Specification for Pipeline Valves

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Shall: As used in a standard, “shall” denotes a minimum requirement in order to conform to the specification.

Should: As used in a standard, “should” denotes a recommendation or that which is advised but not required in order to conform to the specification.

This standard is under the jurisdiction of the API Standards Subcommittee on Valves and Wellhead Equipment (API SC6). This API standard is identical with the English version of ISO 14313:2007. ISO 14313 was prepared by Technical Committee ISO/TC 67 Materials, equipment and offshore structures for petroleum and natural gas industries, SC 2, Pipeline transportation systems.

For the purposes of this standard, the following editorial change has been made:

— A national informative annex (Annex F—API Monogram) has been included giving guidance to users.

This standard shall become effective on the date printed on the cover but may be used voluntarily from the date of distribution.

Contents

Foreword

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

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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

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

ISO 14313 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 2, *Pipeline transportation systems*.

This second edition cancels and replaces the first edition (ISO 14313:1999), which has been technically revised, principally by the following.

— Clause 2, on the requirements for conformity to this International Standard, has been added for clarification.

— Clause 7, on the requirements for allowable stresses and allowable deflection on design, has been revised and clarified.

— Clause 8, on material, has been revised to align the requirements with global industry practice for carbon content and carbon equivalent for pressure-containing, pressure-controlling, welding ends and parts requiring welding.

— New requirements on repairs and NDE of welding repairs have been added to Clause 9 on Welding.

— A new table (Table D.2) has been added to Annex D (informative) to provide more guidance for those requirements listed in the text as requiring agreement between the manufacturer/purchaser.

Introduction

This International Standard is the result of harmonizing the requirements of ISO 14313:1999 and API Spec 6D-2002[5].

The revision of ISO 14313 is developed based on input from both ISO/TC67/SC2 WG2 and API 6D TG technical experts. The technical revisions have been made In order to accommodate the needs of industry and to move this International Standard to a higher level of service to the petroleum and natural gas industry.

Users of this International Standard should be aware that further or differing requirements can be needed for individual applications. This International Standard is not intended to inhibit a manufacturer from offering, or the purchaser from accepting, alternative equipment or engineering solutions for the individual application. This may be particularly applicable where there is innovative or developing technology. Where an alternative is offered, the manufacturer should identify any variations from this International Standard and provide details.

Petroleum and natural gas industries — Pipeline transportation systems — Pipeline valves

1 Scope

This International Standard specifies requirements and provides recommendations for the design, manufacturing, testing and documentation of ball, check, gate and plug valves for application in pipeline systems meeting the requirements of ISO 13623 for the petroleum and natural gas industries.

This International Standard is not applicable to subsea pipeline valves, as they are covered by a separate International Standard (ISO 14723).

This International Standard is not applicable to valves for pressure ratings exceeding PN 420 (Class 2 500).

2 Conformance

2.1 Units of measurement

In this International Standard, data are expressed in both SI units and USC units. For a specific order item, unless otherwise stated, only one system of units shall be used, without combining data expressed in the other system.

For data expressed in SI units, a comma is used as the decimal separator and a space is used as the thousands separator. For data expressed in USC units, a dot (on the line) is used as the decimal separator and a comma is used as the thousands separator.

2.2 Rounding

Except as otherwise required by this International Standard, to determine conformance with the specified requirements, observed or calculated values shall be rounded to the nearest unit in the last right-hand place of figures used in expressing the limiting value, in accordance with the rounding method of ISO 31-0:1992, Annex B, Rule A.

2.3 Compliance to standard

A quality system should be applied to assist compliance with the requirements of this International Standard.

NOTE ISO/TS 29001 gives sector-specific guidance on quality management systems.

The manufacturer shall be responsible for complying with all of the applicable requirements of this International Standard. It shall be permissible for the purchaser to make any investigation necessary in order to be assured of compliance by the manufacturer and to reject any material that does not comply.

3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments, corrigendum, and maintenance agency output) applies.

ISO 31-0,1992, *Quantities and units — Part 0: General principles*

ISO 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

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

ISO 7268, *Pipe components — Definition of nominal pressure*

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

ISO 9712, *Non-destructive testing — Qualification and certification of personnel*

ISO 10474, *Steel and steel products — Inspection documents*

ISO 10497, *Testing of valves — Fire type-testing requirements*

ISO 15156 (all parts), *Petroleum and natural gas industries — Materials for use in H_2S-containing environments in oil and gas production*

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

ISO 15609 (all parts), *Specification and qualification of welding procedures for metallic materials — Welding procedure specification*

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 23277, *Non-destructive testing of welds — Penetrant testing of welds — Acceptance levels*

ISO 23278, *Non-destructive testing of welds — Magnetic particle testing of welds — Acceptance levels*

ASME B1.20.1[1)], *Pipe Threads, General Purpose, Inch*

ASME B16.5-1996, *Pipe Flanges and Flanged Fittings : NPS 1/2 through 24*

ASME B16.10-2000, *Face-to-Face and End-to-End Dimensions of Valves*

ASME B16.34-2004, *Valves, Flanged, Threaded, and Welding End*

ASME B16.47-2006, *Large Diameter Steel Flanges : NPS 26 Through NPS 60 Metric/Inch Standard*

ASME B31.4-2006, *Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids*

ASME B31.8-2003, *Gas Transmission and Distribution Piping Systems*

ASME Boiler and Pressure Vessel Code, Section V: *Nondestructive Examination*

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1) American Society of Mechanical Engineers International, 345 East 47th Street, NY 10017-2392, USA

ASME Boiler and Pressure Vessel Code — Section VIII: *Rules for Construction of Pressure Vessels* Division 1, *Rules for Construction of Pressure Vessels*

ASME Boiler and Pressure Vessel Code — Section VIII: *Rules for Construction of Pressure Vessels* Division 2: *Alternative Rules*

ASME Boiler and Pressure Vessel Code — Section IX: *Welding and Brazing Qualifications*

ASNT SNT-TC-1A[2)], *Recommended Practice No. SNT-TC-1A — Personnel Qualification and Certification in Non-Destructive Testing*

ASTM A320[3)], *Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low-Temperature Service*

ASTM A370, *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*

ASTM A388, *Standard Practice for Ultrasonic Examination of Heavy Steel Forgings*

ASTM A435, *Standard Specification for Straight-Beam Ultrasonic Examination of Steel Plates*

ASTM A577, *Standard Specification for Ultrasonic Angle-Beam Examination of Steel Plates*

AWS QC1[4)], *Standard for AWS Certification of Welding Inspectors*

EN 287-1[5)], *Qualification test of welders — Fusion welding — Part 1: Steels*

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

EN 10204:2004, *Metallic products — Type of inspection documents*

MSS SP-44, *Steel Pipeline Flanges*

MSS SP-55, *Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components — Visual Method for Evaluation of Surface Irregularities*

NACE TM0177-2005, *Standard test method. Laboratory testing of metals for resistance to specific forms of environmental cracking in* H_2S *environments*

NACE TM0284, *Standard Test Method — Evaluation of Pipeline and Pressure Vessel Steels for Resistance to Hydrogen-Induced Cracking*

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2) American Society of Non-Destructive Testing, P.O. Box 28518, 1711 Arlingate Lane, Columbus, OH 43228-0518, USA.

3) ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA.

4) The American Welding Society, 550 NW LeJeune Road, Miami, FL 33126, USA.

5) CEN, European Committee for Standardization, Central Secretariat, Rue de Stassart 36, B-1050, Brussels, Belgium.

4 Terms and definitions

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

4.1
ASME rating class
numerical pressure design class defined in ASME B16.34 and used for reference purposes

NOTE The ASME rating class is designated by the word “class” followed by a number.

4.2
bi-directional valve
valve designed for blocking the fluid in both downstream and upstream directions

4.3
bleed
drain or vent

4.4
block valve
gate, plug or ball valve that blocks flow into the downstream conduit when in the closed position

NOTE Valves are either single- or double-seated, bi-directional or uni-directional.

4.5
breakaway thrust
breakaway torque
maximum thrust or torque required to operate a valve at maximum pressure differential

4.6
by agreement
agreed between manufacturer and purchaser

4.7
double-block-and-bleed valve
DBB
single valve with two seating surfaces that, in the closed position, provides a seal against pressure from both ends of the valve with a means of venting/bleeding the cavity between the seating surfaces

NOTE This valve does not provide positive double isolation when only one side is under pressure. See **double-isolation-and-bleed valve** (4.8).

4.8
double-isolation-and-bleed valve
DIB
single valve with two seating surfaces, each of which, in the closed position, provides a seal against pressure from a single source, with a means of venting/bleeding the cavity between the seating surfaces

NOTE This feature can be provided in one direction or in both directions.

4.9
drive train
all parts of a valve drive between the operator and the obturator, including the obturator but excluding the operator

4.10
flow coefficient
K_v
volumetric flow rate of water at a temperature between 5 °C (40 °F) and 40 °C (104 °F) passing through a valve and resulting in a pressure loss of 0,1 MPa (1 bar; 14.5 psi)

NOTE K_v is expressed in SI units of cubic metres per hour.

NOTE K_v is related to the flow coefficient C_v , expressed in USC units of US gallons per minute at 15,6 °C (60 °F) resulting in a 1 psi pressure drop as given by Equation (1):

$$K_v = \frac{C_v}{1{,}156} \qquad (1)$$

4.11
full-opening valve
valve with an unobstructed opening, not smaller than the internal bore of the end connections

4.12
handwheel
wheel consisting of a rim connected to a hub, for example by spokes, and used to manually operate a valve requiring multiple turns

4.13
locking device
part or an arrangement of parts for securing a valve in the open and/or closed position

4.14
manual actuator
manual operator
wrench (lever) or hand-wheel with or without a gearbox

4.15
maximum pressure differential
MPD
maximum difference between the upstream and downstream pressure across the obturator at which the obturator may be operated

4.16
nominal pipe size
NPS
numerical imperial designation of size which is common to components in piping systems of any one size

NOTE Nominal pipe size is designated by the abbreviation “NPS” followed by a number.

4.17
nominal pressure class
PN
numerical pressure design class as defined in ISO 7268 and used for reference purposes

NOTE Nominal pressure (PN) class is designated by the abbreviation “PN” followed by a number.

4.18
nominal size
DN
numerical metric designation of size that is common to components in piping systems of any one size

NOTE Nominal size is designated by the abbreviation “DN” followed by a number.

4.19
obturator
closure member
part of a valve, such as a ball, clapper, disc, gate or plug that is positioned in the flow stream to permit or prevent flow

4.20
operator
device (or assembly) for opening or closing a valve

4.21
packing gland
component used to compress the stem packing

4.22
position indicator
device to show the position of the valve obturator

4.23
piggability
capability of a valve to permit the unrestricted passage of a pig

4.24
powered actuator
powered operator
electric, hydraulic or pneumatic device bolted or otherwise attached to the valve for powered opening and closing of the valve

4.25
pressure class
numerical pressure design class expressed in accordance with either the nominal pressure (PN) class or the ASME rating class

NOTE In this International Standard, the pressure class is stated by the PN class followed by the ASME rating class between brackets.

4.26
pressure-containing parts
parts, whose failure to function as intended results in a release of contained fluid into the environment

4.27
pressure-controlling parts
parts, such as seat and obturator, intended to prevent or permit the flow of fluids

4.28
process-wetted parts
parts exposed directly to the pipeline fluid

4.29
reduced-opening valve
valve with the opening through the obturator smaller than at the end connection(s)

4.30
seating surfaces
contact surfaces of the obturator and seat which ensure valve sealing

4.31
stem
part that connects the obturator to the operator and which can consist of one or more components

4.32
stem extension assembly
assembly consisting of the stem extension and the stem extension housing

4.33
support ribs or legs
metal structure that provides a stable footing when the valve is set on a fixed base

4.34
through-conduit valve
valve with an unobstructed and continuous cylindrical opening

4.35
uni-directional valve
valve designed for blocking the flow in one direction only

4.36
unless otherwise agreed
⟨modification of the requirements of this International Standard⟩ unless the manufacturer and purchaser agree on a deviation

4.37
unless otherwise specified
⟨modification of the requirements of this International Standard⟩ unless the purchaser specifies otherwise

4.38
venturi plug valve
valve with a substantially reduced opening through the plug and a smooth transition from each full-opening end to the reduced opening

5 Symbols and abbreviated terms

5.1 Symbols

C_v flow coefficient in USC units

K_v flow coefficient in metric units

t thickness

5.2 Abbreviated terms

BM base metal

CE carbon equivalent

DBB double-block-and-bleed

DIB double isolation-and-bleed

DN nominal size

HAZ heat-affected zone

HBW Brinell hardness, tungsten ball indenter

HRC Rockwell C hardness

HV Vickers hardness

MPD maximum pressure differential

MT magnetic-particle testing

NDE non-destructive examination

NPS nominal pipe size

PN nominal pressure

PQR (weld) procedure qualification record

PT penetrant testing

PWHT post-weld heat treatment

RT radiographic testing

SMYS specified minimum yield strength

USC United States Customary (units)

UT ultrasonic testing

WM weld metal

WPS weld procedure specification

WPQ welder performance qualification

6 Valve types and configurations

6.1 Valve types

6.1.1 Gate valves

Typical configurations for gate valves with flanged and welding ends are shown, for illustration purposes only, in Figures 1 and 2.

Gate valves shall have an obturator that moves in a plane perpendicular to the direction of flow. The gate can be constructed of one piece for slab-gate valves or of two or more pieces for expanding-gate valves.

Gate valves shall be provided with a back seat or secondary stem sealing feature in addition to the primary stem seal.

6.1.2 Lubricated and non-lubricated plug valves

Typical configurations for plug valves with flanged and welding ends are shown, for illustration purposes only, in Figure 3.

Plug valves shall have a cylindrical or conical obturator that rotates about an axis perpendicular to the direction of flow.

6.1.3 Ball valves

Typical configurations for ball valves with flanged or welding ends are shown, for illustration purposes only, in Figures 4, 5 and 6.

Ball valves shall have a spherical obturator that rotates on an axis perpendicular to the direction of flow.

6.1.4 Check valves

Typical configurations for check valves are shown, for illustration purposes only, in Figures 7 to 13. Check valves can also be of the wafer, axial flow and lift type.

Check valves shall have an obturator which responds automatically to block fluid in one direction.

6.2 Valve configurations

6.2.1 Full-opening valves

Full-opening flanged-end valves shall be unobstructed in the fully opened position and shall have an internal bore as specified in Table 1. There is no restriction on the upper limit of valve bore sizes.

Full-opening through-conduit valves shall have a circular bore in the obturator that allows a sphere to pass with a nominal size not less than that specified in Table 1.

Welding-end valves can require a smaller bore at the welding end to mate with the pipe.

Valves with a non-circular opening through the obturator shall not be considered full opening.

6.2.2 Reduced-opening valves

Reduced-opening valves with a circular opening through the obturator shall be supplied with a minimum bore as follows, unless otherwise specified:

— valves DN 300 (NPS 12) and below: one size below nominal size of valve with bore according to Table 1;

— valves DN 350 (NPS 14) to DN 600 (NPS 24): two sizes below nominal size of valve with bore according to Table 1;

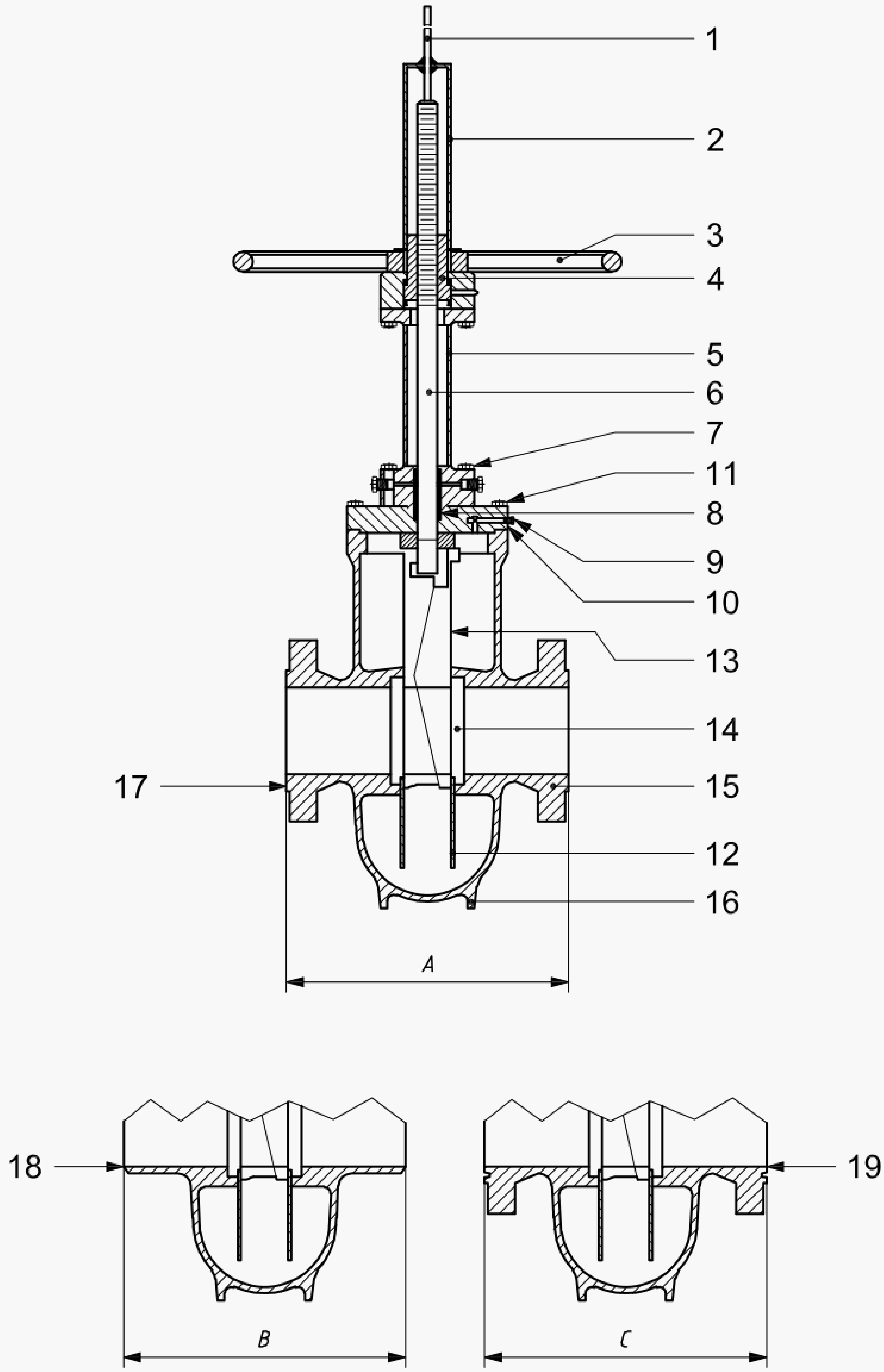
— valves above DN 600 (NPS 24): by agreement.

