welded either directly to the valve bonnet, to the valve body, or to an intervening ring which in turn is either clamped or welded to the bonnet or body. When needed to accommodate large stem strokes individual bellows may be welded in series.

**B.2.3** Stems, in bellows equipped valves, shall be provided with means to prevent stem rotation and thereby avoid transmitting torsional loads to the bellows.

**B.2.4** Valve-to-bellows assemblies shall be designed so that the bellows convolutions or leaves do not buckle or come into rubbing contact with the surrounding body, the bonnet extension or the enclosed stem.

**B.2.5** The stem shall be designed to provide the strength necessary to accommodate the 38 °C (100 °F) pressure rating taking into consideration any additional pressure area loads imposed by the inclusion of the bellows. The manufacturer shall determine if the stem diameter needs to be increased over that required by 5.7.2.

**B.2.6** A stem-to-gate connection for bellows-seal gate valves shall have either a button or T-head end that is designed to fit into a disc slot. Stems shall be constructed in one-piece. Welding or otherwise joining two or more stem pieces is not an acceptable construction.

## B.3 Pressure–temperature ratings

**B.3.1** The bellows assembly for a bellows stem seal valve shall be designed to meet the valve pressure rating at 38 °C with the capability of accommodating a pressure test at 1,5 times the 38 °C pressure rating while preserving the ability to meet the bellows life cycle requirements of Annex C.

**B.3.2** For fluid service above 38 °C, the bellows design may limit the valve pressure rating to pressures less than those specified by 4.1 or may limit the temperature to a value less than the maximum specified by 4.1. When this occurs, the valve manufacturer shall publish applicable pressure/temperature ratings and provide these to the user.



**B.3.3** Restrictions of temperature or pressure imposed by the bellows assembly design shall be marked on the identification plate (see 7.4).

**B.3.4** A bellows stem seal valve shall be limited to applications where temperatures are below the creep range of the bellows material. The temperature for the onset of creep shall be as defined in ASME B16.34:2017, Annex F.

## B.4 Extensions for bellows enclosure

**B.4.1** The cylindrical bonnet or body extension required to enclose a bellows stem seal, see Annex D, shall have a minimum wall thickness that is the greater of either the body minimum wall thickness specified in Table 2 or the wall thickness specified in Table 3 using two-thirds of the actual local inside diameter of the extension.

In the event that the material selected for the extension has a pressure/temperature rating that is less than the body material, considering the entire material temperature range, the minimum wall thickness of the extension shall be increased, as necessary, so that its pressure/temperature rating equals or exceeds that of the body.

**B.4.2** The bonnet or body extension that envelops the bellows shall be integral, attached by a threaded connection that is seal welded or attached by welding.

**B.4.3** The weld for an extension that is welded directly to the bonnet or body shall be a full penetration butt-weld. The welding operator and welding procedure shall be qualified in accordance with ISO 9606-1 or ASME BPVC, Section IX. Heat treatment, following welding, to ensure that the bonnet and extension materials are suitable for the full range of service conditions shall be performed as required in Table A.4. The weld quality shall meet the examination acceptance standards requirements of ISO 15649 as specified for normal fluid service.

## B.5 Type testing

**B.5.1** The adequacy of each design of bellows and its attachment means, including attachment welds, shall be verified by type testing in accordance with Annex C.

**B.5.2** A bellows assembly design change that alters cyclic life demonstrated by a type test, for example, a change in bellows material, bellows thickness, number of plies, welding geometry, or welding procedure, requires an entirely new life cycle type test.

**B.5.3** When the bellows or bellows assembly manufacturer is changed, or when there is a change in the method of manufacture of the bellows or bellows assembly, an entirely new life cycle type test is required.

