CERTIFICATE

By Authority Of
THE UNITED STATES OF AMERICA
Legally Binding Document

By the Authority Vested By Part 5 of the United States Code § 552(a) and Part 1 of the Code of Regulations § 51 the attached document has been duly INCORPORATED BY REFERENCE and shall be considered legally binding upon all citizens and residents of the United States of America. *HEED THIS NOTICE*: Criminal penalties may apply for noncompliance.

Document Name: API 6D: Specification for Pipeline Valves

CFR Section(s): 49 CFR 195.116(d)

Standards Body: American Petroleum Institute

APPROVED

Official Incorporator:
THE EXECUTIVE DIRECTOR
OFFICE OF THE FEDERAL REGISTER
WASHINGTON, D.C.

Specification for Pipeline Valves

ANSI/API SPECIFICATION 6D
TWENTY-THIRD EDITION, APRIL 2008

EFFECTIVE DATE: OCTOBER 1, 2008

ERRATA 1, JUNE 2008
ERRATA 2, NOVEMBER 2008
ERRATA 3, FEBRUARY 2009
ERRATA 4, APRIL 2010
ERRATA 5, NOVEMBER 2010
ERRATA 6, AUGUST 2011
ADDENDUM 1, OCTOBER 2009
ADDENDUM 2, AUGUST 2011

CONTAINS API MONOGRAM ANNEX AS PART OF
U.S. NATIONAL ADOPTION

ISO 14313:2007 (Identical), Petroleum and natural gas industries—Pipeline transportation systems—Pipeline valves

AMERICAN PETROLEUM INSTITUTE

Specification for Pipeline Valves

Upstream Segment

ANSI/API SPECIFICATION 6D
TWENTY-THIRD EDITION, APRIL 2008

EFFECTIVE DATE: OCTOBER 1, 2008

ERRATA 1, JUNE 2008
ERRATA 2, NOVEMBER 2008
ERRATA 3, FEBRUARY 2009
ERRATA 4, APRIL 2010
ERRATA 5, NOVEMBER 2010
ERRATA 6, AUGUST 2011
ADDENDUM 1, OCTOBER 2009
ADDENDUM 2, AUGUST 2011

CONTAINS API MONOGRAM ANNEX AS PART OF
U.S. NATIONAL ADOPTION

ISO 14313:2007 (Identical), Petroleum and natural gas industries—Pipeline transportation systems—Pipeline valves

AMERICAN PETROLEUM INSTITUTE

API Foreword

Nothing contained in any API publication is to be construed as granting any right, by implication or otherwise, for the manufacture, sale, or use of any method, apparatus, or product covered by letters patent. Neither should anything contained in the publication be construed as insuring anyone against liability for infringement of letters patent.

This document was produced under API standardization procedures that ensure appropriate notification and participation in the developmental process and is designated as an API standard. Questions concerning the interpretation of the content of this publication or comments and questions concerning the procedures under which this publication was developed should be directed in writing to the Director of Standards, American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005. Requests for permission to reproduce or translate all or any part of the material published herein should also be addressed to the director.

Generally, API standards are reviewed and revised, reaffirmed, or withdrawn at least every five years. A one-time extension of up to two years may be added to this review cycle. Status of the publication can be ascertained from the API Standards Department, telephone (202) 682-8000. A catalog of API publications and materials is published annually and updated quarterly by API, 1220 L Street, N.W., Washington, D.C. 20005.

Suggested revisions are invited and should be submitted to the Standards and Publications Department, API, 1220 L Street, NW, Washington, DC 20005, standards@api.org.

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*

---

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*

---

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):

$$K_V = \frac{C_V}{1{,}156} \tag{1}$$

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;

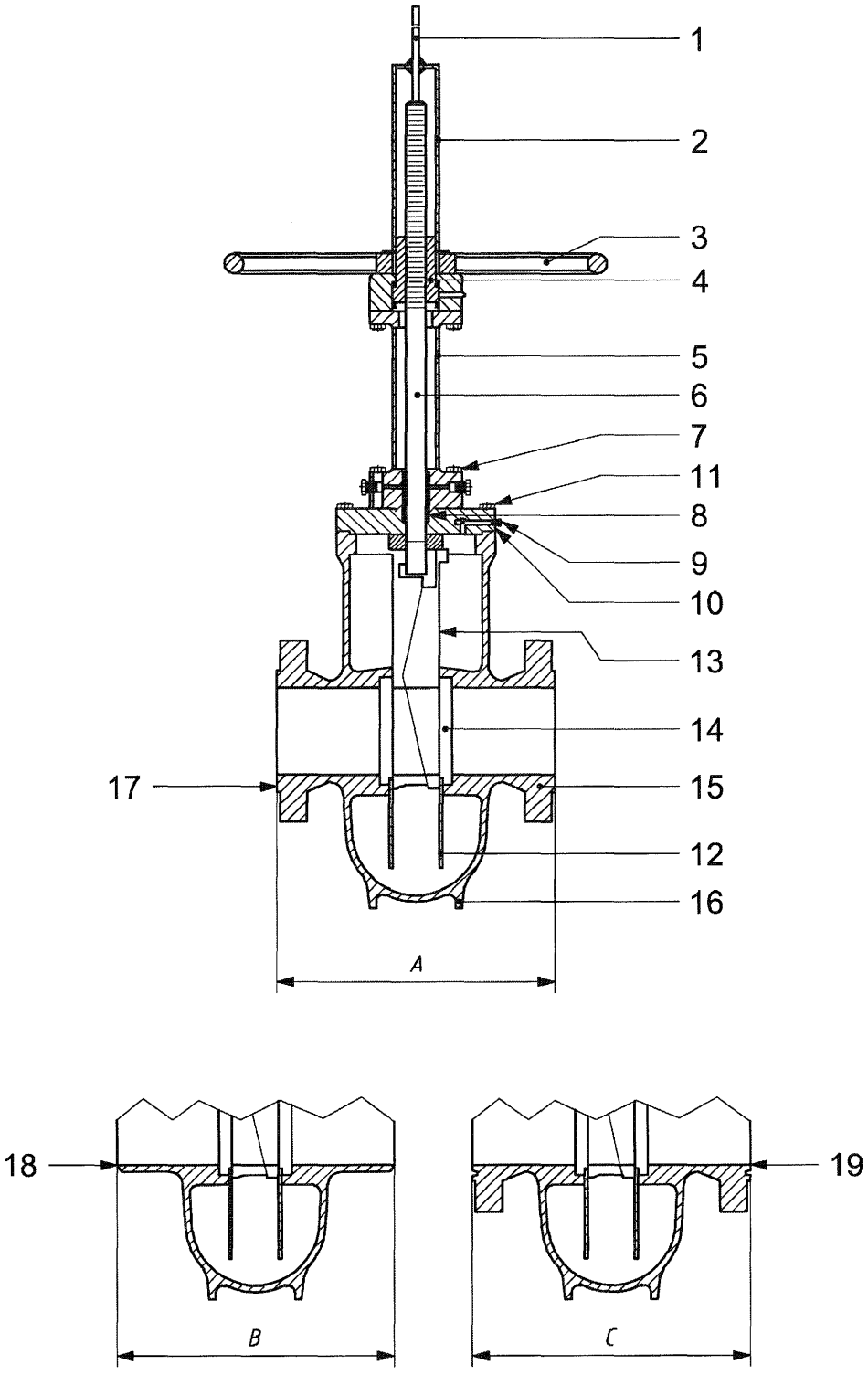
— valves above DN 600 (NPS 24): by agreement.