EXAMPLE A DN 400 (NPS 16) – PN 250 (class 1500) reduced-opening ball valve has a minimum bore of 287 mm.

Reduced-opening valves with a non-circular opening through the obturator shall be supplied with a minimum opening by agreement.

Table 1 — Minimum bore for full-opening valves

DN	NPS	Minimum bore by class mm			
		PN 20 to 100 (Class 150 to 600)	**PN 150 (Class 900)**	**PN 250 (Class 1 500)**	**PN 420 (Class 2 500)**
15	½	13	13	13	13
20	¾	19	19	19	19
25	1	25	25	25	25
32	1¼	32	32	32	32
40	1½	38	38	38	38
50	2	49	49	49	42
65	2½	62	62	62	52
80	3	74	74	74	62
100	4	100	100	100	87
150	6	150	150	144	131
200	8	201	201	192	179
250	10	252	252	239	223
300	12	303	303	287	265
350	14	334	322	315	292
400	16	385	373	360	333
450	18	436	423	406	374
500	20	487	471	454	419
550	22	538	522	500	—
600	24	589	570	546	—
650	26	633	617	594	—
700	28	684	665	641	—
750	30	735	712	686	—
800	32	779	760	730	—
850	34	830	808	775	—
900	36	874	855	819	—
950	38	925	904	—	—
1 000	40	976	956	—	—
1 050	42	1 020	1 006	—	—
1 200	48	1 166	1 149	—	—
1 350	54	1 312	—	—	—
1 400	56	1 360	—	—	—
1 500	60	1 458	—	—	—



Key

1 stem indicator
2 stem enclosure
3 handwheel
4 yoke nut
5 yoke
6 stem
7 yoke bolting
8 stem packing
9 relief valve
10 bonnet
11 bonnet bolting
12 gate guide
13 gate assembly
14 seat ring
15 body
16 support ribs or legs
17 raised face
18 welding end
19 ring joint

A raised-face face-to-face dimension
B welding-end end-to-end dimension
C ring-joint end-to-end dimension

NOTE See Tables 2 to 6 for dimensions *A*, *B* and *C*.

Figure 1 — Expanding-gate/rising-stem gate valve

Key

1 stem indicator
2 stem enclosure
3 hand-wheel
4 yoke nut
5 yoke
6 stem
7 yoke bolting
8 stem packing
9 relief valve
10 bonnet
11 bonnet bolting
12 gate
13 seat ring
14 body
15 support ribs or legs
16 raised face
17 welding end
18 ring joint

A raised-face face-to-face dimension
B welding-end end-to-end dimension
C ring-joint end-to-end dimension

NOTE See Tables 2 to 6 for dimensions *A*, *B* and *C*.

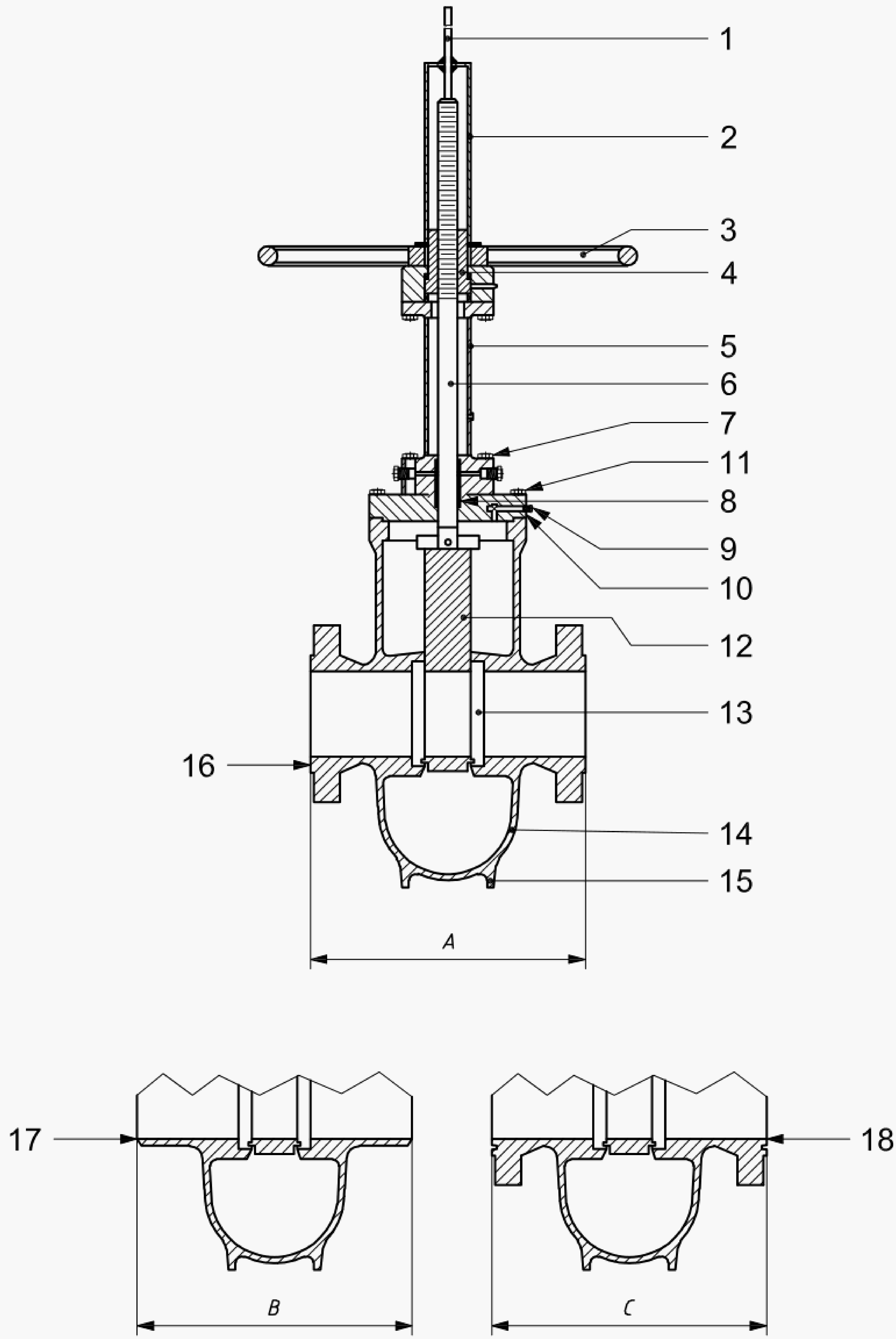
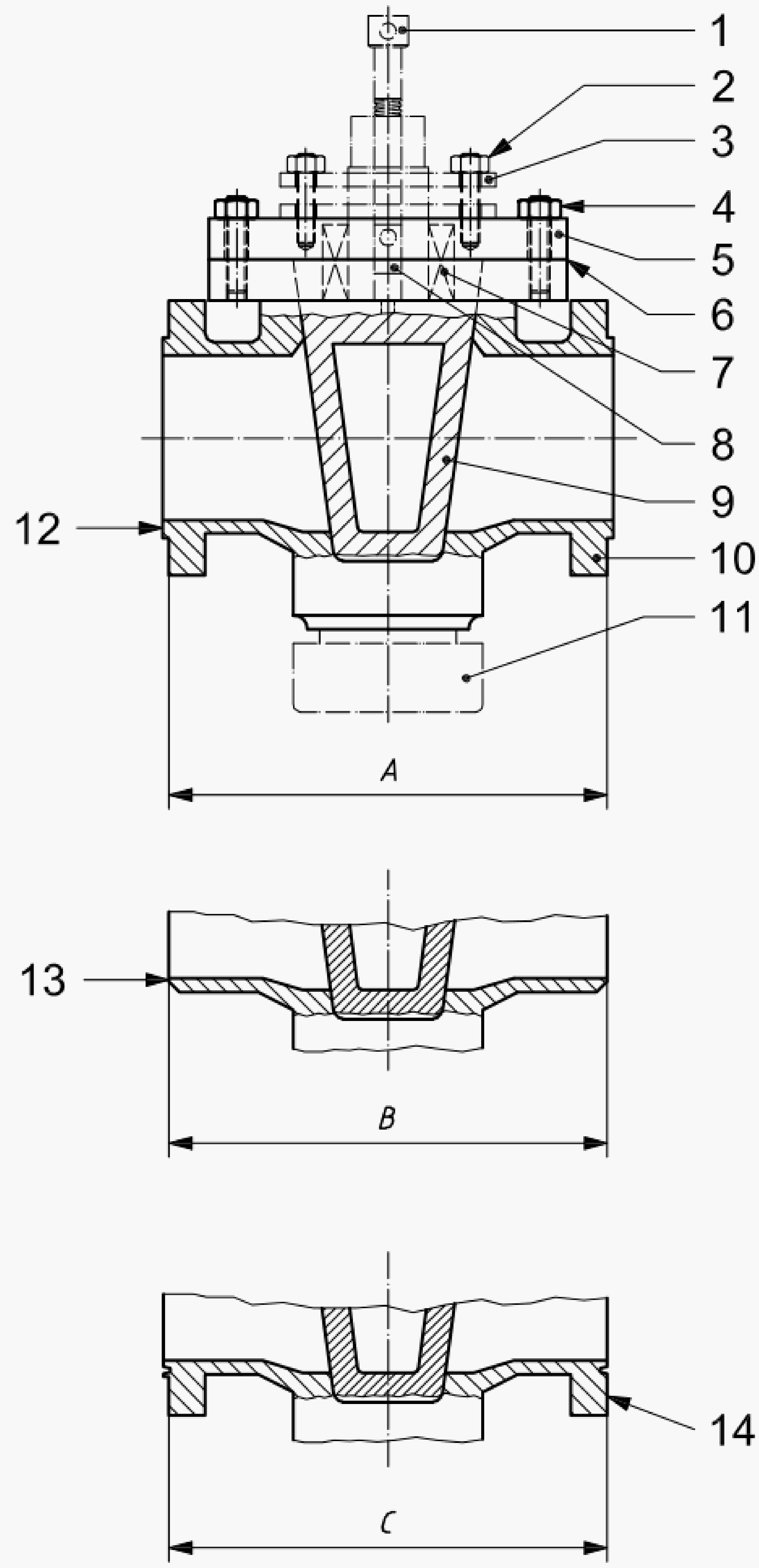


Figure 2 — Slab-gate/through-conduit rising-stem gate valve



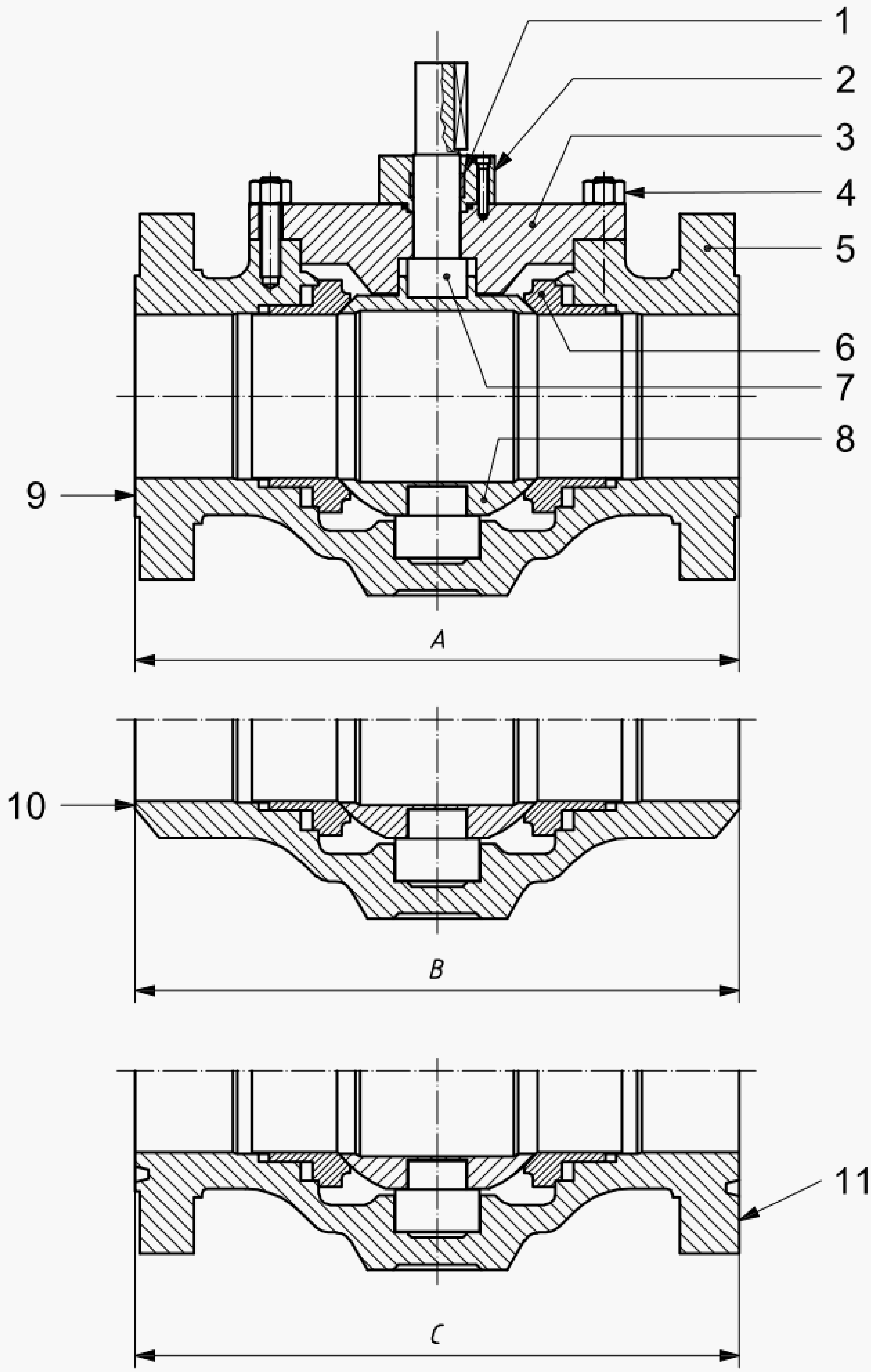
Key

1 lubricator screw
2 gland studs and nuts
3 gland
4 cover studs and nuts
5 cover
6 cover gasket
7 stem packing
8 lubricant check valve
9 plug
10 body
11 stop collar
12 raised face
13 welding end
14 ring joint

A raised-face face-to-face dimension
B welding-end end-to-end dimension
C ring-joint end-to-end dimension

NOTE See Tables 2 to 6 for dimensions *A*, *B* and *C*.

Figure 3 — Plug valve



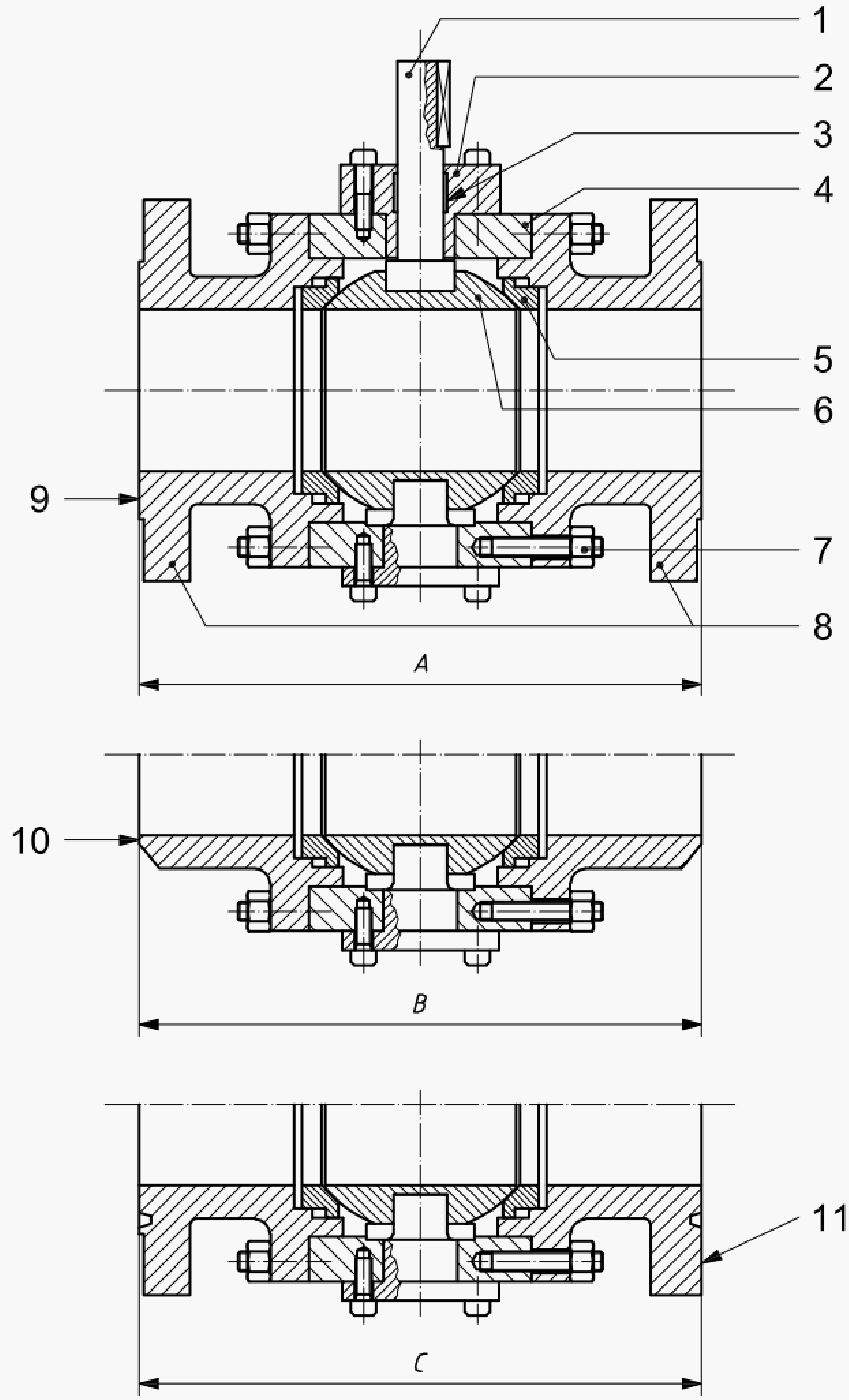
Key

1 stem seal
2 bonnet cover
3 bonnet
4 body bolting
5 body
6 seat ring
7 stem
8 ball
9 raised face
10 welding end
11 ring joint

A raised-face face-to-face dimension
B welding-end end-to-end dimension
C ring-joint end-to-end dimension

NOTE See Tables 2 to 6 for dimensions *A*, *B* and *C*.