**B.5.4** A change in the number of convolutions of a qualified bellows (increasing or decreasing the overall bellows height) is not by itself cause for a new life cycle test provided that the installed bellows travel ratio for compression and extension is equal to or less than that of the qualified bellows. These ratios are defined in Formula (B.1):

$$R_c = \frac{h_f - h_c}{h_f} \text{ and } R_e = \frac{h_e - h_f}{h_f} \qquad \text{(B.1)}$$

where

| | |
|---|---|
| $R_c$ | is the bellows compression ratio; |
| $R_e$ | is the bellows extension ratio; |
| $h_f$ | is the unrestrained (free) bellows height; |
| $h_c$ | is the installed compressed bellows height; |
| $h_e$ | is the installed extended bellows height. |

**B.5.5** A bellows valve shall be designed such that the qualified extension and compression ratios cannot be exceeded.

## B.6 Bellows and bellows assembly materials

**B.6.1** Typical materials for bellows are listed in Table B.1. Some services may require special bellows materials. When specified by the user, materials other than those listed in Table B.1 may be selected for the bellows.

**Table B.1 — Bellows material chart**

| Material type | Typical specification |
|---|---|
| 304 stainless | ASTM 240/ASTM A312 |
| 304L stainless | ASTM 240/ASTM A312 |
| 316 stainless | ASTM 240/ASTM A312 |
| 316L stainless | ASTM 240/ASTM A312 |
| 321 stainless | ASTM 240/ASTM A312 |
| 347 stainless | ASTM A240/ASTM A312 |
| Alloy 600 | ASTM B167/ASTM B168 |
| Alloy 625 | ASTM B443 |
| Alloy 718 | ASTM B670 |
| Alloy 400 | ASTM B127/ASTM B165 |
| Alloy C22 | ASTM B575/ASTM B622 |
| Alloy C276 | ASTM B575/ASTM B622 |

**B.6.2** Fabrication welding operations related to bellows or bellows assemblies shall be performed by qualified welding operators in accordance with qualified welding procedures. Both shall be qualified in accordance with ISO 9606-1, ISO 15607, ISO 15609-1, ISO 15610, ISO 15614-1, ISO 15614-2 or ASME BPVC, Section IX.

**B.6.3** The welds attaching bellows or bellows end fittings to a valve body or bonnet are exempt from post-weld heat treatment requirements.

**B.6.4** Bellows materials shall not be repaired by welding.

**B.6.5** The bellows material shall be either seamless or longitudinally butt-welded unless otherwise specified by the purchaser.

**B.6.6** The bellows shall be of multi-ply construction unless otherwise specified by the purchaser.

**B.6.7** Bellows assemblies, as received from the bellows manufacturer, shall be contained in individual packages so as to prevent damage from handling or moisture prior to assembly.

## B.7 Pressure tests

**B.7.1** Prior to assembly, each bellows or bellows assembly shall be tested for leakage either using a mass spectrometer leakage testing device having a sensitivity of $10^{-3}$ $mm^3/s$ of helium at standard atmospheric pressure and 20 °C and shall show no detectable leakage or using another means that the manufacturer can demonstrate to be of equal leakage detection sensitivity.

**B.7.2** Pressure tests for bellows stem seal valves, with the manufacturer taking into account the consequences of a bellows failure during pressure testing, shall be without stem packing installed or with the stem packing adjustment bolting loosely assembled so as to not effect a stem seal.

**B.7.3** When water is used as the test fluid for pressure testing valves having austenitic stainless-steel bellows the chloride content of the test water shall not exceed 100 mg/l (100 ppm).

**B.7.4** A backseat test is not required for a valve with a bellows stem seal.

## B.8 Marking

**B.8.1** Each bellows assembly shall have a material identification marking.

**B.8.2** The bellows material marking shall appear on the valve identification plate

## B.9 Preparation for despatch

After testing, special care shall be taken to drain test fluid from the bellows chamber.

# Annex C
(normative)

# Type testing of bellows stem seals

## C.1 General

This annex specifies type testing for the purpose of qualifying bellows and bellows assemblies to be used in gate or globe valves described in this document. Included are requirements for testing, examination and acceptance.

## C.2 General requirements

**C.2.1** The bellows is the expandable metal part that acts as the initial stem seal preventing the contained fluid from escaping into the atmosphere surrounding the valve. A bellows assembly includes the bellows and related end fittings. The end fittings may be in the form of rings, caps, or flanges that are attached to the bellows by welding.