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	—	—	—



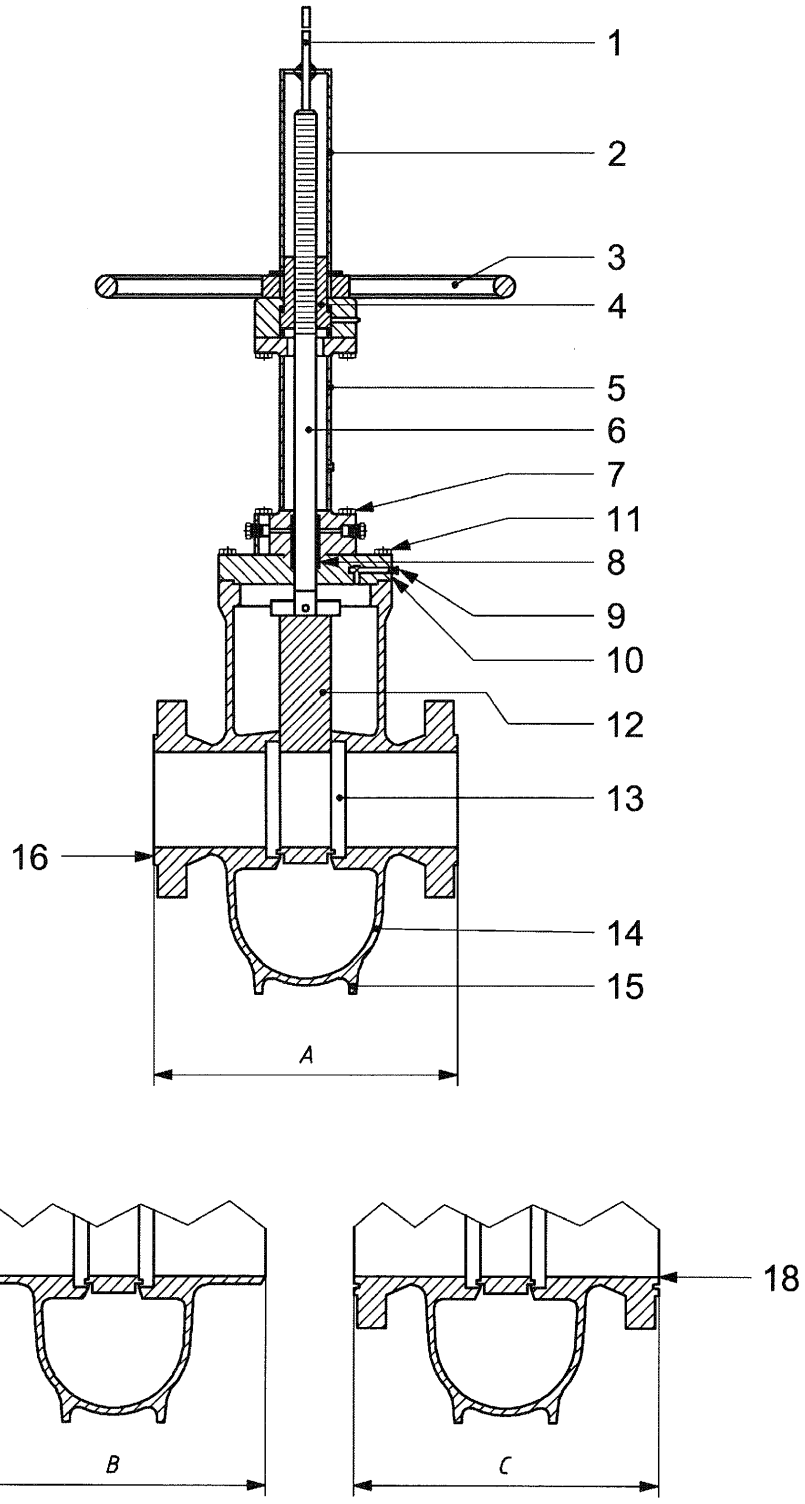
Key

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



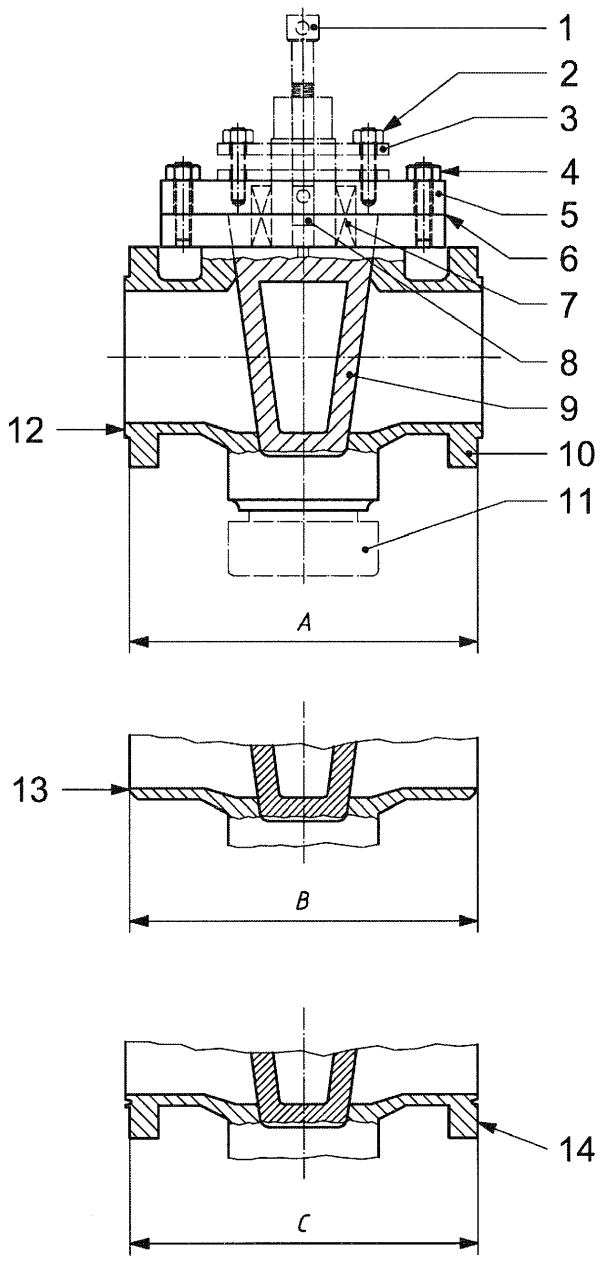
Key