Figure 4 — Top-entry ball valve



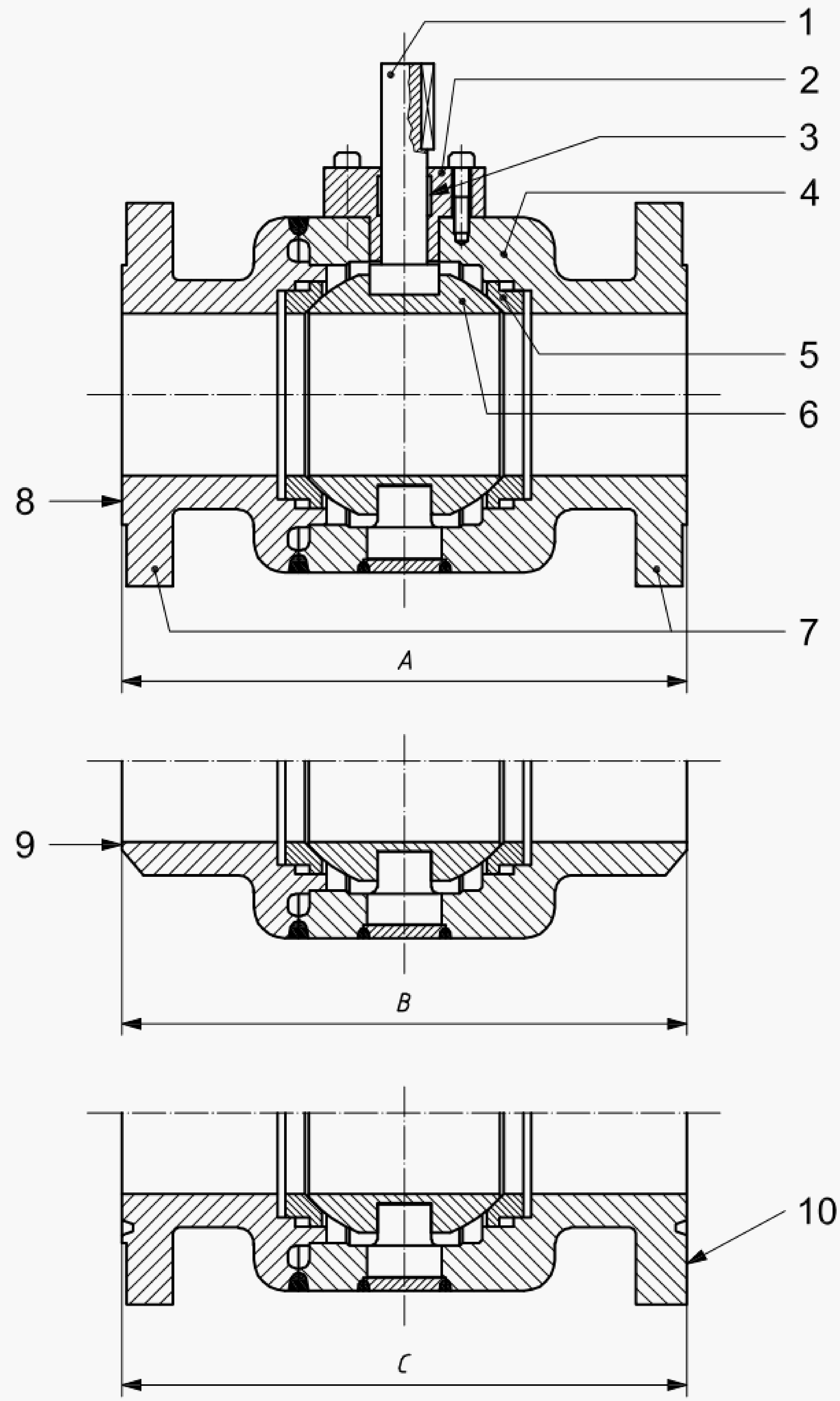
Key

1 stem
2 body cover
3 stem seal
4 body
5 seat ring
6 ball
7 body bolting
8 closure
9 raised face
10 welding end
11 ring joint

A raised-face face-to-face dimension
B welding-end end-to-end dimension
C ring-joint end-to-end dimension

NOTE See Tables 2 to 6 for dimensions *A*, *B* and *C*.

Figure 5 — Three-piece ball valve



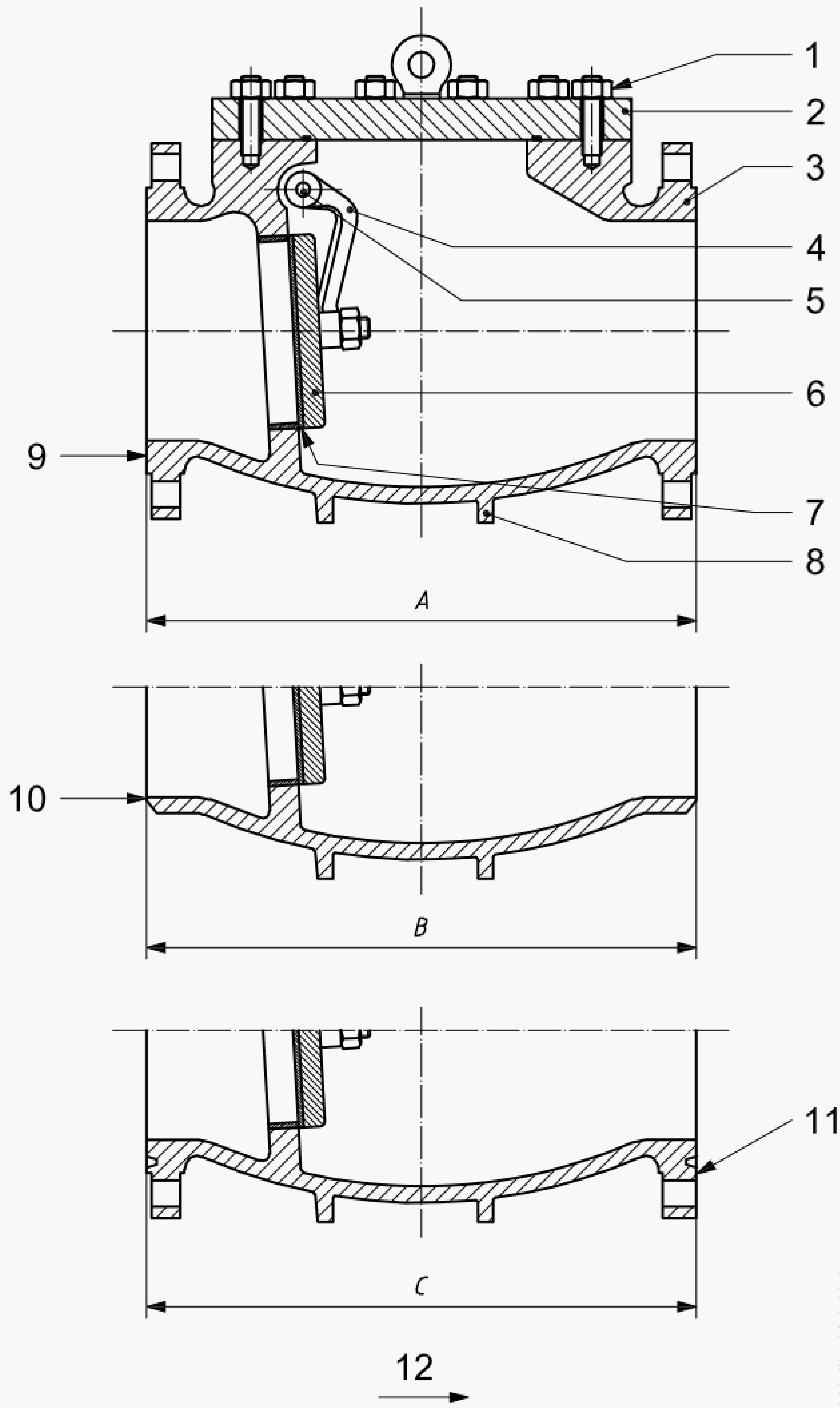
Key

1 stem
2 body cover
3 stem seal
4 body
5 seat ring
6 ball
7 closure
8 raised face
9 welding end
10 ring joint

A raised-face face-to-face dimension
B welding-end end-to-end dimension
C ring-joint end-to-end dimension

NOTE See Tables 2 to 6 for dimensions *A*, *B* and *C*.

Figure 6 — Welded-body ball valve



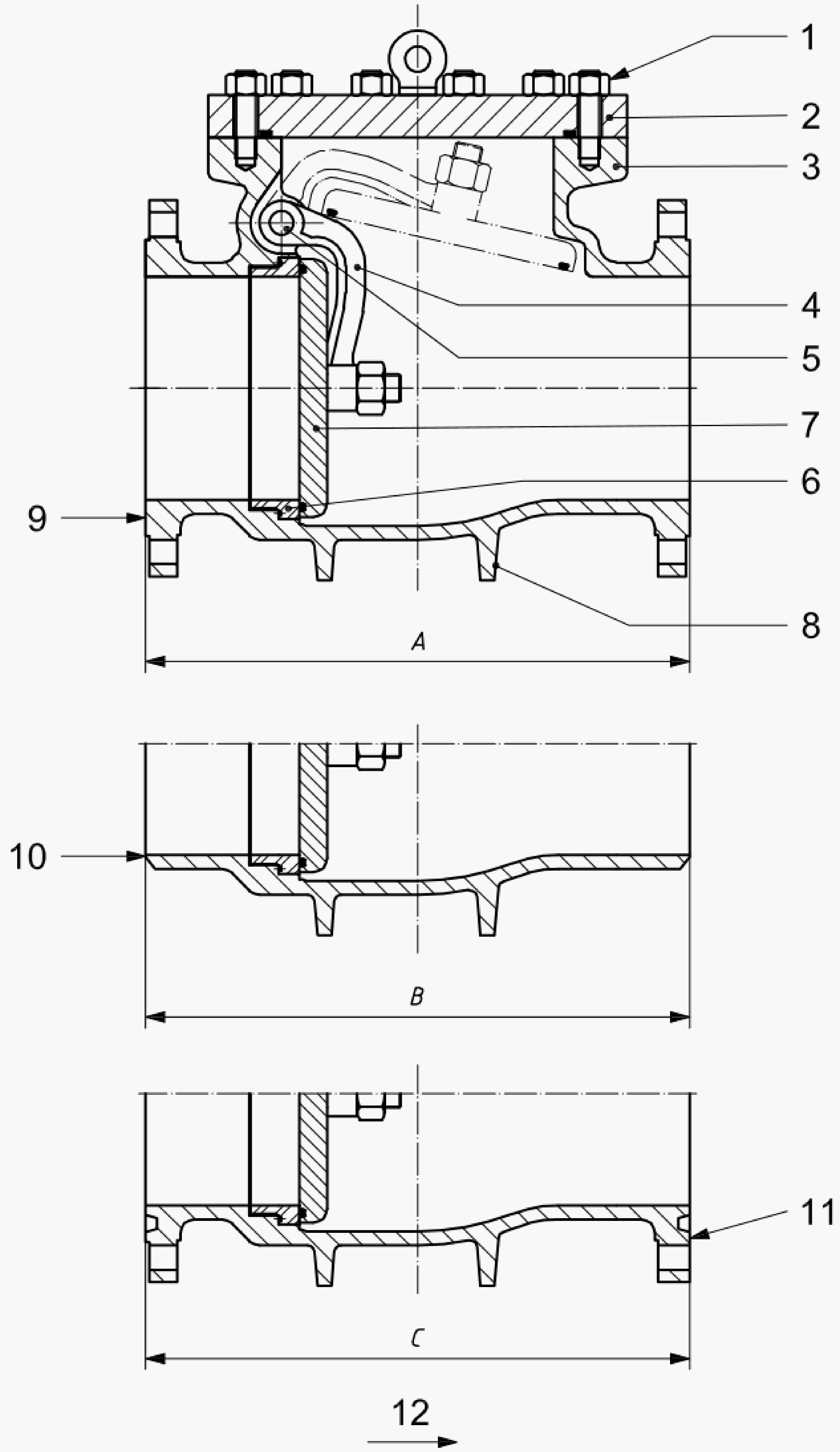
Key

1 cover bolting
2 cover
3 body
4 clapper disc arm
5 shaft
6 clapper disc
7 seat ring
8 support ribs or legs
9 raised face
10 welding end
11 ring joint
12 direction of flow

A raised-face face-to-face dimension
B welding-end end-to-end dimension
C ring-joint end-to-end dimension

NOTE See Tables 2 to 6 for dimensions *A*, *B* and *C*.

Figure 7 — Reduced-opening swing check valve



Key

1 cover bolting
2 cover
3 body
4 clapper disc arm
5 shaft
6 seat ring
7 clapper disc
8 support ribs or legs
9 raised face
10 welding end
11 ring joint
12 direction of flow

A raised-face face-to-face dimension
B welding-end end-to-end dimension
C ring-joint end-to-end dimension

NOTE See Tables 2 to 6 for dimensions *A*, *B* and *C*.

Figure 8 — Full-opening swing check valve

Key

1 body
2 hinge
3 nut
4 closure plate/stud assembly
5 seat ring
6 bearing spacers
7 hinge pin
8 hinge pin retainers
9 direction of flow

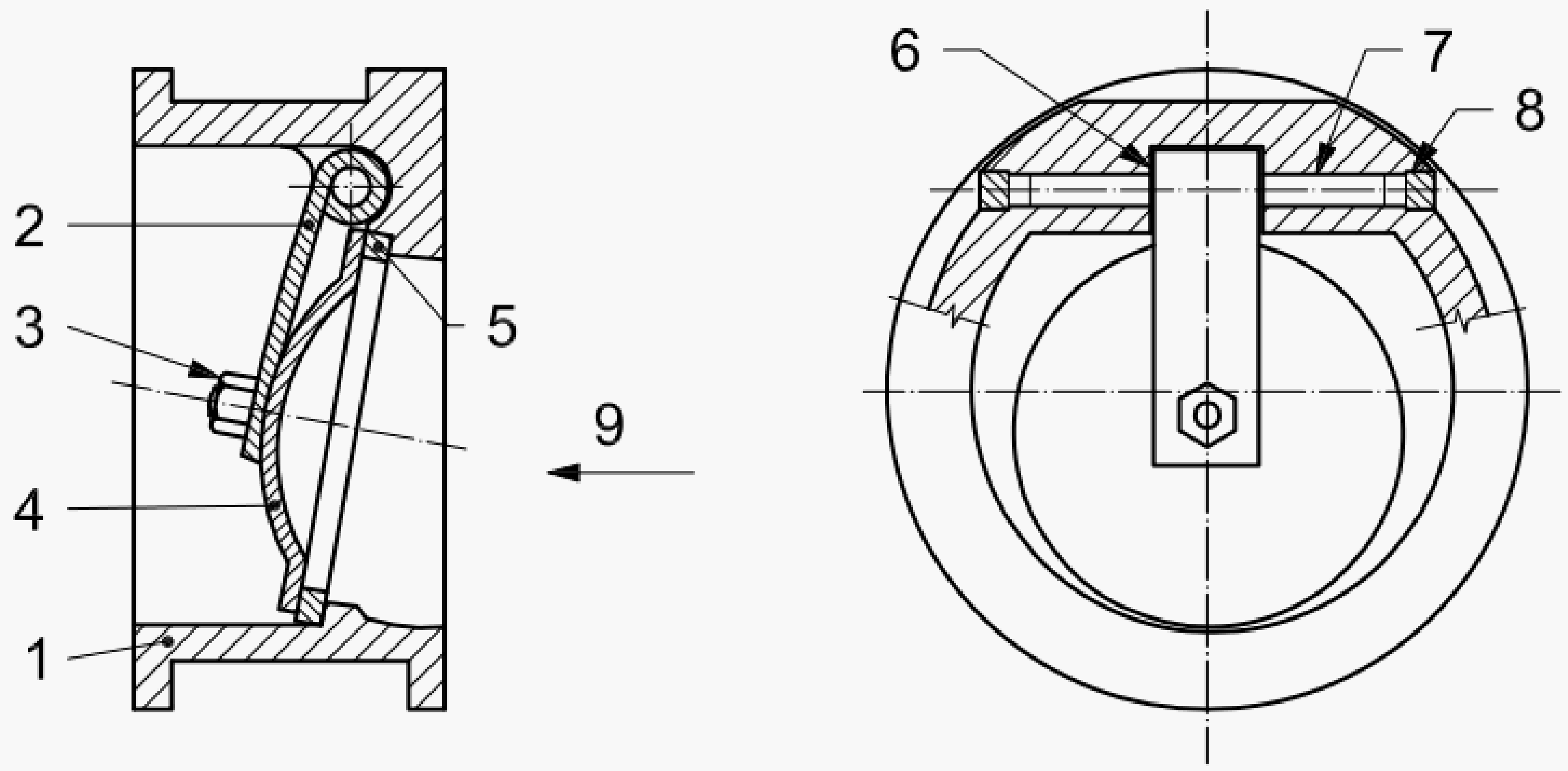
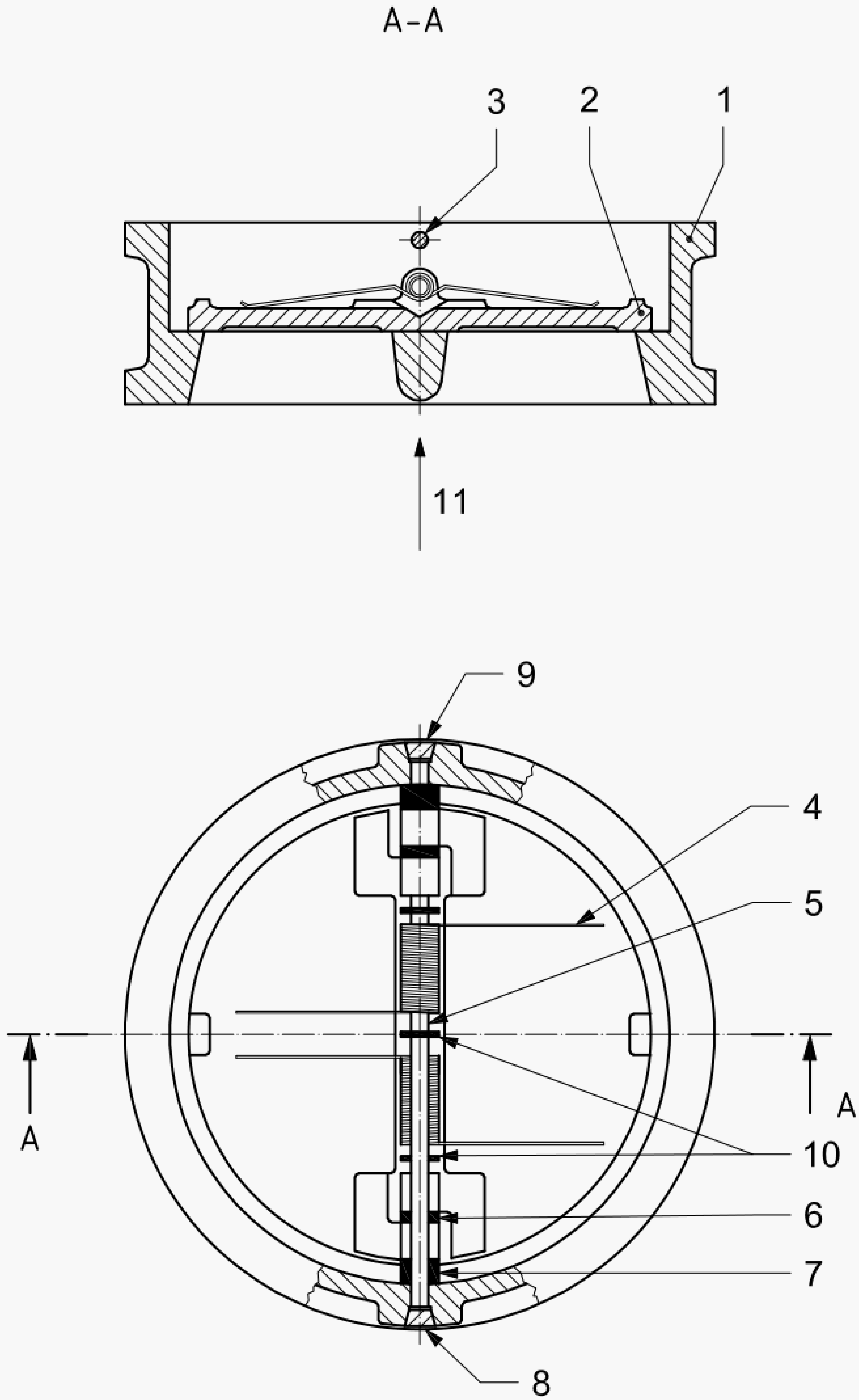