**C.2.2** Each bellows assembly design and each bellows material shall be qualified by type testing. Type testing includes both ambient temperature and high temperature testing. The ambient temperature tests shall be carried out at a pressure at least equal to the rated valve pressure for 38 °C. The high temperature tests shall be carried out at a pressure at least equal to the rated valve pressure for either a temperature at least equal to 427 °C or the maximum temperature for which the bellows is designated.

**C.2.3** A successful qualification requires that three bellows assemblies of the same design and material be type tested at ambient conditions and three more be tested at the high temperature conditions and that all six meet the qualification acceptance requirements. The six bellows assemblies for testing shall be randomly selected from a regular bellows assembly production lot.



## C.3 Test procedure

### C.3.1 Pre-test examination

**C.3.1.1** The bellows assemblies to be tested shall be clean.

**C.3.1.2** Each bellows unrestrained (free) height shall be measured and recorded along with the compressed and extended heights for which the qualification applies. The compressed and extended ratios (see B.6.4) shall be calculated and recorded in the test report.

**C.3.1.3** All bellows assembly welds shall be examined using a liquid dye penetrant. Any indication of a crack or any other weld defect shall be cause for rejection.

**C.3.1.4** Each bellows assembly shall be subjected to a helium leakage test. The assembly shall show no detectable leakage when tested with an instrument that has a sensitivity of $10^{-3}$ $mm^3/s$ of helium.

### C.3.2 Pressure test

**C.3.2.1** Each bellows assembly shall be pressure tested.

**C.3.2.2** The pressure test fluid shall be water containing less than 100 mg/l (100 ppm) of chlorides.

**C.3.2.3** For the pressure test, the bellows shall be positioned at its compressed design height corresponding to the valve open position. Positioning may be either in a valve assembly or in a test fixture that duplicates the intended valve assembly.

**C.3.2.4** The test fluid pressure shall be applied in the same direction (externally or internally) for which the bellows assembly is to be qualified.

**C.3.2.5** The test fluid pressure shall be not less than 1,5 times the rated pressure of the valve at 38 °C.

**C.3.2.6** The minimum pressure test duration shall be 5 min.

**C.3.2.7** Any visually detectable leakage over the test duration shall be cause for rejection.

### C.3.3 Cycle test

**C.3.3.1** Each bellows assembly shall be cycle tested.

**C.3.3.2** For the cycle test, the bellows assembly shall be installed in either a completely assembled valve (with the packing removed) or a test fixture that simulates the intended bellows valve installation and incorporates its maximum possible extension and compression.

**C.3.3.3** The frequency of cycling shall not exceed one cycle per second.

**C.3.3.4** One complete cycle is defined as movement of the bellows from the design compressed position to the design extended position and return to the compressed position corresponding to the valve open-closed-open positions.

**C.3.3.5** The ambient cycle test cycling shall be carried out at ambient temperature and with the bellows subjected to a water pressure, as a minimum, equal to the 38 °C intended valve pressure rating. The high temperature cycle test shall be carried out at a temperature that is at least the greater of 427 °C or the maximum bellows assembly rated temperature and with the bellows subjected to a pressure, as a minimum, equal to the intended valve pressure rating at the test temperature. The test fluid for the high temperature test may be a liquid or a gas at the manufacturer's option.

**C.3.3.6** Water containing less than 100 mg/l (100 ppm) of chlorides shall be used.

**C.3.3.7** The minimum number of test cycles required for qualification for each bellows assembly shall be in accordance with Table C.1.



**Table C.1 — Bellows test cycles**

| Valve rating | Test cycles (minimum) | |
|---|---|---|
| | Gate valve | Globe valve |
| Class ≤ 800 | 2 000 | 5 000 |
| Class > 800 | 2 000 | 2 000 |

### C.3.4 Post test examination

**C.3.4.1** Upon completion of the cycle test, repeat the liquid dye penetrant examination of C.3.1.3.

**C.3.4.2** After the liquid dye penetrant examination each bellows assembly shall be tested for leakage in accordance with either a) or b) below as follows.

a) Submerge the bellows assembly under water for a period of 5 min while applying air at a pressure greater than 560 kPa (5,6 bar).

b) Perform a helium leakage test using an instrument that has a sensitivity of $10^{-3}$ $mm^3/s$ of helium.