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



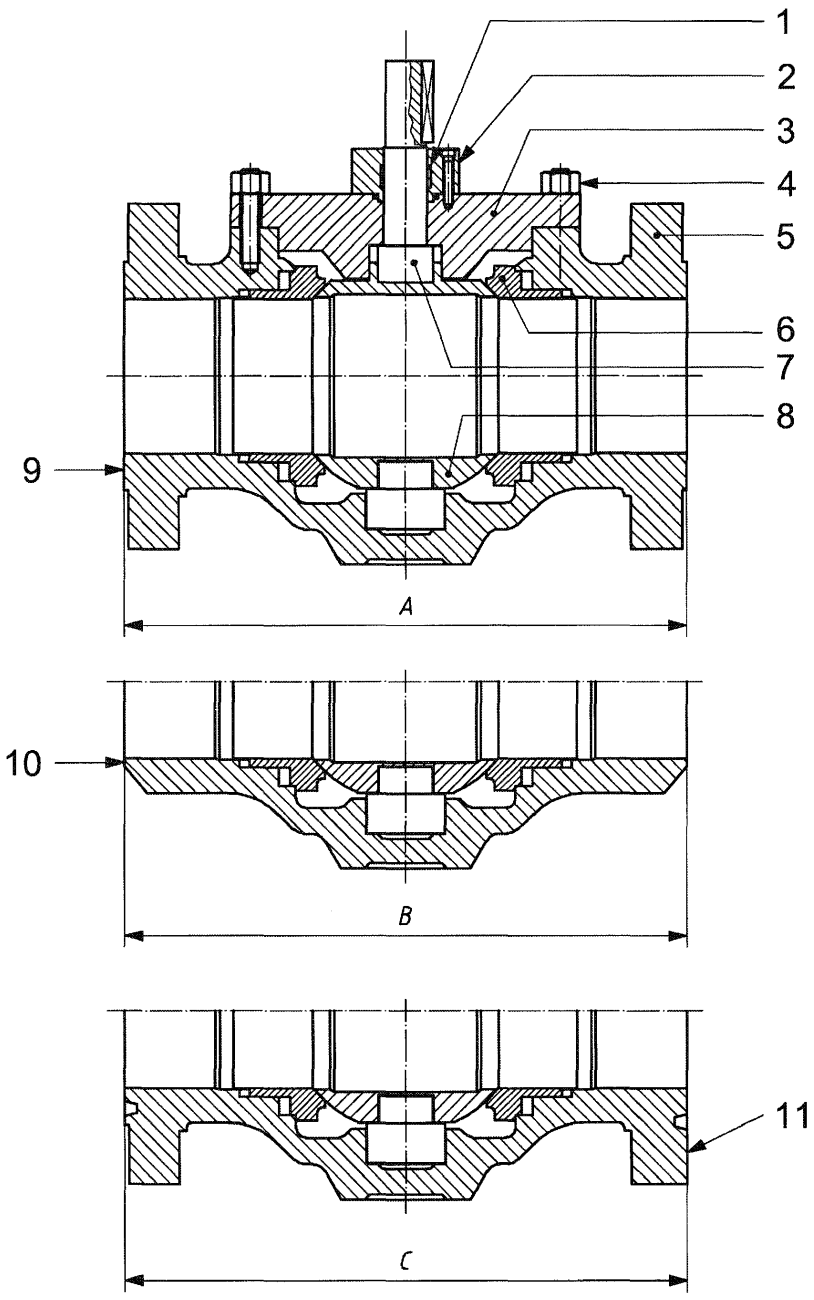
Key

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



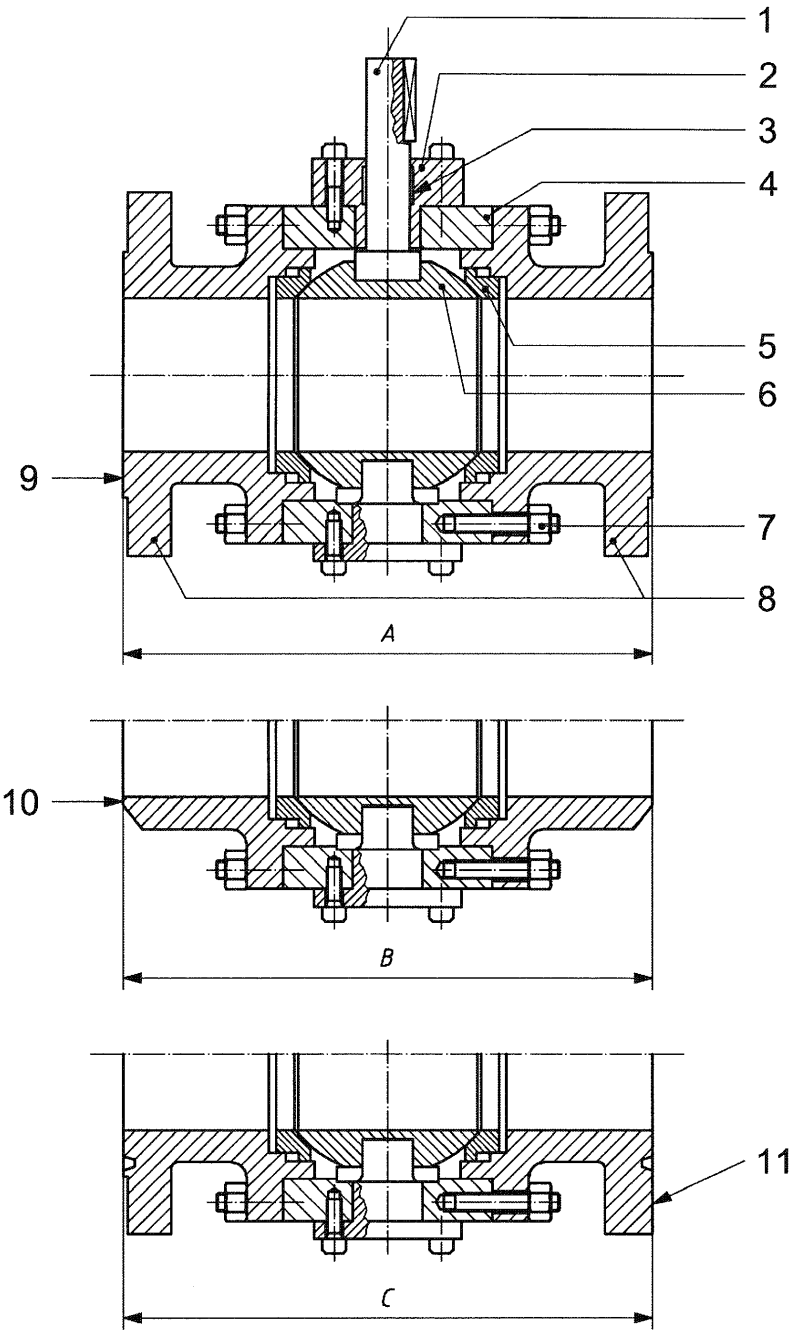
Key