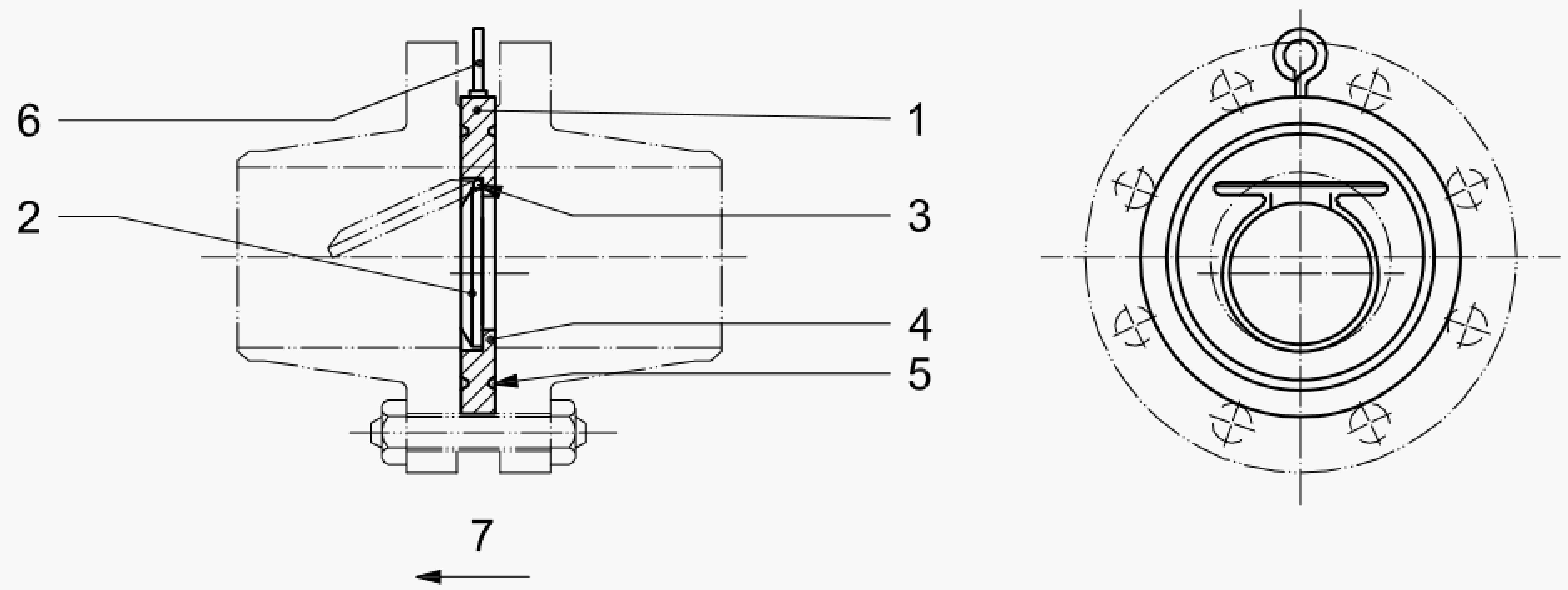
Figure 9 — Single-plate wafer-type check valve, long pattern



Key

1 body
2 closure plate
3 stop pin
4 spring
5 hinge pin
6 plate lug bearings
7 body lug bearings
8 stop pin retainers
9 hinge pin retainers
10 spring bearings
11 direction of flow

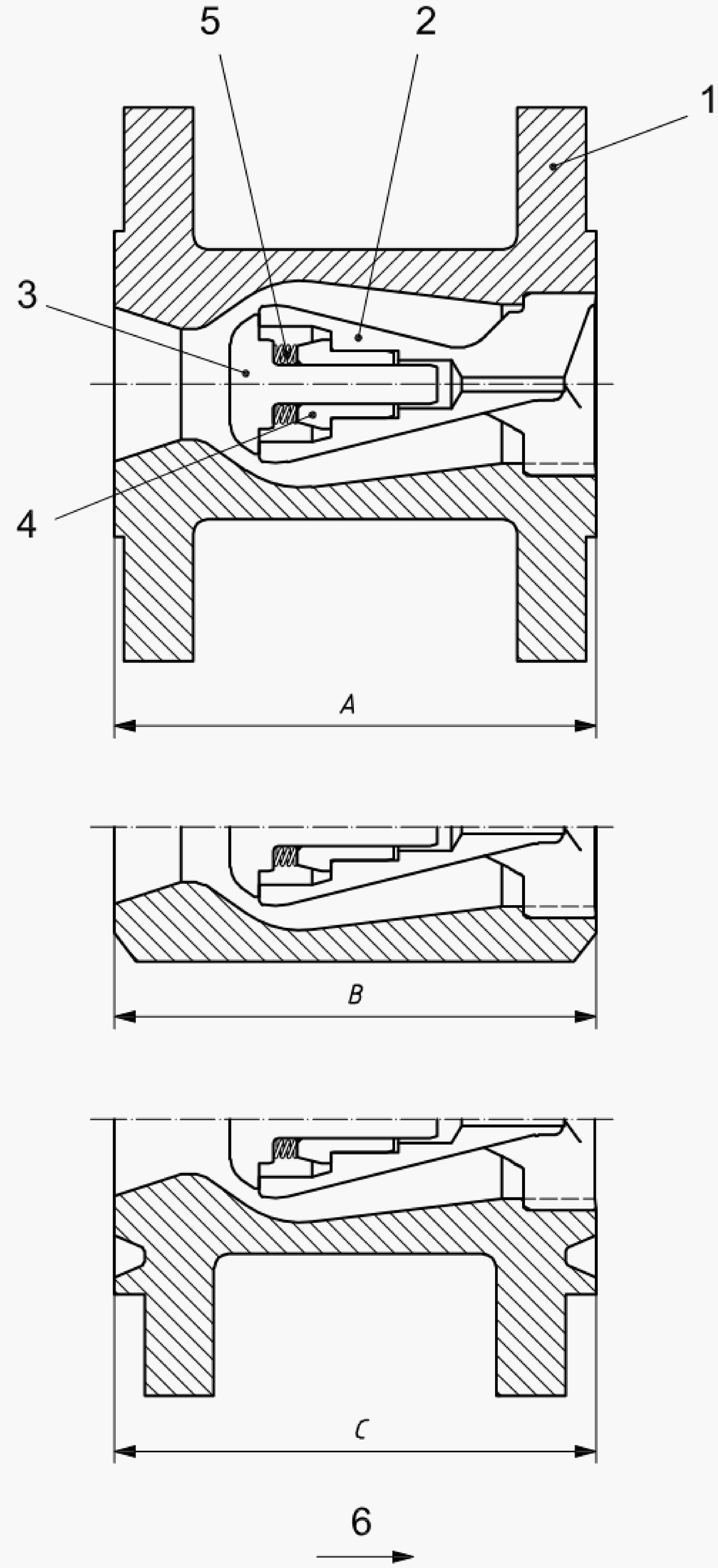
Figure 10 — Typical dual-plate wafer-type check valve, long pattern



Key

1 body
2 clapper
3 pin
4 clapper seal
5 body seal
6 lifting eye
7 direction of flow

Figure 11 — Single-plate wafer-type check valve, short pattern



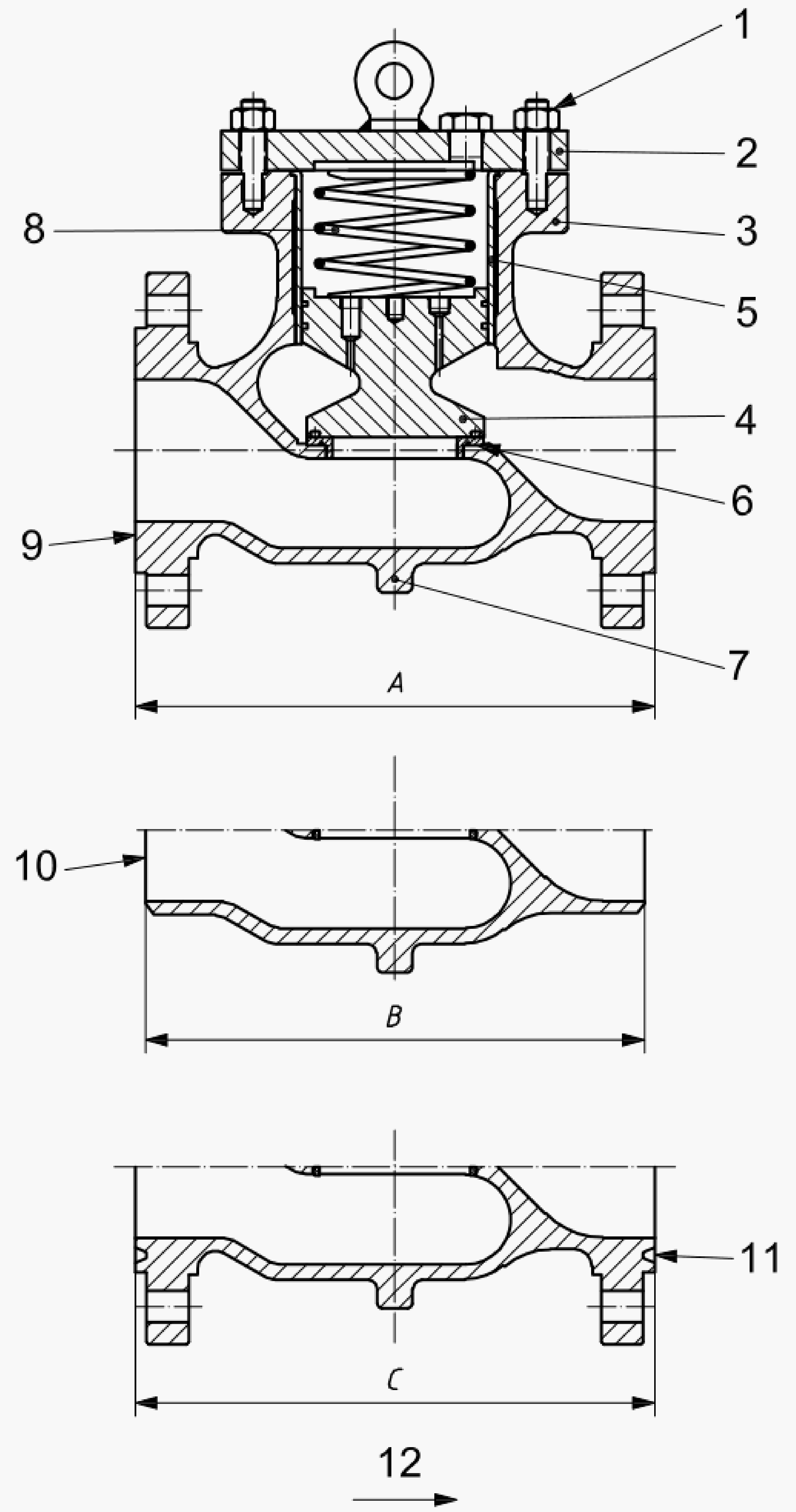
Key

1 body
2 rod guidance
3 disc
4 bearing
5 spring
6 flow direction

A raised-face face-to-face dimension
B welding-end end-to-end dimension
C ring-joint end-to-end dimension

NOTE See Tables 2 to 6 for dimensions *A*, *B* and *C*.

Figure 12 — Axial flow check valve



Key

1 cover bolting
2 cover
3 body
4 piston
5 liner
6 seat ring
7 support ribs or legs
9 raised face
10 welding end
11 ring joint
12 direction of flow

A raised-face face-to-face dimension
B welding-end end-to-end dimension
C ring-joint end-to-end dimension

NOTE See Tables 2 to 6 for dimensions *A*, *B* and *C*.

Figure 13 — Piston check valve

7 Design

7.1 Design standards and calculations

Pressure-containing parts, including bolting, shall be designed with materials specified in Clause 8.

Design and calculations for pressure-containing elements shall be in accordance with an internationally recognized design code or standard with consideration for pipe loads, operating forces, etc. The choice of standard shall be by agreement.

NOTE 1 Examples of internationally recognized design codes or standards are ASME Section VIII Division 1 or Division 2, ASME B16.34, EN 12516-1 and EN 13445-3.

The allowable stress values shall be consistent with the selected design code or standard.

If the selected design code or standard specifies a test pressure less than 1,5 times the design pressure, then the design pressure for the body calculation shall be increased such that the hydrostatic test pressure in 11.3 can be applied.

NOTE 2 Some design codes or standards require a consistent and specific application of requirements for fabrication and testing, including NDE.

7.2 Pressure and temperature rating

The nominal pressure (PN) class or the ASME rating class shall be used for the specification of the required pressure class.

Valves covered by this International Standard shall be furnished in one of the following classes:

— PN 20 (class 150);

— PN 50 (class 300);

— PN 64 (class 400);

— PN 100 (class 600);

— PN 150 (class 900);

— PN 250 (class 1500);

— PN 420 (class 2500).

Pressure-temperature ratings for class-rated valves shall be in accordance with the applicable rating table for the appropriate material group in ASME B16.34.

Pressure-temperature ratings for PN-rated valves shall be in accordance with the applicable rating table for the appropriate material group in EN 1092-1.

If intermediate design pressures and temperatures are specified by the purchaser, the pressure-temperature rating shall be determined by linear interpolation.

Pressure-temperature ratings for valves made from materials not covered by ASME B16.34 and EN 1092-1 shall be determined from the material properties in accordance with the applicable design standard.

NOTE Non-metallic parts can limit maximum pressures and minimum and maximum operating temperatures.

The maximum operating pressure at the minimum and maximum operating temperatures shall be marked on the nameplate.

7.3 Sizes

Valves constructed to this International Standard shall be furnished in nominal sizes as listed in Table 1.

NOTE In this International Standard, DN sizes are stated first followed by the equivalent NPS size between brackets.

Except for reduced-opening valves, valve sizes shall be specified by the nominal sizes (DN) or nominal pipe size (NPS).

Reduced-opening valves with a circular opening shall be specified by the nominal size of the end connections and the nominal size of the reduced opening in accordance with Table 1.

EXAMPLE 1 A DN 400 – PN 20 valve with a reduced 303 mm diameter circular opening shall be specified as DN 400 (NPS 16) × DN 300 (NPS 12).

Reduced-opening valves with a non-circular opening and reduced-opening check valves shall be designated as reduced-bore valves and specified by the nominal size corresponding to the end connections followed by the letter “R”.

EXAMPLE 2 Reduced-bore valve with DN 400 (NPS 16) end connections and a 381 mm × 305 mm rectangular opening shall be specified as 400R.