**C.3.4.3** Any detectable leakage either from the bellows or the bellows assembly welds is cause for failure.

## C.4 Acceptability

Acceptance of the bellows assembly design and construction shall be based on all six of the assemblies meeting the qualification test requirements.

## C.5 Test report

A test report shall be prepared and be available at the valve manufacturer's facility for review upon request of the purchaser when such provision is included in the valve purchase order.

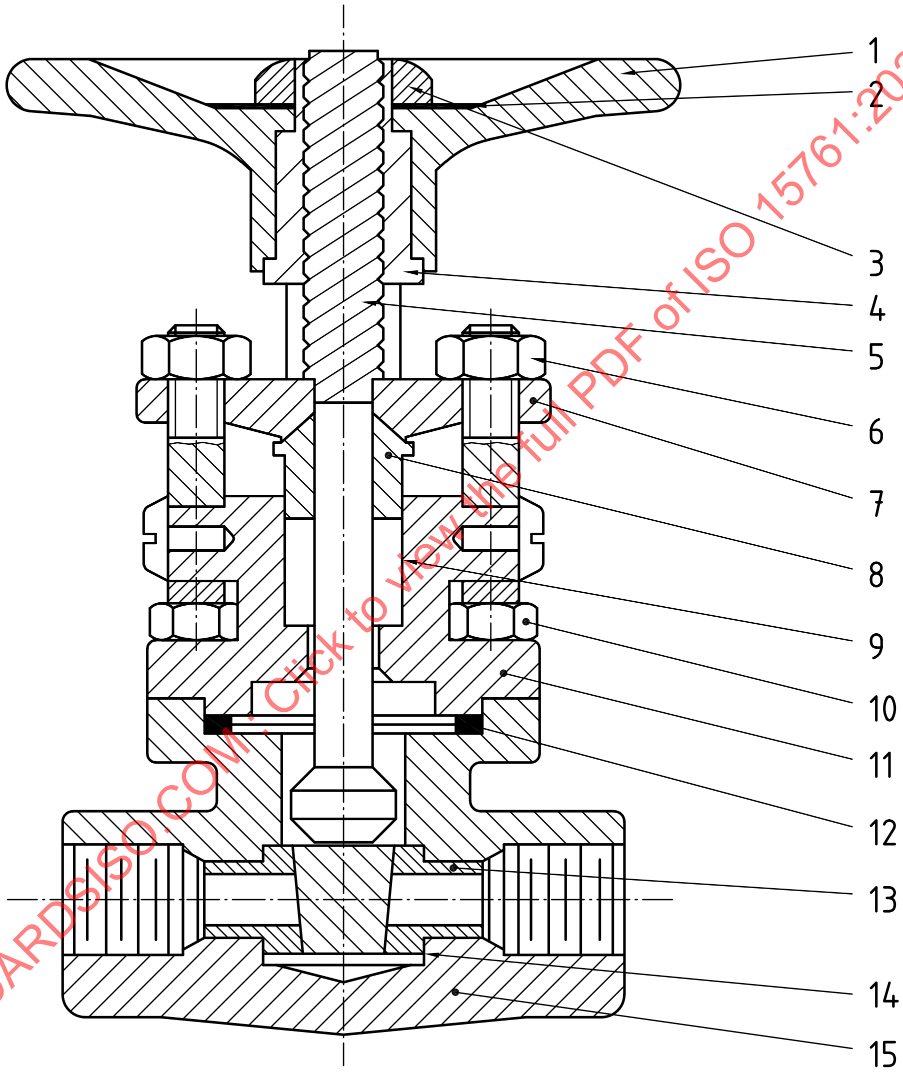


# Annex D
(informative)

# Identification of valve parts

The purpose of Figures D.1 to D.3 is to identify part names only.






**Key**

| | | | |
|---|---|---|---|
| 1 | handwheel | 9 | packing |
| 2 | identification plate | 10 | bonnet bolting |
| 3 | handwheel nut | 11 | bonnet |
| 4 | stem nut | 12 | gasket |
| 5 | stem | 13 | seat ring |
| 6 | gland bolting | 14 | gate |
| 7 | gland flange | 15 | body |
| 8 | gland | | |

**Figure D.1 — Outside screw and yoke gate valve**