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



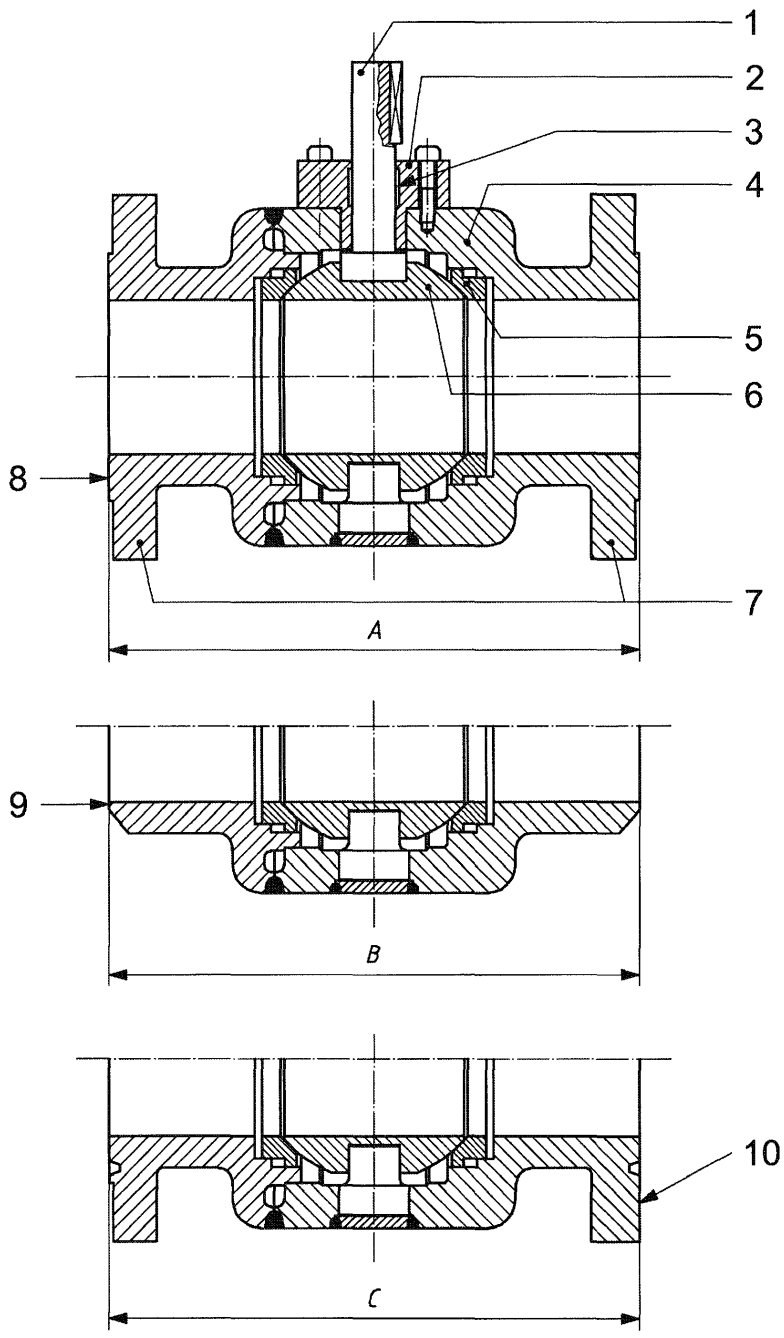
Key

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



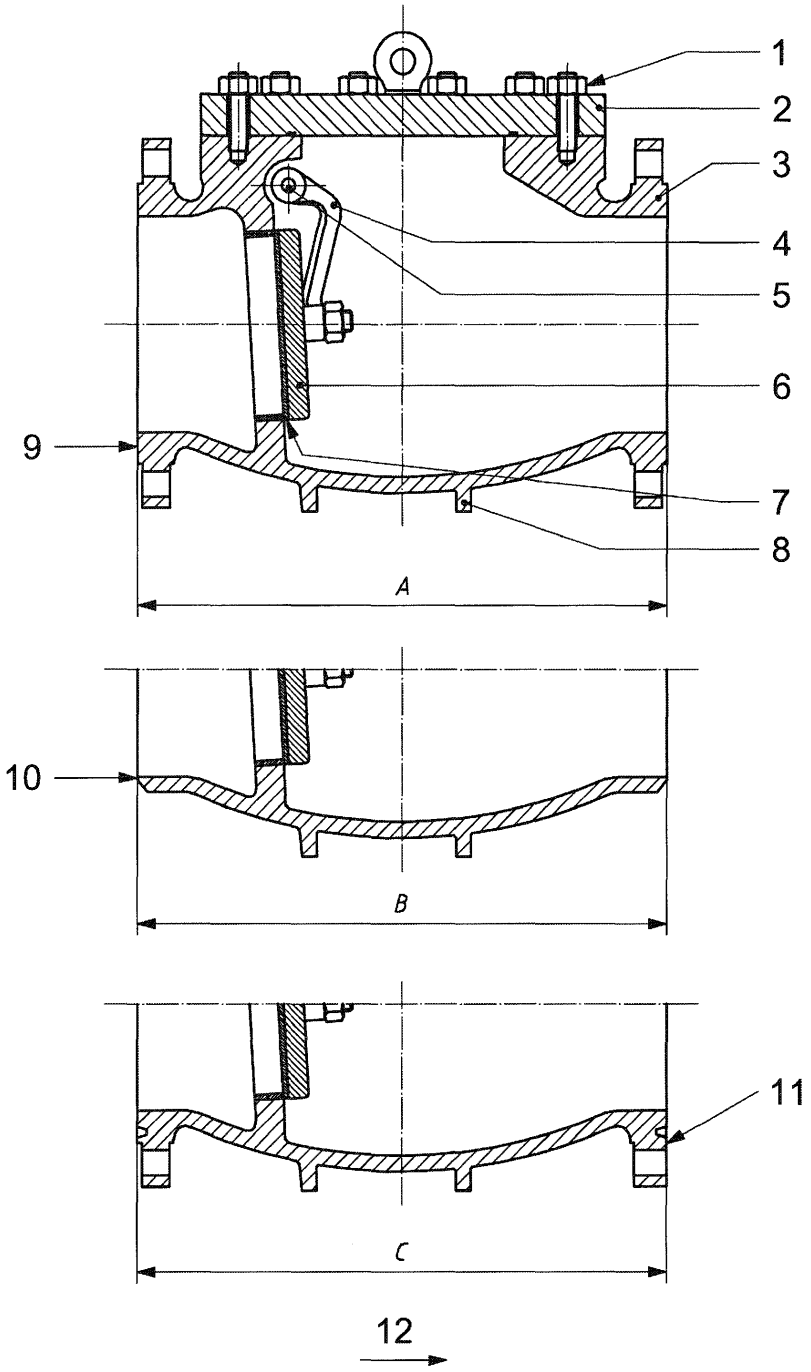
Key