7.4 Face-to-face and end-to-end dimensions

Unless otherwise agreed, face-to-face (A) and end-to-end (B and C) dimensions of valves shall be in accordance with Tables 2 to 6; see Figures 1 to 13 for diagrams of dimensions A, B and C.

Face-to-face and end-to-end dimensions for valve sizes not specified in Tables 2 to 6 shall be in accordance with ASME B16.10. Face-to-face and end-to-end dimensions not shown in Table 2 to Table 6 or in ASME B16.10 shall be established by agreement.

The length of valves having one welding end and one flanged end shall be determined by adding half the length of a flanged-end valve to half the length of a welding-end valve.

Tolerances on the face-to-face and end-to-end dimensions shall be ± 2 mm for valve sizes DN 250 (NPS 10) and smaller, and ± 3 mm for valve sizes DN 300 (NPS 12) and larger.

The nominal size and face-to-face or end-to-end dimensions shall be stated on the nameplate if not specified in, or not in accordance with, Tables 2 to 6.

Table 2 — Gate valves — Face-to-face (*A*) and end-to-end (*B* and *C*) dimensions

DN	NPS	Dimension mm					
		Raised face *A*	Welding end *B*	Ring joint *C*	Raised face *A*	Welding end *B*	Ring joint *C*
		PN 20 (class 150)			PN 50 (class 300)		
50	2	178	216	191	216	216	232
65	2½	191	241	203	241	241	257
80	3	203	283	216	283	283	298
100	4	229	305	241	305	305	321
150	6	267	403	279	403	403	419
200	8	292	419	305	419	419	435
250	10	330	457	343	457	457	473
300	12	356	502	368	502	502	518
350	14	381	572	394	762	762	778
400	16	406	610	419	838	838	854
450	18	432	660	445	914	914	930
500	20	457	711	470	991	991	1 010
550	22	—	—	—	1 092	1 092	1 114
600	24	508	813	521	1 143	1 143	1 165
650	26	559	864	—	1 245	1 245	1 270
700	28	610	914	—	1 346	1 346	1 372
750	30	610[a]	914	—	1 397	1 397	1 422
800	32	711	965	—	1 524	1 524	1 553
850	34	762	1 016	—	1 626	1 626	1 654
900	36	711[b]	1 016	—	1 727	1 727	1 756

Table 2 *(continued)*

DN	NPS	Dimension mm					
		Raised face *A*	Welding end *B*	Ring joint *C*	Raised face *A*	Welding end *B*	Ring joint *C*
		PN 64 (class 400)			PN 100 (class 600)		
50	2	292	292	295	292	292	295
65	2½	330	330	333	330	330	333
80	3	356	356	359	356	356	359
100	4	406	406	410	432	432	435
150	6	495	495	498	559	559	562
200	8	597	597	600	660	660	664
250	10	673	673	676	787	787	791
300	12	762	762	765	838	838	841
350	14	826	826	829	889	889	892
400	16	902	902	905	991	991	994
450	18	978	978	981	1 092	1 092	1 095
500	20	1 054	1 054	1 060	1 194	1 194	1 200
550	22	1 143	1 143	1 153	1 295	1 295	1 305
600	24	1 232	1 232	1 241	1 397	1 397	1 407
650	26	1 308	1 308	1 321	1 448	1 448	1 461
700	28	1 397	1 397	1 410	1 549	1 549	1 562
750	30	1 524	1 524	1 537	1 651	1 651	1 664
800	32	1 651	1 651	1 667	1 778	1 778	1 794
850	34	1 778	1 778	1 794	1 930	1 930	1 946
900	36	1 880	1 880	1 895	2 083	2 083	2 099

Table 2 *(continued)*

DN	NPS	Dimension mm					
		Raised face *A*	Welding end *B*	Ring joint *C*	Raised face *A*	Welding end *B*	Ring joint *C*
		PN 150 (class 900)			PN 250 (class 1500)		
50	2	368	368	371	368	368	371
65	2½	419	419	422	419	419	422
80	3	381	381	384	470	470	473
100	4	457	457	460	546	546	549
150	6	610	610	613	705	705	711
200	8	737	737	740	832	832	841
250	10	838	838	841	991	991	1 000
300	12	965	965	968	1 130	1 130	1 146
350	14	1 029	1 029	1 038	1 257	1 257	1 276
400	16	1 130	1 130	1 140	1 384	1 384	1 407
450	18	1 219	1 219	1 232	1 537	1 537	1 559
500	20	1 321	1 321	1 334	1 664	1 664	1 686
550	22	—	—	—	—	—	—
600	24	1 549	1 549	1 568	1 943	1 943	1 972
		PN 420 (class 2500)					
50	2	451	451	454			
65	2½	508	508	514			
80	3	578	578	584			
100	4	673	673	683			
150	6	914	914	927			
200	8	1 022	1 022	1 038			
250	10	1 270	1 270	1 292			
300	12	1 422	1 422	1 445			

[a] Through-conduit valves shall be 660 mm.

[b] Through-conduit valves shall be 813 mm.

Table 3 — Plug valves — Face-to-face (A) and end-to-end (B and C) dimensions

DN	NPS	Dimension mm											
		Short-pattern			Regular-pattern			Venturi-pattern			Round-port, full-bore		
		Raised face A	Welding end B	Ring joint C	Raised face A	Welding end B	Ring joint C	Raised face A	Welding end B	Ring joint C	Raised face A	Welding end B	Ring joint C
		PN 20 (class 150)											
50	2	178	267	191	—	—	—	—	—	—	267	—	279
65	2½	191	305	203	—	—	—	—	—	—	298	—	311
80	3	203	330	216	—	—	—	—	—	—	343	—	356
100	4	229	356	241	—	—	—	—	—	—	432	—	445
150	6	267	457	279	394	—	406	—	—	—	546	—	559
200	8	292	521	305	457	—	470	—	—	—	622	—	635
250	10	330	559	343	533	—	546	533	559	546	660	—	673
300	12	356	635	368	610	—	622	610	635	622	762	—	775
350	14	—	—	—	—	—	—	686	686	699	—	—	—
400	16	—	—	—	—	—	—	762	762	775	—	—	—
450	18	—	—	—	—	—	—	864	864	876	—	—	—
500	20	—	—	—	—	—	—	914	914	927	—	—	—
600	24	—	—	—	—	—	—	1 067	1 067	1 080	—	—	—
		PN 50 (class 300)											
50	2	216	267	232	—	—	—	—	—	—	283	283	298
65	2½	241	305	257	—	—	—	—	—	—	330	330	346
80	3	283	330	298	—	—	—	—	—	—	387	387	403
100	4	305	356	321	—	—	—	—	—	—	457	457	473
150	6	403	457	419	403	—	419	403	457	419	559	559	575
200	8	419	521	435	502	—	518	419	521	435	686	686	702
250	10	457	559	473	568	—	584	457	559	473	826	826	841
300	12	502	635	518	—	—	—	502	635	518	965	965	981
350	14	—	—	—	—	—	—	762	762	778	—	—	—
400	16	—	—	—	—	—	—	838	838	854	—	—	—
450	18	—	—	—	914	—	930	914	914	930	—	—	—
500	20	—	—	—	991	—	1 010	991	991	1 010	—	—	—
550	22	—	—	—	1 092	—	1 114	1 092	1 092	1 114	—	—	—
600	24	—	—	—	1 143	—	1 165	1 143	1 143	1 165	—	—	—
650	26	—	—	—	1 245	—	1 270	1 245	1 245	1 270	—	—	—
700	28	—	—	—	1 346	—	1 372	1 346	1 346	1 372	—	—	—
750	30	—	—	—	1 397	—	1 422	1 397	1 397	1 422	—	—	—
800	32	—	—	—	1 524	—	1 553	1 524	1 524	1 553	—	—	—
850	34	—	—	—	1 626	—	1 654	1 626	1 626	1 654	—	—	—
900	36	—	—	—	1 727	—	1 756	1 727	1 727	1 756	—	—	—

Table 3 (*continued*)

DN	NPS	Dimension mm											
		Short-pattern			Regular-pattern			Venturi-pattern			Round-port, full-bore		
		Raised face *A*	Welding end *B*	Ring joint *C*	Raised face *A*	Welding end *B*	Ring joint *C*	Raised face *A*	Welding end *B*	Ring joint *C*	Raised face *A*	Welding end *B*	Ring joint *C*
		PN 64 (class 400)											
50	2	—	—	—	292	292	295	—	—	—	330	—	333
65	2½	—	—	—	330	330	333	—	—	—	381	—	384
80	3	—	—	—	356	356	359	—	—	—	445	—	448
100	4	—	—	—	406	406	410	—	—	—	483	559	486
150	6	—	—	—	495	495	498	495	495	498	610	711	613
200	8	—	—	—	597	597	600	597	597	600	737	845	740
250	10	—	—	—	673	673	676	673	673	676	889	889	892
300	12	—	—	—	762	762	765	762	762	765	1 016	1 016	1 019
350	14	—	—	—	—	—	—	826	826	829	—	—	—
400	16	—	—	—	—	—	—	902	902	905	—	—	—
450	18	—	—	—	—	—	—	978	978	981	—	—	—
500	20	—	—	—	—	—	—	1 054	1 054	1 060	—	—	—
550	22	—	—	—	—	—	—	1 143	1 143	1 159	—	—	—
600	24	—	—	—	—	—	—	1 232	1 232	1 241	—	—	—
650	26	—	—	—	—	—	—	1 308	1 308	1 321	—	—	—
700	28	—	—	—	—	—	—	1 397	1 397	1 410	—	—	—
750	30	—	—	—	—	—	—	1 524	1 524	1 537	—	—	—
800	32	—	—	—	—	—	—	1 651	1 651	1 667	—	—	—
850	34	—	—	—	—	—	—	1 778	1 778	1 794	—	—	—
900	36	—	—	—	—	—	—	1 880	1 880	1 895	—	—	—

Table 3 *(continued)*

DN	NPS	Dimension mm								
		Regular-pattern			Venturi-pattern			Round-port, full-bore		
		Raised face *A*	Welding end *B*	Ring joint *C*	Raised face *A*	Welding end *B*	Ring joint *C*	Raised face *A*	Welding end *B*	Ring joint *C*
		PN 100 (class 600)								
50	2	292	292	295	—	—	—	330	—	333
65	2½	330	330	333	—	—	—	381	—	384
80	3	356	356	359	—	—	—	445	—	448
100	4	432	432	435	—	—	—	508	559	511
150	6	559	559	562	559	559	562	660	711	664
200	8	660	660	664	660	660	664	794	845	797
250	10	787	787	791	787	787	791	940	1 016	943
300	12	—	—	—	838	838	841	1 067	1 067	1 070
350	14	—	—	—	889	889	892	—	—	—
400	16	—	—	—	991	991	994	—	—	—
450	18	—	—	—	1 092	1 092	1 095	—	—	—
500	20	—	—	—	1 194	1 194	1 200	—	—	—
550	22	—	—	—	1 295	1 295	1 305	—	—	—
600	24	—	—	—	1 397	1 397	1 407	—	—	—
650	26	—	—	—	1 448	1 448	1 461	—	—	—
750	30	—	—	—	1 651	1 651	1 664	—	—	—
800	32	—	—	—	1 778	1 778	1 794	—	—	—
850	34	—	—	—	1 930	1 930	1 946	—	—	—
900	36	—	—	—	2 083	2 083	2 099	—	—	—
		PN 150 (class 900)								
50	2	368	—	371	—	—	—	381	—	384
65	2½	419	—	422	—	—	—	432	—	435
80	3	381	381	384	—	—	—	470	—	473
100	4	457	457	460	—	—	—	559	—	562
150	6	610	610	613	610	610	613	737	—	740
200	8	737	737	740	737	737	740	813	—	816
250	10	838	838	841	838	838	841	965	—	968
300	12	—	—	—	965	965	968	1 118	—	1 121
400	16	—	—	—	1 130	1 130	1 140	—	—	—

Table 3 (*continued*)

DN	NPS	Dimension mm								
		Regular-pattern			Venturi-pattern			Round-port, full-bore		
		Raised face *A*	Welding end *B*	Ring joint *C*	Raised face *A*	Welding end *B*	Ring joint *C*	Raised face *A*	Welding end *B*	Ring joint *C*
		PN 250 (class 1500)								
50	2	368	—	371	—	—	—	391	—	394
65	2½	419	—	422	—	—	—	454	—	457
80	3	470	470	473	—	—	—	524	—	527
100	4	546	546	549	—	—	—	625	—	629
150	6	705	705	711	705	705	711	787	—	794
200	8	832	832	841	832	832	841	889	—	899
250	10	991	991	1 000	991	991	1 000	1 067	—	1 076
300	12	1 130	1 130	1 146	1 130	1 130	1 146	1 219	—	1 235
		PN 420 (class 2500)								
50	2	451	—	454	—	—	—	—	—	—
65	2½	508	—	514	—	—	—	—	—	—
80	3	578	—	584	—	—	—	—	—	—
100	4	673	—	683	—	—	—	—	—	—
150	6	914	—	927	—	—	—	—	—	—
200	8	1 022	—	1 038	—	—	—	—	—	—
250	10	1 270	—	1 292	—	—	—	—	—	—
300	12	1 422	—	1 445	—	—	—	—	—	—

Table 4 — Ball valves — Face-to-face (*A*) and end-to-end (*B* and *C*) dimensions

DN	NPS	Dimension mm					
		Full-bore and reduced-bore			Short-pattern, full-bore and reduced-bore		
		Raised face *A*	Welding end *B*	Ring joint *C*	Raised face *A*	Welding end *B*	Ring joint *C*
		PN 20 (class 150)					
50	2	178	216	191	—	—	—
65	2½	191	241	203	—	—	—
80	3	203	283	216	—	—	—
100	4	229	305	241	—	—	—
150	6	394	457	406	267	403	279
200	8	457	521	470	292	419	305
250	10	533	559	546	330	457	343
300	12	610	635	622	356	502	368
350	14	686	762	699	—	—	—
400	16	762	838	775	—	—	—
450	18	864	914	876	—	—	—
500	20	914	991	927	—	—	—
550	22	—	—	—	—	—	—
600	24	1 067	1 143	1 080	—	—	—
650	26	1 143	1 245	—	—	—	—
700	28	1 245	1 346	—	—	—	—
750	30	1 295	1 397	—	—	—	—
800	32	1 372	1 524	—	—	—	—
850	34	1 473	1 626	—	—	—	—
900	36	1 524	1 727	—	—	—	—
950	38	—	—	—	—	—	—
1 000	40	—	—	—	—	—	—
1 100	42	—	—	—	—	—	—
1 200	48	—	—	—	—	—	—
1 400	54	—	—	—	—	—	—
1 500	60	—	—	—	—	—	—

Table 4 (*continued*)

DN	NPS	Dimension mm					
		Full-bore and reduced-bore			Short-pattern, full-bore and reduced-bore		
		Raised face *A*	Welding end *B*	Ring joint *C*	Raised face *A*	Welding end *B*	Ring joint *C*
		PN 50 (class 300)					
50	2	216	216	232	—	—	—
65	2½	241	241	257	—	—	—
80	3	283	283	298	—	—	—
100	4	305	305	321	—	—	—
150	6	457	457	419	—	—	—
200	8	502	521	518	419	419	435
250	10	568	559	584	457	457	473
300	12	648	635	664	502	502	518
350	14	762	762	778	—	—	—
400	16	838	838	854	—	—	—
450	18	914	914	930	—	—	—
500	20	991	991	1 010	—	—	—
550	22	1 092	1 092	1 114	—	—	—
600	24	1 143	1 143	1 165	—	—	—
650	26	1 245	1 245	1 270	—	—	—
700	28	1 346	1 346	1 372	—	—	—
750	30	1 397	1 397	1 422	—	—	—
800	32	1 524	1 524	1 553	—	—	—
850	34	1 626	1 626	1 654	—	—	—
900	36	1 727	1 727	1 756	—	—	—
950	38	—	—	—	—	—	—
1 000	40	—	—	—	—	—	—
1 100	42	—	—	—	—	—	—
1 200	48	—	—	—	—	—	—
1 400	54	—	—	—	—	—	—
1 500	60	—	—	—	—	—	—

Table 4 (*continued*)

DN	NPS	Dimension mm					
		Full-bore and reduced-bore			Full-bore and reduced-bore		
		Raised face *A*	Welding end *B*	Ring joint *C*	Raised face *A*	Welding end *B*	Ring joint *C*
		PN 64 (class 400)			PN 100 (class 600)		
50	2	—	—	—	292	292	295
65	2½	—	—	—	330	330	333
80	3	—	—	—	356	356	359
100	4	406	406	410	432	432	435
150	6	495	495	498	559	559	562
200	8	597	597	600	660	660	664
250	10	673	673	676	787	787	791
300	12	762	762	765	838	838	841
350	14	826	826	829	889	889	892
400	16	902	902	905	991	991	994
450	18	978	978	981	1 092	1 092	1 095
500	20	1 054	1 054	1 060	1 194	1 194	1 200
550	22	1 143	1 143	1 153	1 295	1 295	1 305
600	24	1 232	1 232	1 241	1 397	1 397	1 407
650	26	1 308	1 308	1 321	1 448	1 448	1 461
700	28	1 397	1 397	1 410	1 549	1 549	1 562
750	30	1 524	1 524	1 537	1 651	1 651	1 664
800	32	1 651	1 651	1 667	1 778	1 778	1 794
850	34	1 778	1 778	1 794	1 930	1 930	1 946
900	36	1 880	1 880	1 895	2 083	2 083	2 099
950	38	—	—	—	—	—	—
1 000	40	—	—	—	—	—	—
1 100	42	—	—	—	—	—	—
1 200	48	—	—	—	—	—	—

Table 4 (*continued*)

DN	NPS	Dimension mm					
		Full-bore and reduced-bore			Full-bore and reduced bore		
		Raised face *A*	Welding end *B*	Ring joint *C*	Raised face *A*	Welding end *B*	Ring joint *C*
		PN 150 (class 900)			PN 250 (class 1500)		
50	2	368	368	371	368	368	371
65	2½	419	419	422	419	419	422
80	3	381	381	384	470	470	473
100	4	457	457	460	546	546	549
150	6	610	610	613	705	705	711
200	8	737	737	740	832	832	841
250	10	838	838	841	991	991	1 000
300	12	965	965	968	1 130	1 130	1 146
350	14	1 029	1 029	1 038	1 257	1 257	1 276
400	16	1 130	1 130	1 140	1 384	1 384	1 407
450	18	1 219	1 219	1 232	1 537	—	1559
500	20	1 321	1 321	1 334	1 664	—	1686
550	22	—	—	—	—	—	—
600	24	1 549	1 549	1 568		—	1972
650	26	1 651	—	1 673	1 943		
700	28	—	—	—			
750	30	1 880	—	1 902			
800	32	—	—	—			
850	34	—	—	—			
900	36	2 286	—	2 315			
		PN 420 (class 2500)					
50	2	451	451	454			
65	2½	508	508	540			
80	3	578	578	584			
100	4	673	673	683			
150	6	914	914	927			
200	8	1 022	1 022	1 038			
250	10	1 270	1 270	1 292			
300	12	1 422	1 422	1 445			

Table 5 — Check valves, full opening and reduced types — Face-to-face (*A*) and end-to-end (*B* and *C*) dimensions

DN	NPS	Dimension mm											
		PN 20 (class 150)			PN 50 (class 300)			PN 64 (class 400)			PN 100 (class 600)		
		Raised face	Welding end	Ring joint	Raised face	Welding end	Ring joint	Raised face	Welding end	Ring joint	Raised face	Welding end	Ring joint
		A	*B*	*C*	*A*	*B*	*C*	*A*	*B*	*C*	*A*	*B*	*C*
50	2	203	203	216	267	267	283	292	292	295	292	292	295
65	2½	216	216	229	292	292	308	330	330	333	330	330	333
80	3	241	241	254	318	318	333	356	356	359	356	356	359
100	4	292	292	305	356	356	371	406	406	410	432	432	435
150	6	356	356	368	445	445	460	495	495	498	559	559	562
200	8	495	495	508	533	533	549	597	597	600	660	660	664
250	10	622	622	635	622	622	638	673	673	676	787	787	791
300	12	699	699	711	711	711	727	762	762	765	838	838	841
350	14	787	787	800	838	838	854	889	889	892	889	889	892
400	16	864	864	876	864	864	879	902	902	905	991	991	994
450	18	978	978	991	978	978	994	1 016	1 016	1 019	1 092	1 092	1 095
500	20	978	978	991	1 016	1 016	1 035	1 054	1 054	1 060	1 194	1 194	1 200
550	22	1 067	1 067	1 080	1 118	1 118	1 140	1 143	1 143	1 153	1 295	1 295	1 305
600	24	1 295	1 295	1 308	1 346	1 346	1 368	1 397	1 397	1 407	1 397	1 397	1 407
650	26	1 295	1 295	—	1 346	1 346	1 372	1 397	1 397	1 410	1 448	1 448	1 461
700	28	1 448	1 448	—	1 499	1 499	1 524	1 600	1 600	1 613	1 600	1 600	1 613
750	30	1 524	1 524	—	1 594	1 594	1 619	1 651	1 651	1 664	1 651	1 651	1 664
900	36	1 956	1 956	—	2 083	2 083	—	2 083	2 083	—	2 083	2 083	—
950	38	—	—	—	—	—	—	—	—	—	—	—	—
1 000	40	—	—	—	—	—	—	—	—	—	—	—	—
1 100	42	—	—	—	—	—	—	—	—	—	—	—	—
1 200	48	—	—	—	—	—	—	—	—	—	—	—	—
1 400	54	—	—	—	—	—	—	—	—	—	—	—	—
1 500	60	—	—	—	—	—	—	—	—	—	—	—	—

Table 5 (*continued*)

DN	NPS	Dimension mm								
		PN 150 (class 900)			PN 250 (class 1500)			PN 420 (class 2500)		
		Raised face	Welding end	Ring joint	Raised face	Welding end	Ring joint	Raised face	Welding end	Ring joint
		A	*B*	*C*	*A*	*B*	*C*	*A*	*B*	*C*
50	2	368	368	371	368	368	371	451	451	454
65	2½	419	419	422	419	419	422	508	508	514
80	3	381	381	384	470	470	473	578	578	584
100	4	457	457	460	546	546	549	673	673	683
150	6	610	610	613	705	705	711	914	914	927
200	8	737	737	740	832	832	841	1 022	1 022	1 038
250	10	838	838	841	991	991	1 000	1 270	1 270	1 292
300	12	965	965	968	1 130	1 130	1 146	1 422	1 422	1 445
350	14	1 029	1 029	1 038	1 257	1 257	1 276	—	—	—
400	16	1 130	1 130	1 140	1 384	1 384	1 407	—	—	—
450	18	1 219	1 219	1 232	1 537	1 537	1 559	—	—	—
500	20	1 321	1 321	1 334	1 664	1 664	1 686	—	—	—
600	24	1 549	1 549	1 568	1 943	1 943	1 972	—	—	—

Table 6 — Single- and dual-plate, long- and short-pattern, wafer-type check valves — Face-to-face dimensions

DN	NPS	Face-to-face dimension mm													
		PN 20 (class 150)		PN 50 (class 300)		PN 64 (class 400)		PN 100 (class 600)		PN 150 (class 900)		PN 250 (class 1500)		PN 420 (class 2500)	
		Short-pattern	Long-pattern	Short-pattern	Long-pattern	Short-pattern	Long-pattern	Short-pattern	Long-pattern	Short-pattern	Long-pattern	Short-pattern	Long-pattern	Short-pattern	Long-pattern
50	2	19	60	19	60	19	60	19	60	19	70	19	70	—	70
65	2½	19	67	19	67	19	67	19	67	19	83	19	83	—	83
80	3	19	73	19	73	19	73	19	73	19	83	22	83	—	86
100	4	19	73	19	73	22	79	22	79	22	102	32	102	—	105
150	6	19	98	22	98	25	137	29	137	35	159	44	159	—	159
200	8	29	127	29	127	32	165	38	165	44	206	57	206	—	206
250	10	29	146	38	146	51	213	57	213	57	241	73	248	—	250
300	12	38	181	51	181	57	229	60	229	—	292	—	305	—	305
350	14	44	184	51	222	64	273	67	273	—	356	—	356	—	—
400	16	51	191	51	232	64	305	73	305	—	384	—	384	—	—
450	18	60	203	76	264	83	362	83	362	—	451	—	468	—	—
500	20	64	219	83	292	89	368	92	368	—	451	—	533	—	—
600	24	—	222	—	318	—	394	—	438	—	495	—	559	—	—
750	30	—	—	—	—	—	—	—	—	—	—	—	—	—	—
900	36	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 100	42	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 200	48	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 400	54	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 500	60	—	—	—	—	—	—	—	—	—	—	—	—	—	—

7.5 Valve operation

The purchaser should specify the method of operation and the maximum pressure differential (MPD) at which the valve is required to be opened by the lever, gearbox or actuator. If not specified, the pressure as determined in accordance with 7.2 for material at 38 °C (100 °F) shall be the MPD.

The manufacturer shall provide the following data to the purchaser, if requested:

— flow coefficient C_v or K_v;

— breakaway thrust or torque for new valve;

— maximum allowable stem thrust or torque on the valve and, if applicable, the maximum allowable input torque to the gearbox;

— number of turns for manually operated valves.

7.6 Pigging

The purchaser shall specify the requirements for piggability of the valves.

NOTE Guidance can be found in Clause D.4.

7.7 Valve ends

7.7.1 Flanged ends

7.7.1.1 General

Flanges shall be furnished with a raised face or ring joint face (raised face or full face). Dimensions, tolerances and finishes, including drilling templates, flange facing, spot facing and back facing, shall be in accordance with

— ASME B16.5 for sizes up to and including DN 600 (NPS 24), except DN 550 (NPS 22),

— MSS SP-44 for DN 550 (NPS 22) and

— ASME B16.47, Series A, for DN 650 (NPS 26) and larger sizes.

If none of the above standards applies, the selection of another design code or standard shall be made by agreement.

The manufacturing method shall ensure flange alignment in accordance with 7.7.1.2, 7.7.1.3 and 7.7.1.4.

7.7.1.2 Offset of aligned flange centrelines — Lateral alignment

For valves up to and including DN 100 (NPS 4), the maximum flange misalignment shall be 2 mm (0.079 in).

For valves larger than DN 100 (NPS 4), the maximum flange misalignment shall be 3 mm (0.118 in).

7.7.1.3 Parallelism of aligned flange faces — Angular alignment

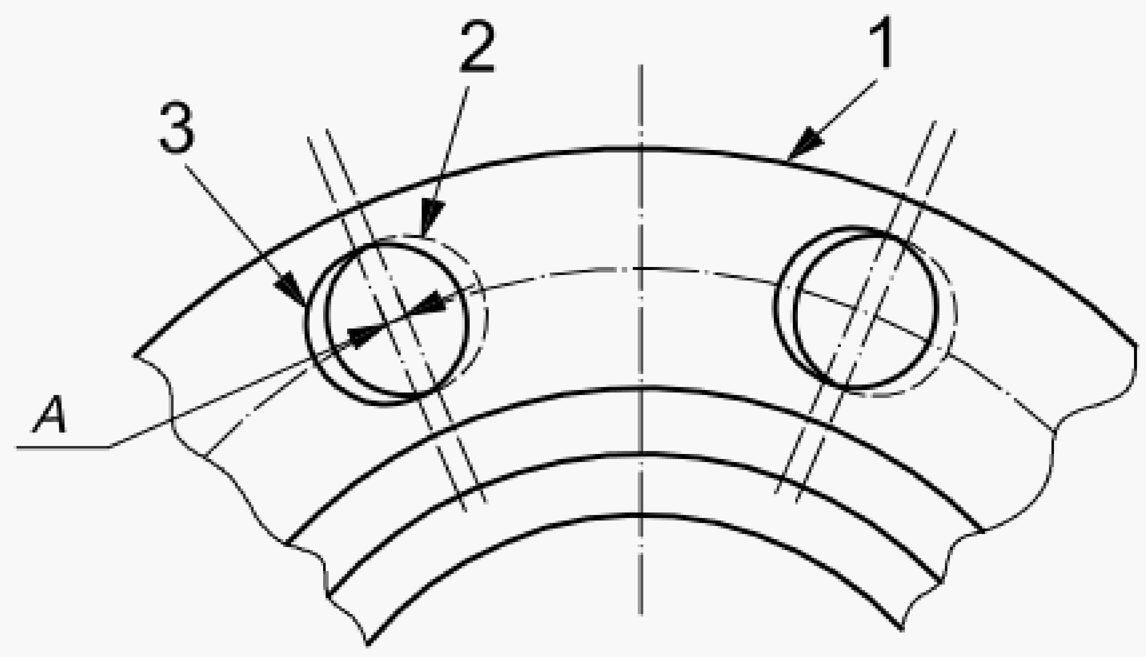
The maximum measured difference between flanges shall be 2,5 mm/m (0.03 in/ft).

7.7.1.4 Total allowable misalignment of bolt holes

For valves up to and including DN 100 (NPS 4), the maximum total allowable mismisalignment shall be no greater than 2 mm (0.079 in) at the bolt holes (see Figure 14).

For valves larger than DN 100 (NPS 4), the maximum total allowable misalignment shall be equivalent to 3 mm (0.118 in) at the bolt holes.

The surface finish of the nut bearing area at the back face of flanged valves shall be parallel to within 1° of the flange face.



Key

1 flange

2 hole in first flange

3 hole in opposite flange for alignment

A bolt-hole misalignment (see 7.7.1.4)

Figure 14 — Bolt-hole misalignment

7.7.2 Welding ends

Welding ends shall conform to ASME B31.4-2006, Figures 434.8.6 (a) (1) and (2) or ASME B31.8-2003, Figures 14 and 15, unless otherwise agreed. In the case of a heavy-wall valve body, the outside profile may be tapered at 30° and then to 45° as illustrated in ASME B16.25-2003, Figure 1.

The purchaser shall specify the outside diameter, wall thickness, material grade, SMYS and any special chemistry of the mating pipe, and whether cladding has been applied.

7.7.3 Alternate valve end connections

Other end connections can be specified by the purchaser.

7.8 Pressure relief

The manufacturer shall determine whether fluid can become trapped in the body cavity in the open- and/or closed-valve position.

If fluid trapping is possible, then valves for liquid or condensing service shall be provided with automatic cavity-pressure relief, unless otherwise agreed. Automatic cavity relief arrangements for gas service shall be provided by agreement.

Cavity relief, if required, shall prevent the pressure in the cavity from exceeding 1,33 times the valve pressure rating at the specified maximum operating temperature, determined in accordance with 7.2. External cavity relief valves shall be DN 15 (NPS ½) or larger.

If cavity relief valves are required, purchaser may specify provisions to faciliate in service testing.

7.9 Bypasses, drains and vents

Bypass, drain and vent connections and plug entries shall be drilled and threaded unless otherwise specified. The purchaser can specify other types of connections, such as welded or flanged.

WARNING — Threaded connections can be susceptible to crevice corrosion.

Thread profiles shall be tapered unless otherwise agreed. Tapered threads shall be capable of providing a seal and comply with ASME B1.20.1. If the use of parallel threads is specified, the connection shall have a head section for trapping and retaining a sealing member suitable for the specified valve service. Parallel threads shall comply with ISO 228-1.

Minimum sizes shall be in accordance with Table 7 or by agreement.

Table 7 — Thread/pipe sizes for bypass, drain and vent

Nominal size of valve		Thread/pipe size
DN	**NPS**	mm (in)
15 to 40	½ to 1½	8 (¼)
50 to 100	2 to 4	15 (½)
150 to 200	6 to 8	20 (3/4)
> 200	> 8	25 (1)

7.10 Injection points

Injection points for sealant, lubrication or flushing shall be provided for seats and/or stem if specified by the purchaser and shall incorporate a check valve and a secondary means of isolation for each injection point.

7.11 Drain, vent and sealant lines

Drain, vent and sealant lines shall be provided if specified and shall be extended by means of rigid pipework, if necessary. The lines shall be fastened to the valve and/ or extensions and terminate close to the stem extension top works, by agreement.

Drain and vent lines shall

— have a design pressure not less than the rated pressure of the valve on which they are installed;

— be capable of withstanding the hydrostatic shell test pressure of the valve;

— be designed in accordance with a recognised design code;

— be suitable for blow-down operation, where applicable.

Sealant lines shall have a design pressure not less than the greater of the pipeline valve rated pressure and the injection pressure.

The purchaser should specify the injection pressure or the pipe for use. If not specified by the purchaser, the manufacturer shall advise the maximum injection pressure for the system. The size of the sealant lines shall be by agreement. Prior to assembly, the internal bores of sealant lines shall be clean and free from rust and any foreign particles.

7.12 Drain, vent and sealant valves

Drain and vent block valves shall be provided, if specified, shall have a rated pressure not less than the valve on which they are installed and be suitable for blow-down operation. Block and check valves fitted to sealant injection lines shall be rated for the greater of the pipeline valve rated pressure and the injection pressure defined in 7.11.

7.13 Hand-wheels and wrenches — Levers

Wrenches for valves shall either be of an integral design or consist of a head which fits on the stem and is designed to take an extended handle. The head design shall allow permanent attachment of the extended section if specified by the purchaser.

The maximum force required at the hand-wheel or wrench to apply the breakaway torque or thrust shall not exceed 360 N (80 lbf).

Wrenches that are of integral design (not loose) shall not be longer than twice the face-to-face or end-to-end dimension unless otherwise agreed.

NOTE Loose wrenches are not considered part of the valve and are not required to meet the maximum length requirements.

Hand-wheel diameter(s) shall not exceed the face-to-face or end-to-end length of the valve or 1 000 mm, whichever is smaller, unless otherwise agreed. Except for valve sizes DN 40 (NPS 1½) and smaller, spokes shall not extend beyond the perimeter of the hand-wheel unless otherwise agreed.

If specified by the purchaser, the hand-wheel of the gearbox input shaft shall be provided with a torque-limiting device, such as a shear pin, to prevent damage to the drive train.

Direction of closing shall be clockwise, unless otherwise specified.

7.14 Locking devices

Valves shall be supplied with locking devices if specified by the purchaser. Locking devices for check valves shall be designed to lock the valve in the open position only.

Locking devices for other types of valve shall be designed to lock the valve in the open and/or closed position.

7.15 Position of the obturator

Except for check valves, the position of the obturator shall not be altered by dynamic forces of the passing flow or in the case of screw operated gate valves by forces generated from internal pressure.

7.16 Position indicators

Valves fitted with manual or powered actuators shall be furnished with a visible indicator to show the open and the closed position of the obturator.

For plug and ball valves, the wrench and/or the position indicator shall be in line with the pipeline when the valve is open and transverse when the valve is closed. The design shall be such that the component(s) of the indicator and/or wrench cannot be assembled to falsely indicate the valve position.

Valves without position stops shall have provision for the verification of open and closed alignment with the operator/actuator removed.

7.17 Travel stops

Travel stops shall be provided on the valve and/or operator and they shall locate the position of the obturator in the open and closed position. The travel stops shall not affect the sealing capability of the valve.

7.18 Actuator, operators and stem extensions

7.18.1 General

Actuators can be powered by electric, hydraulic or pneumatic means. The output of the actuator shall not exceed the stress limits of the valve drive train permitted by 7.20.2, unless otherwise agreed.

NOTE Typical quarter-turn valve-to-actuator interfaces are given in ISO 5211 [8].

7.18.2 Misalignment

Misalignment or improper assembly of components shall be prevented by suitable means, such as a dowel pin or fitting bolt, which ensures the correct location of manual or powered operators and stem extension assemblies.

7.18.3 Sealing

Operators, stem extensions and their interfaces shall be sealed to prevent ingress of external contaminants and moisture.

7.18.4 Overpressure protection

Operators and stem extension assemblies shall be provided with a means of preventing pressure build-up in the mechanism resulting from stem or bonnet seal leakage.

7.18.5 Protection of extended stems and shafts in below ground service

Extended stems and shafts in below-ground service shall be protected by an extension casing (housing).