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



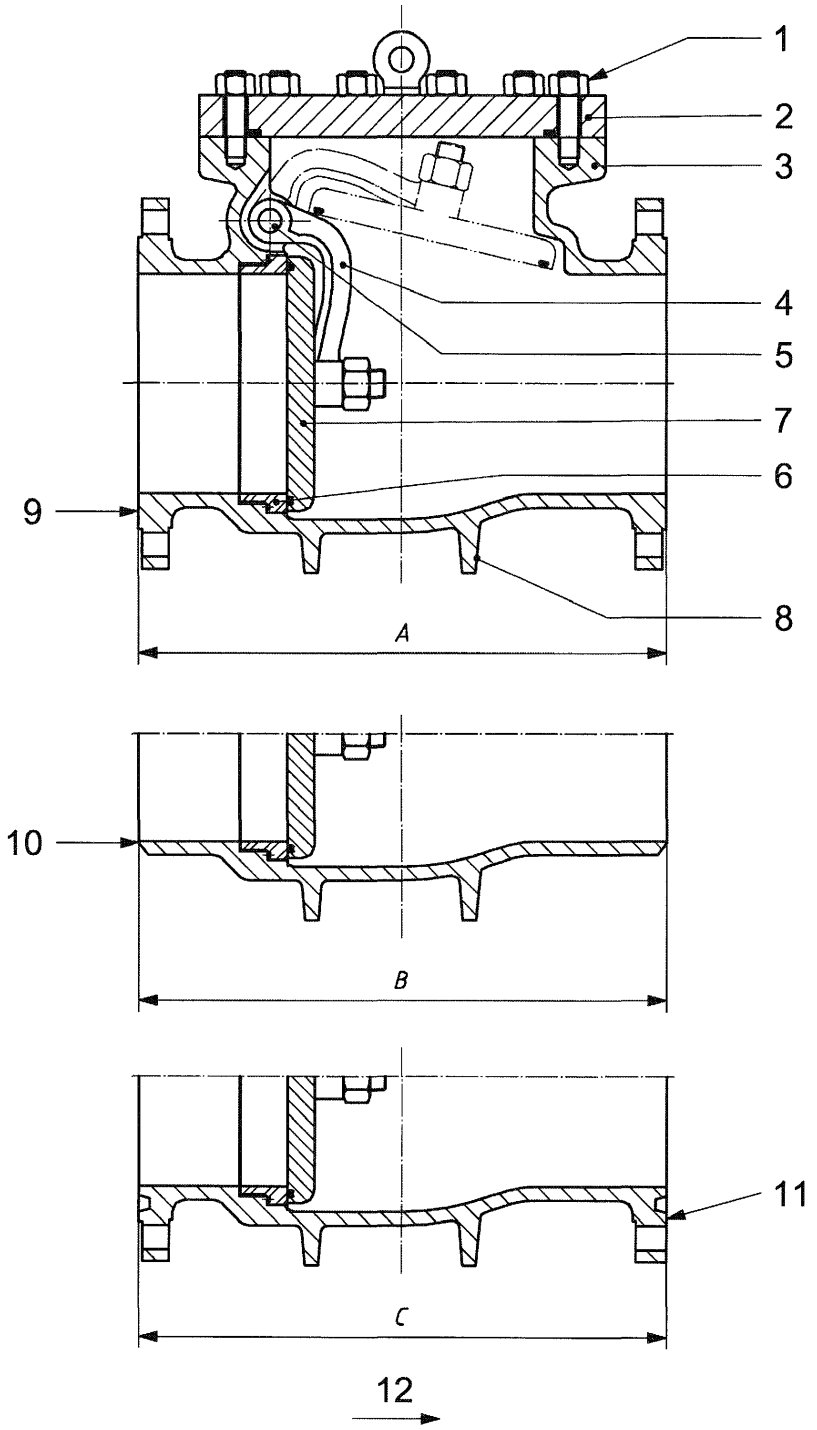
Key

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

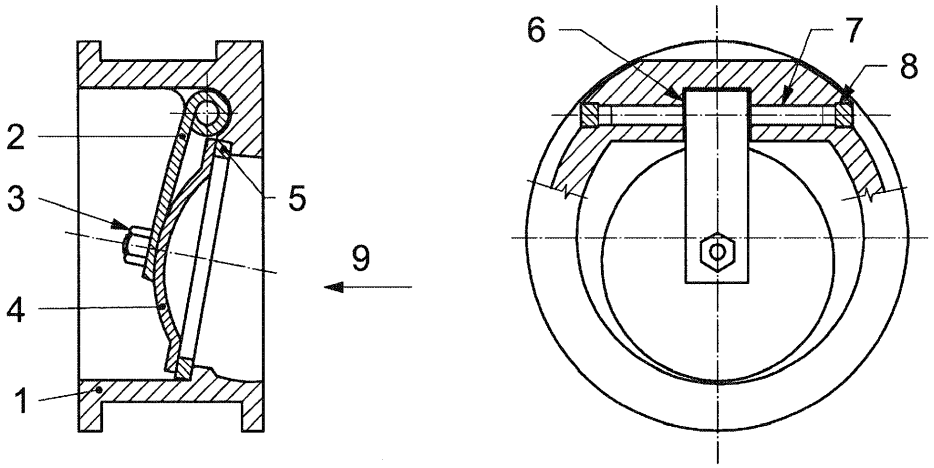
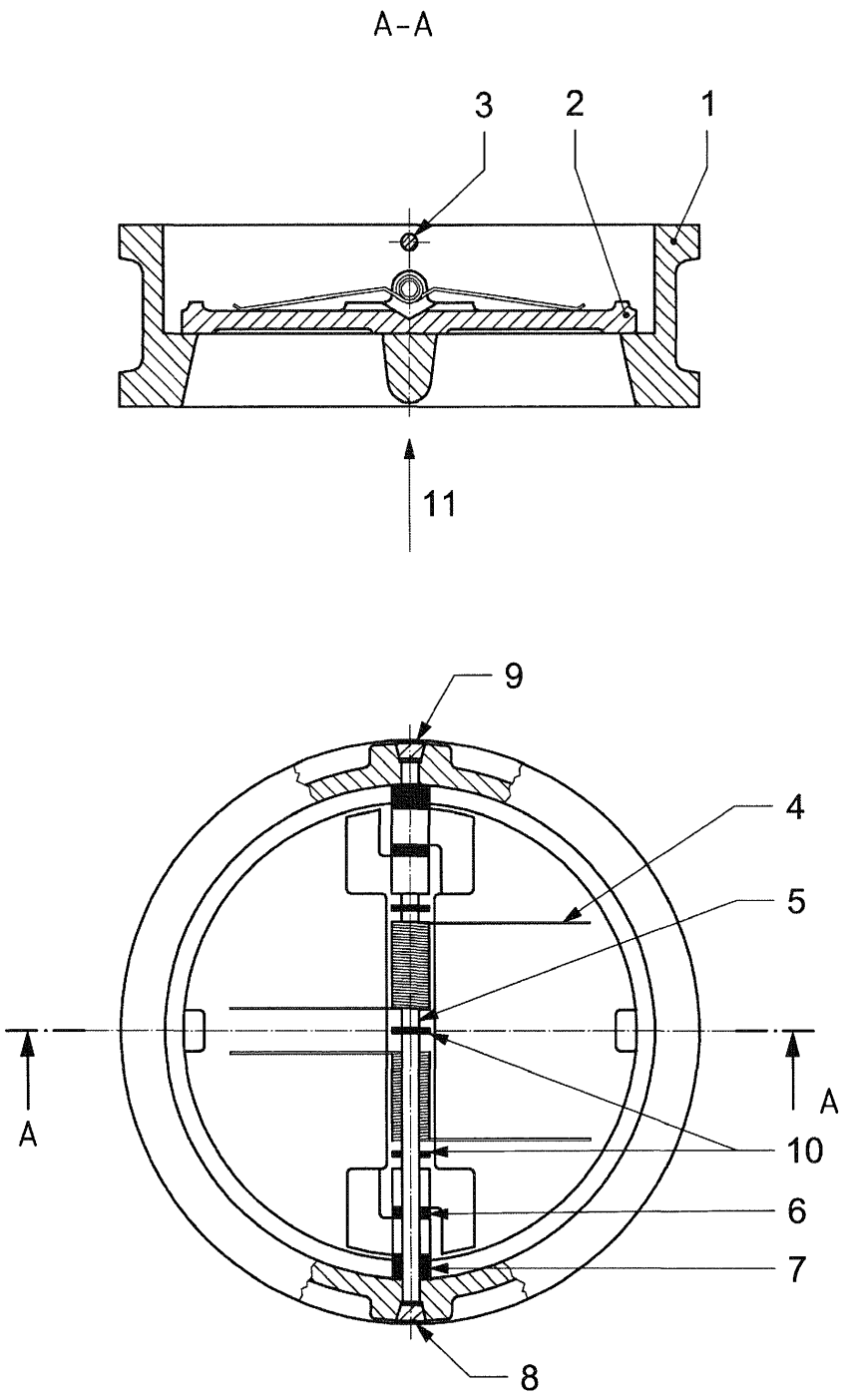