7.19 Lifting

Valves of size DN 200 (NPS 8) and larger shall be provided with lifting points, unless otherwise agreed. The manufacturer shall verify suitability of the lifting points. If the valve manufacturer is responsible for the supply of the valve and operator assembly, the valve manufacturer shall verify the suitability of the lifting points for the complete valve and operator assembly.

If the purchaser is responsible for the supply of the operator assembly, the purchaser shall provide adequate information to enable the manufacturer to verify the suitability of the lifting points for the complete assembly.

NOTE Regulatory requirements can specify special design, manufacturing and certification of lifting points.

7.20 Drive trains

7.20.1 Design thrust or torque

The design thrust or torque for all drive train calculations shall be at least two times the breakaway thrust or torque.

NOTE This design factor is to allow for thrust or torque increase in service due to infrequent cycling, low-temperature operation and the adverse effect of debris.

7.20.2 Allowable stresses

Tensile stresses in drive train components, including stem extensions, shall not exceed 67 % of SMYS when delivering the design thrust or torque. Shear, torsion and bearing stresses shall not exceed the limits specified in ASME Code Section VIII, Division 2, Part AD-132, except that design stress intensity values, S_m, shall be 67 % of SMYS.

These stress limits do not apply to the components of rolling-element or other proprietary bearings or high bearing strength capable materials that are included in the drive train where manufacturer's recommendations or limits derived from tests and service experience apply. These limits shall be justified in design documents.

The drive train shall be designed such that the weakest component is outside the pressure boundary.

A strength efficiency factor of 0,75 shall be used for fillet welds.

WARNING — If an actuator or operator can deliver a thrust or torque that is greater than the design thrust or torque of the drive train, such a thrust or torque can result in permanent deformation or failure of drive train components.

7.20.3 Allowable deflections

Deflections of the extended drive train shall not prevent the obturator from reaching the fully closed or fully open position.

For all valves, attention shall be paid to deflection and strain. Adherence to the allowable stress limits of design codes alone might not result in a functionally acceptable design. The manufacturer shall demonstrate, by calculation or test, that under loads resulting from design pressure and any defined pipe or external loads, distortion of the obturator or seat does not impair functionality or sealing.

7.21 Stem retention

Valves shall be designed to ensure that the stem does not eject under any internal pressure condition or if the packing gland components and/or valve operator mounting components are removed.

7.22 Fire type-testing

If specified by the purchaser, fire type-testing certification of the design shall be provided. Fire type-testing shall be carried out in accordance with Clause D.5, unless otherwise agreed.

7.23 Anti-static device

Soft-seated valves shall have an anti-static device, unless otherwise agreed. If specified by the purchaser, valves shall be tested in accordance with Clause B.5.

7.24 Design documents

The design shall be documented in a retrievable and reproducible form.

7.25 Design document review

Design documentation shall be reviewed and verified by competent personnel other than the person who performed the original design.

8 Materials

8.1 Material specification

Specifications for metallic pressure-containing and pressure-controlling parts shall be issued by the manufacturer and shall address the following, as a minimum:

- chemical analysis;
- carbon equivalent (if applicable);
- heat treatment;
- mechanical properties including charpy impacts and hardness (if applicable);
- testing;
- certification.

Metallic pressure-containing parts shall be made of materials consistent with the pressure temperature rating as determined in accordance with 7.2. Use of other materials shall be by agreement.

8.2 Service compatibility

All process-wetted parts, metallic and non-metallic, and lubricants shall be suitable for the commissioning fluids and service specified by the purchaser. Metallic materials shall be selected so as to avoid corrosion and galling, which would impair function and/or pressure containing capability.

Selection of elastomeric materials for valves intended for hydrocarbon gas service at pressures of PN 100 (class 600) and above shall consider the effect of explosive decompression.

8.3 Forged parts

Each forging shall be hot worked and heat treated to produce uniform grain size and mechanical properties in the finished product.

8.4 Composition limits

The chemical composition of carbon steel pressure-containing and pressure-controlling parts shall be in accordance with the applicable material standards.

The chemical composition of carbon steel welding ends shall meet the following requirements unless otherwise agreed.

- The carbon content shall not exceed 0,23 % by mass.
- The sulfur content shall not exceed 0,035 % by mass.
- The phosphorus content shall not exceed 0,035 % by mass.
- The carbon equivalent, CE, shall not exceed 0,43 %.

The CE shall be calculated in accordance with Equation (2)[6]:

$$CE = \% C + \% Mn/6 + (\% Cr + \% Mo + \% V)/5 + (\% Ni + \% Cu)/15 \quad (2)$$

The chemical composition of other carbon steel parts shall be in accordance with the applicable material standards.

The carbon content of austenitic stainless steel welding ends shall not exceed 0,03 % by mass, except for stabilized material in which case a carbon content of up to 0,08 % by mass is permissible.

The chemical composition of other materials shall be established by agreement.

8.5 Toughness test requirements

All carbon, alloy steels and non-austenitic stainless steel for pressure-containing parts in valves shall meet the toughness test requirements of the applicable pipeline design standard.

All carbon, alloy steels and non-austenitic stainless steel for pressure-containing parts in valves with a specified design temperature below − 29 °C (− 20 °F) shall be impact-tested using the Charpy V-notch technique in accordance with ISO 148-1 or ASTM A370.

NOTE Design standards or local requirements can require impact testing for minimum design temperatures higher than − 29 °C (− 20 °F).

A minimum of one impact test, comprised of a set of three specimens, shall be performed on a representative test bar of each heat of the material in the final heat-treated condition.

Test specimens shall be cut from a separate or attached block taken from the same heat, reduced by forging where applicable, and heat-treated to the same heat treatment, including stress-relieving, as the product materials, except that it is not necessary to retest pressure-containing parts stress-relieved at or below a previous stress-relieving or tempering temperature.

The impact test shall be performed at the lowest temperature as defined in the applicable material specifications and pipeline design standard.

Except for material for bolting, impact test results for full-size specimens shall meet the requirements of Table 8. Where the material specification or the pipeline design standard requires impact values higher than those shown in Table 8, the higher values shall apply. Impact test results for bolting material shall meet the requirements of ASTM A320.

Table 8 — Minimum Charpy V-notch impact requirements (full-size specimen)

Specified minimum tensile strength MPa	**Average of three specimens** J	**Single specimen** J
< 586	20	16
586 to 689	27	21
> 689	34	26

6) The symbols used in this equation are not in accordance with the ISO directives for elements used in mathematical equations. However, due to its wide-spread use, a derogation has been granted to retain this equation in its original form.

8.6 Bolting

Bolting material shall be suitable for the specified valve service and pressure rating.

Carbon and low-alloy steel bolting material with a hardness exceeding HRC 34 (HBW 321) shall not be used for valve applications where hydrogen embrittlement can occur, unless otherwise agreed.

NOTE Hydrogen embrittlement can occur in buried pipelines with cathodic protection.

Hardness limits for other bolting materials shall be by agreement.

8.7 Sour service

Materials for pressure-containing and pressure-controlling parts and bolting shall meet the requirements of ISO 15156 (all parts) if sour service is specified by the purchaser.

8.8 Vent and drain connections

Threaded plugs shall be compatible with the valve body material or made from a corrosion resistant material.

9 Welding

9.1 Qualifications

Welding, including repair welding, of pressure-containing and pressure-controlling parts shall be performed in accordance with procedures qualified to ISO 15607, ISO 15609, ISO 15614-1 or ASME Section IX and 9.2 and 9.3 of this International Standard. Welders and welding operators shall be qualified in accordance with ISO 9606-1, ASME Section IX or EN 287-1.

NOTE 1 The purchaser, pipeline design standards, material specifications and/or local requirements can specify additional requirements.

The results of all qualification tests shall be documented in a PQR.

PWHT shall be performed in accordance with the relevant material specification.

NOTE 2 Some pipeline welding standards can have more stringent requirements for the essential variables of welding. It can be necessary to provide full weld test rings, in the same heat treatment condition as the finished valve, for weld procedure qualification.

9.2 Impact testing

Qualifications of procedures for welding include repair welding; pressure-containing parts shall meet the toughness test requirements of the applicable pipeline design standard.

As a minimum, impact testing shall be carried out for the qualification of procedures for welding on valves with a design temperature below − 29 °C (− 20 °F).

NOTE Design standards and/or local requirements might require impact testing at minimum design temperatures above − 29 °C (− 20 °F).

A set of three weld-metal impact specimens shall be taken from the weld metal (WM) at the location shown in Figure 15. The specimens shall be oriented with the notch perpendicular to the surface of the material.

A set of three impact specimens shall be taken from the heat-affected zone (HAZ) at the location shown in Figure 16. The notch shall be placed perpendicularly to the material surface at a location resulting in a maximum amount of HAZ material located in the resulting fracture.

HAZ tests shall be conducted for each of the materials being joined, when the base materials being joined are of a different P-number and/or Group-number in accordance with ISO 9606-1, ISO 15607, ISO 15609, ISO 15614-1 or ASME Section IX when one or both of the base materials being joined are not listed in the P-number grouping.

Impact testing shall be performed in accordance with ISO 148-1 or ASTM A370 using the Charpy V-notch technique. Specimens shall be etched to determine the location of the weld and HAZ.

The impact test temperature for welds and heat-affected zones shall be at or below the minimum design temperature specified for the valve.

Impact test results for full-size specimens shall meet the requirements of Table 8. If the material specification or the pipeline design standard requires higher impact values than those shown in Table 8, the higher values shall apply.

9.3 Hardness testing

Hardness testing shall be carried out as part of the welding procedure qualification on pressure-containing and pressure-controlling parts in valves required to meet ISO 15156 (all parts).

Hardness surveys shall be performed on BM, WM and HAZ in accordance with the requirements of ISO 15156-2. The hardness method used shall be Vickers HV_5 or HV_{10}.

NOTE For existing qualification, other hardness measurement methods (such as HRC or HRB) are acceptable by agreement.

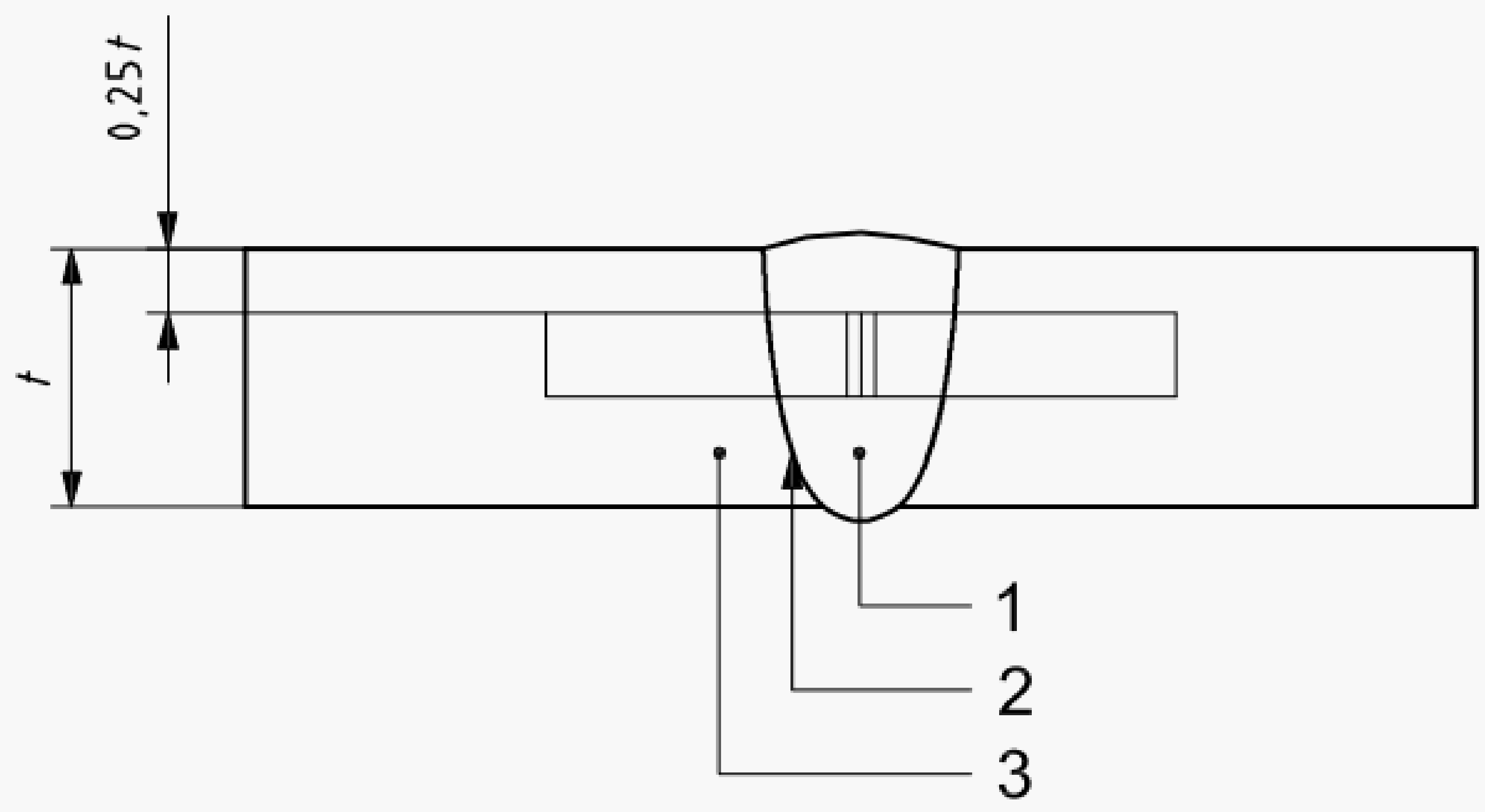
9.4 Repair

Minor defects may be removed by grinding provided there is a smooth transition between the ground area and the original contour and the minimum wall thickness requirements are not affected.

Repair of defects shall be performed in accordance with a documented procedure specifying requirements for defect removal, welding, heat treatment, NDE and reporting as applicable. Repairs of fabrication welds shall be limited to 30 % of the weld length for partial-penetration repairs or 20 % of the weld length for full-penetration repairs, except the minimum length of any weld repair shall be 50 mm.

The heat treatment (if applicable) of weld repairs shall be in accordance with the applicable material standard.

Weld repair of forgings and plates to correct manufacturing defects shall be by agreement. Weld repair of castings shall be in accordance with the applicable material standard.



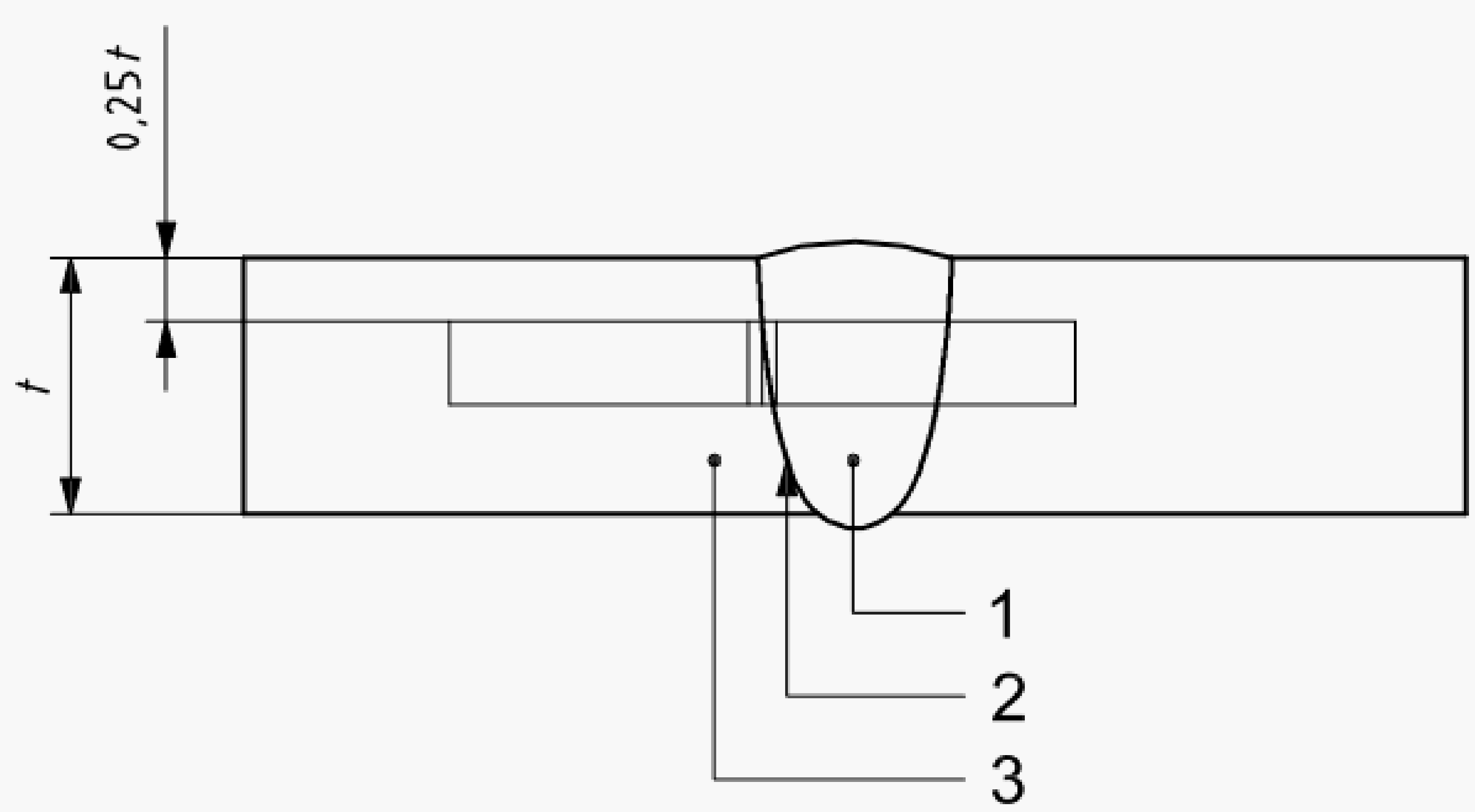
Key

1 weld metal

2 heat-affected zone

3 base metal

Figure 15 — Charpy V-notch weld-metal (WM) specimen location



Key

1 weld metal

2 heat-affected zone

3 base metal

Figure 16 — Charpy V-notch heat-affected zone (HAZ) specimen location

10 Quality control

10.1 NDE requirements

Any purchaser specified NDE requirements shall be selected from the list in accordance with Annex A. Final NDE activities shall be conducted after heat treatment unless otherwise agreed.

10.2 Measuring and test equipment

10.2.1 General

Measuring and test equipment shall be identified, controlled and calibrated at intervals specified in the manufacturer's instructions.

10.2.2 Dimension-measuring equipment

Dimension-measuring equipment shall be controlled and calibrated in accordance with methods specified in documented procedures.

10.2.3 Pressure-measuring devices

10.2.3.1 Type and accuracy

Test pressure measuring devices shall be either pressure gauges or pressure transducers that are accurate to within ± 2,0 % of the full-scale reading.

10.2.3.2 Gauge range

Pressure measurements shall be made between 25 % and 75 % of the full pressure range of the measuring device.

10.2.3.3 Calibration procedure

Pressure-measuring devices shall be periodically recalibrated with a master pressure-measuring device or a dead-weight tester at 25 %, 50 % and 75 % of the full pressure scale.

10.2.4 Temperature-measuring devices

Temperature-measuring devices shall be capable of indicating and recording temperature fluctuations of 5 °C (8 °F).

10.3 Qualification of inspection and test personnel

10.3.1 NDE personnel

NDE personnel shall be qualified in accordance with the requirements specified in ISO 9712 or ASNT SNT-TC-1A.

Personnel performing visual examinations shall have passed an annual eye examination in accordance with ISO 9712 or ASNT SNT-TC-1A within the previous twelve months.

10.3.2 Welding inspectors

Personnel performing visual inspection of welding operations and completed welds shall be qualified and certified to the requirements of AWS QC1, or equivalent, or a manufacturer's documented training programme.

10.4 NDE of repairs

After defect removal, the excavated area shall be examined by magnetic-particle (MT) or liquid-penetrant (PT) methods in accordance with Annex A. Repair welds on pressure-containing parts shall be examined using the same NDE method that was used to detect the defect with a minimum of MT or PT. Acceptance criteria shall be as specified in Annex A for the appropriate product form. The final NDE activities shall be conducted after post weld heat treatment unless otherwise agreed.

The NDE requirements specified by the purchaser in 10.1 shall also apply to repair welding.

10.5 Weld end NDE

If the purchaser specifies that weld ends be subjected to volumetric or surface NDE, the examination and acceptance criteria shall be in accordance with Clause A.22.

10.6 Visual inspection of castings

All castings as a minimum shall be visually inspected in accordance with MSS SP-55.

11 Pressure testing

11.1 General

Each valve shall be tested prior to shipment. The purchaser shall specify which particular supplementary tests in Annex B shall be performed.

Testing shall be performed in the sequence detailed in 11.2 to 11.5. Pressure testing shall be carried out before coating of the valves.

If the valve has been previously tested in accordance with this International Standard, subsequent repeat testing may be performed without removal of the valve external coating.

Test fluid shall be fresh water or, by agreement, light-weight oil having a viscosity not exceeding that of water. Water shall contain a corrosion inhibitor and, by agreement, antifreeze. The chloride content of test water in contact with austenitic and duplex stainless steel wetted components of valves shall not exceed 30 µg/g (30 ppm by mass).

Valves shall be tested with the seating and sealing surfaces free from sealant except where the sealant is the primary means of sealing. A secondary sealant system, if provided, shall not be used before or during tests.

Tests specified with the valve half-open may also be performed with the valve fully open, provided the body cavity is simultaneously filled and pressurized through a cavity connection.

If valve-body connections are not available for direct monitoring, methods for monitoring pressures and/or leakage shall be determined.

Supply pressure shall be stabilized prior to the start of pressure testing and shall be held for the minimum test durations listed in Tables 9, 10 and 11.

Pressure testing shall be performed in accordance with documented procedures.

11.2 Stem backseat test

Testing of the backseat shall commence with the packing gland loose. Self-energized packing or seals shall be removed unless a test port is provided for this test.

The valves shall be filled with the ends closed off and the obturator in the partially open position until leakage of the test fluid around the stem is observed. The backseat shall then be closed and a minimum pressure of 1,1 times the pressure rating determined in accordance with 7.2 for material at 38 °C (100 °F) applied for the duration specified in Table 9.

Monitoring for leakage shall be through a test access port or by monitoring leakage around the loosened packing.

No visible leakage is permitted at this test pressure.

NOTE This test is performed prior to hydrostatic shell test.

WARNING — Appropriate safety precautions shall be taken.

Table 9 — Minimum duration of stem backseat tests

Valve size		**Test duration**
DN	**NPS**	min
⩽ 100	⩽ 4	2
⩾ 150	⩾ 6	5

11.3 Hydrostatic shell test

Valve ends shall be closed off and the obturator placed in the partially open position during the test. If specified by the purchaser, the method of closing the ends shall permit the transmission of the full-pressure force acting on the end blanks to the valve body. If present, external relief valves shall be removed and their connections plugged.

The test pressure shall be 1,5 or more times the pressure rating determined in accordance with 7.2 for material at 38 °C (100 °F). The duration shall not be less than that specified in Table 10.

Table 10 — Minimum duration of hydrostatic shell tests

Valve size		**Test duration**
DN	**NPS**	min
15 to 100	½ to 4	2
150 to 250	6 to 10	5
300 to 450	12 to 18	15
⩾ 500	⩾ 20	30

No visible leakage is permitted during the hydrostatic shell test.

After hydrostatic shell testing, external relief valves shall be fitted to the valve. The connection to the valve body shall be tested at 95 % of the set pressure of the relief valve for 2 min for valve sizes up to and including DN 100 (NPS 4), and 5 min for valve sizes DN 150 (NPS 6) and larger. The relief-valve connection shall be free of visible leakage during this period.

The external relief valves shall be set to relieve at the specified pressure and tested in accordance with 11.4.5.

11.4 Hydrostatic seat test

11.4.1 Preparation

Lubricants or sealants shall be removed from seats and obturator sealing surfaces except where the lubricant or sealant is the primary means of sealing. Assembly lubricants for metal-to-metal contact surfaces may be used by agreement.

11.4.2 Test pressure and duration

The test pressure for all seat tests shall not be less than 1,1 times the pressure rating determined in accordance with 7.2 for material at 38 °C (100 °F). The test duration shall be in accordance with Table 11.

Table 11 — Minimum duration of seat tests

Valve size		Test duration
DN	NPS	min
15 to 100	½ to 4	2
⩾ 150	⩾ 6	5

11.4.3 Acceptance criteria

Leakage for soft-seated valves and lubricated plug valves shall not exceed ISO 5208 Rate A (no visible leakage). For metal-seated valves the leakage rate shall not exceed ISO 5208:1993, Rate D, except that the leakage rate during the seat test in Clause B.4 shall not be more than two times ISO 5208:1993, Rate D, unless otherwise specified. The test procedures for various types of block valve are given in 11.4.4.

NOTE Special application can require that the leakage rate be less than ISO 5208:1993, Rate D.

11.4.4 Seat test procedures for block valves

11.4.4.1 Uni-directional

With the valve half-open, the valve and its cavity shall be completely filled with test fluid. The valve shall then be closed and the test pressure applied to the appropriate end of the valve.

Leakage from the upstream seat shall be monitored via the valve body cavity vent or drain connection, where provided. For valves without body cavity or drain connection, or downstream seated valves, seat leakage shall be monitored at the respective downstream end of the valve (the valve end downstream of the pressurized test fluid).

11.4.4.2 Bi-directional

With the valve half-open, the valve and its cavity shall be completely filled with test fluid. The valve shall then be closed and the test pressure applied successively to both ends of the valve.

Seat leakage shall be monitored from each seat via the valve body cavity vent or drain connection, where provided. For valves without a body-cavity vent or drain connection, seat leakage shall be monitored from the respective downstream end of the valve.

11.4.4.3 Additional seat testing

If the purchaser specifies the functionality for the valve to be that of double-block-and-bleed (DBB) valves, the test described in Clause B.10 shall be performed.

If the purchaser specifies the functionality for the valve to be that of double-isolation-and-bleed (DIB-1), both seats bi-directional, the test described in Clause B.11 shall be performed.

If the purchaser specifies the functionality for the valve to be that of DIB-2, one seat uni-directional and one seat bi-directional, the test described in Clause B.12 shall be performed.

11.4.4.4 Check valves

The pressure shall be applied in the direction of the required flow blockage.

11.4.5 Test of cavity relief valve

If provided, the external relief valve shall be set and certified to relieve at the specified pressure either by the relief-valve supplier or the valve manufacturer. The set pressure of relief valves shall be between 1,1 and 1,33 times the valve pressure rating determined in accordance with 7.2 for material at 38 °C (100 °F).

11.4.6 Installation of body connections after testing

Parts, such as vent or drain plug(s) and cavity-relief valves, shall be fitted, on completion of testing, in accordance with documented procedures.

11.4.7 Alternative seat test

High-pressure gas seat testing in accordance with Clause B.4 can be performed in lieu of the hydrostatic seat test by agreement.

11.5 Testing of drain, vent and sealant injection lines

If provided, drain and vent lines shall be subject to a hydrostatic test with the valve in accordance with 11.3. If testing with the valve is not practical, these lines may be tested separately, provided the final assembly connection is subjected to the hydrostatic test in 11.3 or, by agreement, a pneumatic pressure test as listed in B.3.3. The test pressure for sealant injection lines shall be by agreement.

11.6 Draining

Upon completion of tests, valves shall be drained of test fluids, dried and, where applicable, lubricated before shipment.

12 Coating

All non-corrosion-resistant valves shall be coated externally in accordance with the manufacturer's standards, unless otherwise agreed.

Corrosion-resistant valves shall not be coated unless otherwise agreed.

Flange faces, weld bevel ends and exposed stems shall not be coated.

Parts and equipment that have bare metallic surfaces shall be protected with a rust preventative that can provide protection at temperatures up to 50 °C (122 °F).

13 Marking

Valves shall be marked in accordance with the requirements of Table 12.

Body/cover/closure stamping shall be performed using a low-stress die-stamp, rounded “V” or Dot Face type. Each valve shall be provided with an austenitic stainless steel nameplate securely affixed and so located that it is easily accessible. The marking on the nameplate shall be visually legible.

On valves whose size or shape limits the body markings, they may be omitted in the following order:

a) manufacturer’s name or trademark;

b) material;

c) rating;

d) size.

The nameplate and serial number may be omitted for valves smaller than DN 50 (NPS 2), by agreement.

NOTE The purchaser can specify requirements for the marking of valve components.

For valves with one seat uni-directional and one seat bi-directional, the directions of both seats shall be specified on a separate identification plate as illustrated in Figure 17. In Figure 17, one symbol indicates the bi-directional seat and the other symbol indicates the uni-directional seat.

An example of valve marking is given in Annex E.

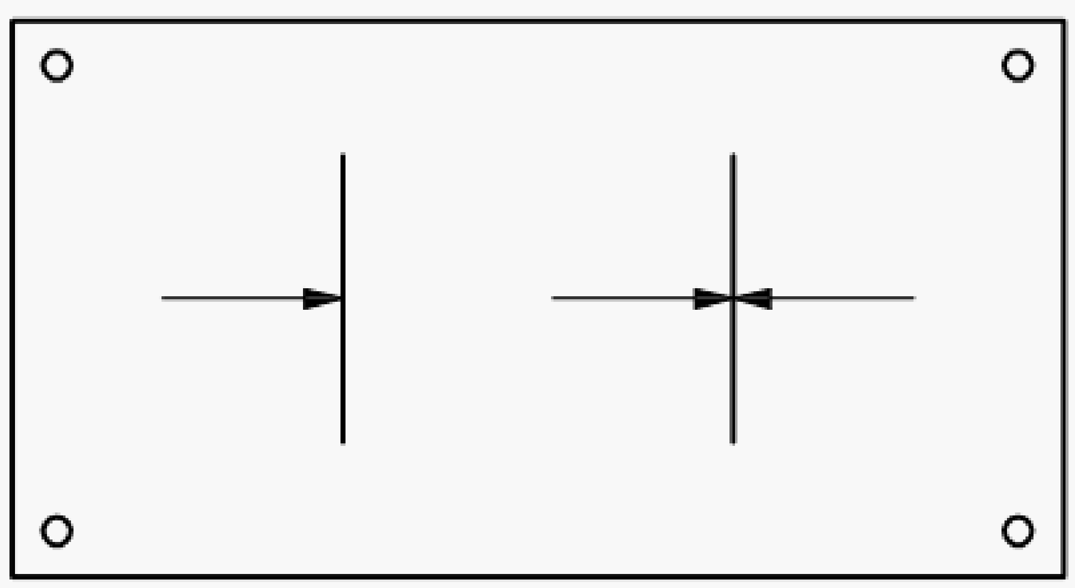


Figure 17 — Typical identification plate for a valve with one seat uni-directional and one seat bi-directional

Table 12 — Valve marking

No.	Marking	Location
1	manufacturer's name or trademark	both body and nameplate
2	pressure class	both body and nameplate
3	pressure/temperature rating: a) maximum operating pressure at maximum operating temperature b) maximum operating pressure at minimum operating temperature	nameplate
4	face-to-face/end-to-end dimensions (7.4)	nameplate
5	body material designation [a]: material symbol, e.g. AISI, ASME, ASTM or ISO	both body and nameplate; melt identification (e.g. cast or heat number) on body only
6	bonnet/cover material designation: material symbol e.g. AISI, ASME, ASTM, ISO	bonnet/cover [including melt identification (e.g. heat number)]
7	trim identification[b]: symbols indicating material of stem and sealing faces of closure members if different from that of body	nameplate
8	nominal valve size a) full-opening valves: nominal valve size b) reduced-opening valves: shall be marked as specified in 7.3	body or nameplate or both (where practicable)
9	ring joint groove number	valve flange edge
10	SMYS (units) of valve ends, where applicable	body weld bevel ends
11	flow direction (for check valves only)	body
12	seat sealing direction (valves with preferred direction only)	separate identification plate on valve body
13	seat test per Clauses B.10, B.11, B.12 for DBB, DIB-1 or DIB-2, respectively (where applicable)	nameplate
14	unique serial number	both body and nameplate
15	date of manufacture (month and year)	nameplate
16	ISO 14313 [c]	nameplate

[a] When the body is fabricated of more than one type of steel, the end-connection material governs the marking.

[b] MSS SP-25 gives guidance on marking.

[c] For identical national adoptions of this International Standard, other nationally recognized designations may be marked in addition to those given in ISO 14313, e.g. ISO 14313/API Spec 6D.

14 Preparation for shipment

Flanged and welding ends shall be blanked off to protect the gasket surfaces, welding ends and valve internals during shipment.

Protective covers shall be made of wood, wood fibre, plastic or metal and shall be securely attached to the valve ends by bolting, steel straps, steel clips or suitable friction-locking devices. The design of the covers shall prevent the valves from being installed unless the covers have been removed.

Plug, ball and reverse-acting through-conduit gate valves shall be shipped in the fully open position, unless fitted with a fail-to-close actuator.

Other gate valve types shall be shipped with the gate in the fully closed position.

Check valves DN 200 (NPS 8) and larger shall be shipped with the disc secured or supported during transport. A warning label shall be attached to the protective cover with instructions to remove, prior to installation, material from inside the valve that secures or supports the disc.

Valves shipped with stem extensions and without an operating mechanism shall have the annular space closed and the stem extension secured to the outer housing.

15 Documentation

The documentation listed below shall be retained by the manufacturer for a minimum of ten years following the date of manufacture:

a) design documentation;

b) weld procedure specification (WPS);

c) weld procedure qualification record (PQR);

d) welder performance qualification (WPQ);

e) qualification records of NDE personnel;

f) records of test equipment calibration;

g) for valves DN 50 (NPS 2) and larger:

   1) material test report for body, bonnet/cover(s) and end-connector(s)/closure(s) traceable to the unique valve serial number;

   2) serial number;

   3) pressure test results;

h) for sour service valves, certificate of compliance to ISO 15156 (all parts).

NOTE Purchaser or regulatory requirements can specify a longer record retention period.

The documentation shall be provided by the manufacturer in legible, retrievable and reproducible form and free of damage.

The purchaser can specify supplementary documentation in accordance with Annex C.

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Valves shipped with stem extensions and without an operating mechanism shall have the annular space closed and the stem extension secured to the outer housing.

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g) for valves DN 50 (NPS 2) and larger:

   1) material test report for body, bonnet/cover(s) and end-connector(s)/closure(s) traceable to the unique valve serial number;

   2) serial number;

   3) pressure test results;

h) for sour service valves, certificate of compliance to ISO 15156 (all parts).

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Flanged and welding ends shall be blanked off to protect the gasket surfaces, welding ends and valve internals during shipment.

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Valves shipped with stem extensions and without an operating mechanism shall have the annular space closed and the stem extension secured to the outer housing.

15 Documentation

The documentation listed below shall be retained by the manufacturer for a minimum of ten years following the date of manufacture:

a) design documentation;

b) weld procedure specification (WPS);

c) weld procedure qualification record (PQR);

d) welder performance qualification (WPQ);

e) qualification records of NDE personnel;

f) records of test equipment calibration;

g) for valves DN 50 (NPS 2) and larger:

   1) material test report for body, bonnet/cover(s) and end-connector(s)/closure(s) traceable to the unique valve serial number;

   2) serial number;

   3) pressure test results;

h) for sour service valves, certificate of compliance to ISO 15156 (all parts).

NOTE Purchaser or regulatory requirements can specify a longer record retention period.

The documentation shall be provided by the manufacturer in legible, retrievable and reproducible form and free of damage.

The purchaser can specify supplementary documentation in accordance with Annex C.

14 Preparation for shipment

Flanged and welding ends shall be blanked off to protect the gasket surfaces, welding ends and valve internals during shipment.

Protective covers shall be made of wood, wood fibre, plastic or metal and shall be securely attached to the valve ends by bolting, steel straps, steel clips or suitable friction-locking devices. The design of the covers shall prevent the valves from being installed unless the covers have been removed.

Plug, ball and reverse-acting through-conduit gate valves shall be shipped in the fully open position, unless fitted with a fail-to-close actuator.

Other gate valve types shall be shipped with the gate in the fully closed position.

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