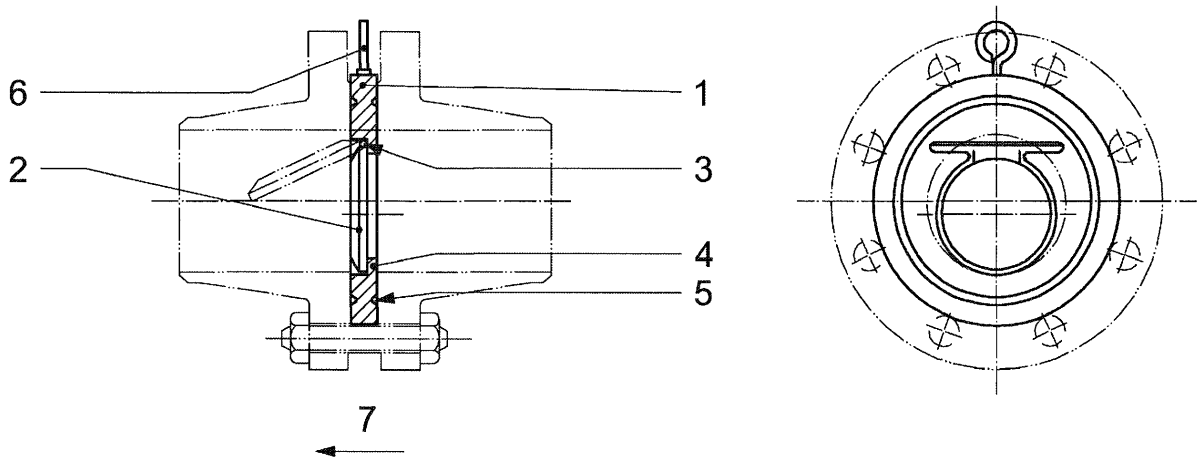
Figure 9 — Single-plate wafer-type check valve, long pattern



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

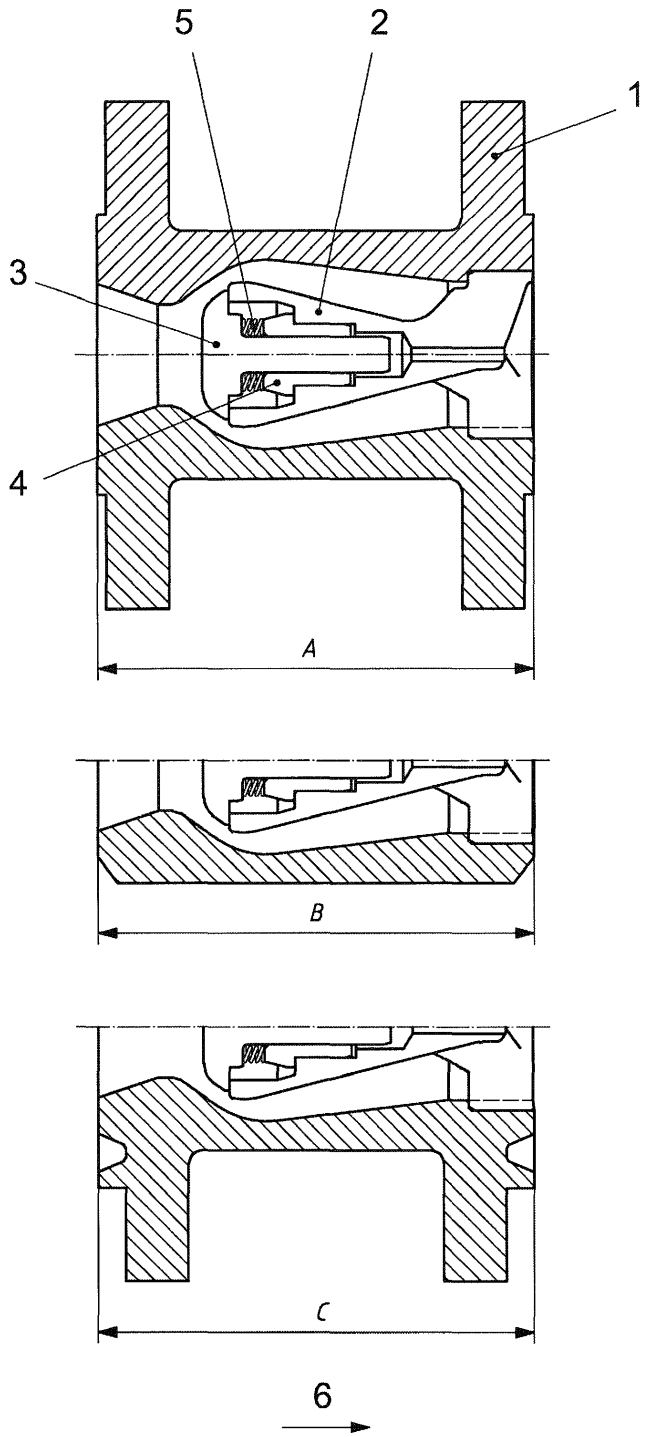
Figure 10 — Typical dual-plate wafer-type check valve, long pattern



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



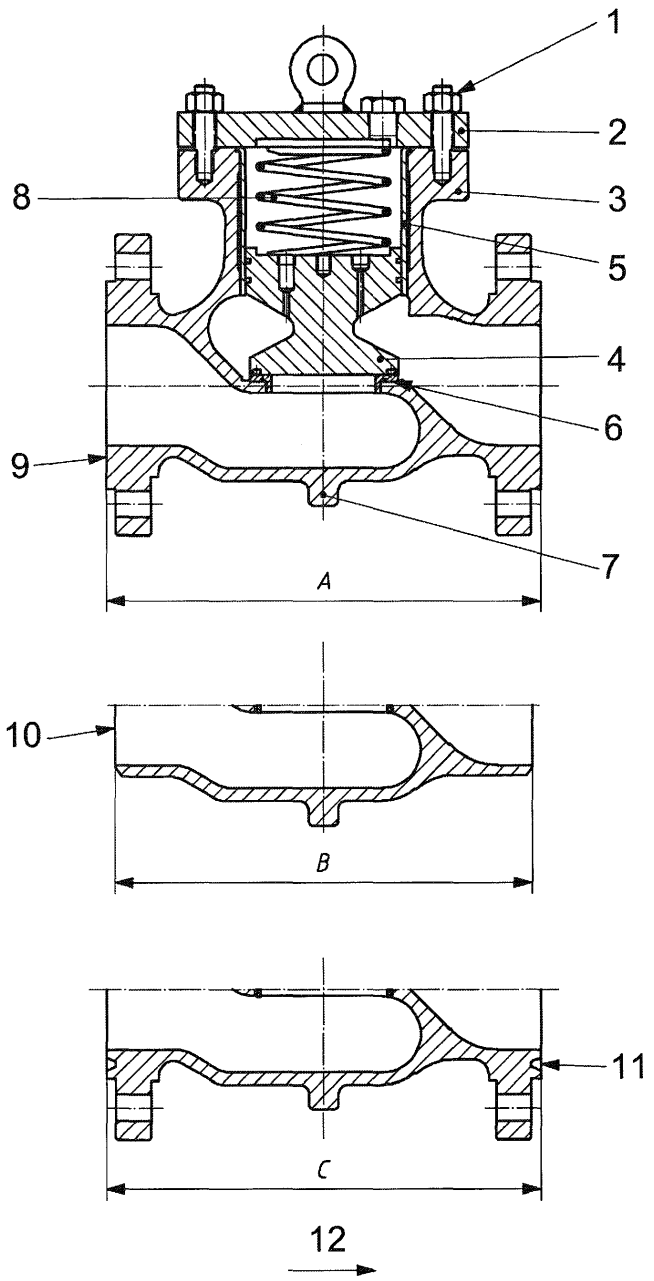
Key

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	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
		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	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*
		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	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*
		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	2099	—	—	—
		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	Welding end	Ring joint	Raised face	Welding end	Ring joint
		A	B	C	A	B	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	Welding end	Ring joint	Raised face	Welding end	Ring joint
		A	*B*	*C*	*A*	*B*	*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

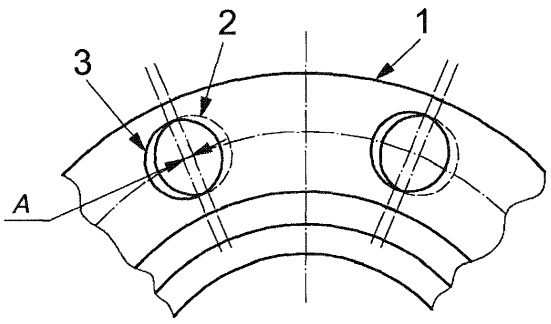
The maximum measured difference between flanges shall be 2,5 mm/m (0.03 in/ft).

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.

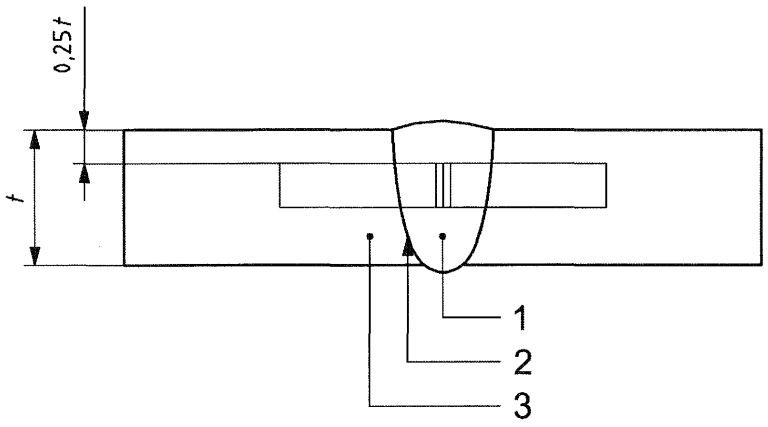
9.4 Repair

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.

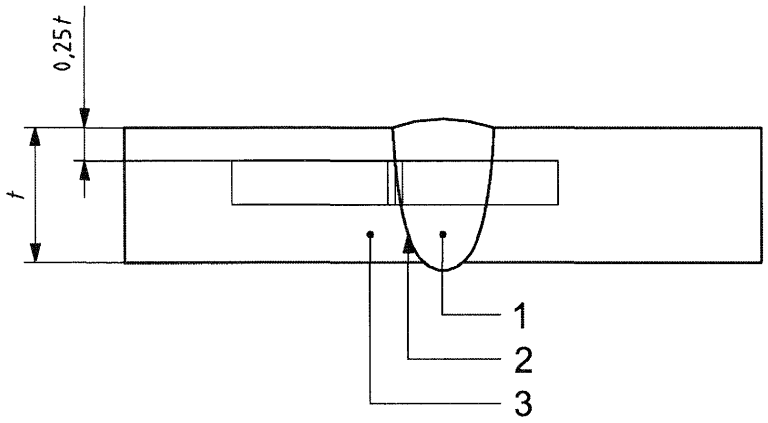
Weld repair of forgings and plates to correct manufacturing defects shall be by agreement. Weld repair of castings shall be in accordance with the applicable material standard.



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.

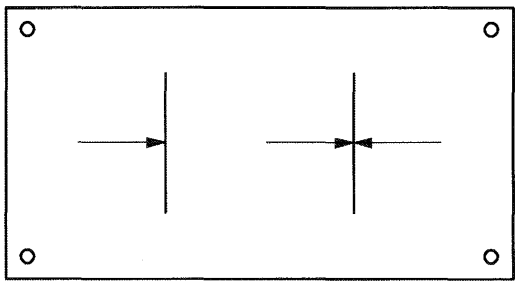


Figure 17 — Typical identification plate for a valve with one seat uni-directional and one seat bi-directional

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.

Annex A
(normative)

Requirements for non-destructive examination

A.1 General

This annex specifies the requirements for non-destructive examination (NDE) that shall be performed by the manufacturer if specified by the purchaser.

A.2 Radiographic testing (RT) of castings on 100 % of critical areas

Examination shall be carried out in accordance with ASME B16.34-2004, Appendix-I.

Acceptance shall be in accordance with ASME B16.34-2004, Appendix-I.

A.3 Radiographic testing (RT) of castings on 100 % of accessible areas

Examination shall be carried out in accordance with ASME B16.34-2004, Appendix-I.

Acceptance shall be in accordance with ASME B16.34-2004, Appendix-I.

A.4 Ultrasonic testing (UT) of castings on 100 % of critical areas

Examination shall be carried out in accordance with ASME B16.34-2004, Appendix-IV.

Acceptance shall be in accordance with ASME B16.34-2004, Appendix-IV.

A.5 Ultrasonic testing (UT) of castings on 100 % of accessible areas

Examination shall be carried out in accordance with ASME B16.34-2004, Appendix-IV.

Acceptance shall be in accordance with ASME B16.34-2004, Appendix-IV.

A.6 Magnetic-particle testing (MT) of castings on 100 % of surface area

Examination shall be carried out in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 7.

Acceptance shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Appendix 6, except that relevant indications (rounded and linear) of less than 5 mm are acceptable.

A.7 Penetrant testing (PT) of castings on 100 % of surface area

Examination shall be carried out in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 6.

Acceptance shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Appendix 8, except that relevant indications (rounded and linear) of less than 5 mm are acceptable.

A.8 Ultrasonic testing (UT) of forgings and plate on 100 % of surface area

Examination shall be carried out in accordance with ASTM A388, ASTM A435 or ASTM A577, as applicable.

Acceptance shall be in accordance with ASTM A388, ASTM A435 or ASTM A577, as applicable.

A.9 Magnetic-particle testing (MT) of forgings on 100 % of surface area

Examination shall be carried out in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 7.

Acceptance shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 Appendix 6.

A.10 Penetrant testing (PT) of forgings on 100 % of surface area

Examination shall be carried out in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 6.

Acceptance shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Appendix 8.

A.11 Radiographic testing (RT) of weldments on 100 % of weld

Examination shall be carried out in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 2.

Acceptance shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, UW-51, for linear indications and ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Appendix 4, for rounded indications.

A.12 Ultrasonic testing (UT) of full-penetration welds on 100 % of weld

Examination shall be carried out in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 4.

Acceptance shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Appendix 12.

A.13 Magnetic-particle testing (MT) of welds on 100 % of weld surface area

Examination shall be carried out in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 7.

Acceptance shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Appendix 6 or ISO 23278.

A.14 Penetrant testing (PT) of welds on 100 % of weld surface area

Examination shall be carried out in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 6.

Acceptance shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Appendix 8 or ISO 23277.

A.15 Magnetic-particle testing (MT) of bolting

Examination shall be carried out in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 7.

Acceptance shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Appendix 6.

A.16 Penetrant testing (PT) of bolting

Examination shall be carried out in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 6.

Acceptance shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Appendix 8.

A.17 Magnetic-particle testing (MT) on 100 % of machined surfaces

Examination shall be carried out in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 7.

Acceptance shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Appendix 6.

A.18 Penetrant testing (PT) on 100 % of machined surfaces

Examination shall be carried out in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 6.

Acceptance shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Appendix 8.

A.19 Penetrant testing (PT) of weld bevels of welding ends

Examination shall be carried out in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 6.

Acceptance shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Appendix 8.

A.20 Magnetic-particle testing (MT) of weld bevels of welding ends

Examination shall be carried out in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 7.

Acceptance shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Appendix 6.

A.21 Penetrant testing (PT) of weld overlay

Examination shall be carried out in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 6.

Acceptance criteria for non-machined overlay shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Appendix 8, except that relevant indications (rounded and linear) of less than 5 mm are acceptable.

Acceptance criteria for machined overlay shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Appendix 8, except that there shall be no indications in the seal areas.

A.22 NDE volumetric and surface for weld ends

Volumetric NDE examination of welding ends (see Clauses A.2, A.4 or A.8) shall be performed for a minimum length equal to 1,5 times the mating pipe wall thickness or 50 mm, whichever is greater. Surface NDE shall be performed on the machined ends of the valve-weld bevel per Clauses A.19 or A.20.

Annex B
(normative)

Supplementary test requirements

B.1 General

This annex specifies requirements for supplementary testing, which shall be performed by the manufacturer if specified by the purchaser. The frequency of testing shall also be specified by the purchaser, if not defined in this annex.

B.2 Hydrostatic testing

By agreement, hydrostatic testing may be performed at pressures higher than specified in 11.3 and 11.4 and/or for periods longer than specified in Tables 9, 10 or 11.

B.3 Low-pressure gas seat testing

B.3.1 Acceptance

The acceptable leakage rate for low-pressure gas seat testing shall be

— ISO 5208:1993, Rate A (no visible leakage), for soft-seated valves and lubricated-plug valves;

— ISO 5208:1993, Rate D, for metal-seated valves.

B.3.2 Type I

The seat test specified in 11.4 shall be repeated at a test pressure between 0,05 MPa (0.5 bar; 7.3 psi) and 0,10 MPa (1.0 bar; 14.5 psi) using air or nitrogen as the test medium.

B.3.3 Type II

The seat test specified in 11.4 shall be repeated at a test pressure of 0,55 MPa ± 00,7 MPa (5.5 bar ± 0.7 bar; 80.8 psi ± 10.3 psi) using air or nitrogen as the test medium.

B.4 High-pressure gas testing

B.4.1 General

High-pressure gas testing shall be performed after hydrostatic shell testing.

WARNING — High-pressure gas testing involves potential hazards. Appropriate safety precautions should be taken.

B.4.2 Seat testing

The seat tests specified in 11.2 and 11.4 shall be replaced with a high-pressure seat test using an inert gas as the test medium. The test pressure and duration shall be as specified in 11.2 and 11.4.

B.4.3 Shell testing

Valves designated by the purchaser shall have a high-pressure gas shell test performed using inert gas as the test medium. The minimum test pressure shall be 1,1 times the pressure rating determined in accordance with 7.2 for the material at 38 °C (100 °F). The test duration shall be in accordance with Table B.1.

Table B.1 — Minimum duration of pneumatic shell tests

Valve size		Test duration
DN	NPS	min
15 to 450	½ to 18	15
⩾ 500	⩾ 20	30

B.5 Anti-static testing

The electrical resistance between the obturator and the valve body and between the stem/shaft and the valve body shall be measured using a direct-current power source not exceeding 12 V. The resistance shall be measured on dry valves before pressure testing and shall not exceed 10 Ω.

At least 5 % of the valves in the order shall be tested.

B.6 Torque/thrust functional testing

The maximum torque or thrust required to operate ball, gate or plug valves shall be measured at the pressure specified by the purchaser for the following valve operations:

a) open to closed with the bore pressurized and the cavity at atmospheric pressure;

b) closed to open with both sides of the obturator pressurized and the cavity at atmospheric pressure;

c) closed to open with one side of the obturator pressurized and the cavity at atmospheric pressure;

d) as in (c) but with the other side of the obturator pressurized.

Torque or thrust values shall be measured with seats free of sealant except where the sealant is the primary means of sealing. If necessary for assembly, a lubricant with a viscosity not exceeding that of SAE 10W motor oil or equivalent may be used.

Thrust and torque testing shall be performed following hydrostatic shell testing and, if specified, prior to any low-pressure gas seat testing.

The measured torque or thrust results shall be recorded and shall not exceed the manufacturer's documented breakaway torque/thrust.

B.7 Drive train strength test

B.7.1 General

The test torque shall be the greater of

a) twice the manufacturer's predicted break-away torque/thrust, or

b) twice the measured break-away torque/thrust.

The test torque shall be applied with obturator blocked for a minimum time of 1 min.

NOTE For gate valves, the thrust can be tensile or compressive, whichever is the most stringent condition.

B.7.2 Acceptance criteria

The test shall not cause any permanent visible deformation of the drive train.

For ball and plug valves, the total torsional deflection of the extended drive train when delivering the design torque shall not exceed the overlap contact angle between the seat and obturator.

B.8 Cavity relief testing

B.8.1 Frequency

Each valve shall be tested.

Cavity relief testing is not required if protection of the cavity against over-pressure is ensured, for both the open and the closed position, by a hole in the obturator or around the seat seal.

B.8.2 Trunnion-mounted ball valves and through-conduit gate valves with internal-relieving seats

The procedure for cavity-relief testing of trunnion-mounted ball valves and through-conduit gate valves with internal-relieving seats shall be as follows.

a) Fill the valve in the half-open position with water.

b) Close the valve and allow water to overflow from the test connection at each end of the valve.

c) Apply pressure to the valve cavity until one seat relieves the cavity pressure into the valve end; record this relief pressure.

d) For valve types with second-seat relief, continue to increase the pressure to the cavity until the second seat relieves; record the relief pressure of the second seat.

Failure to relieve at a pressure less than 1,33 times the valve pressure rating shall be cause for rejection.

B.8.3 Floating-ball valves

The procedure for cavity-relief testing of floating-ball valves shall be as follows.

a) With the valve half-open, pressurize the valve to 1,33 times the valve pressure rating specified in 7.2 for the material at 38 °C (100 °F).

b) Close the valve and vent each end to atmospheric pressure.

c) Open the valve to the half-open position and monitor for the release of test medium trapped in the cavity.

Evidence of trapped pressurizing medium in the cavity shall be cause for rejection.

B.9 Hydrogen-induced cracking test

Process-wetted and pressure-containing parts that are manufactured, fabricated or formed from plate shall be resistant to hydrogen-induced cracking (HIC). This shall be demonstrated by successful HIC testing in accordance with NACE TM0284, except that the test solution shall comply with NACE TM0177. HIC acceptance criteria, such as the crack-sensitivity ratio (CSR), crack-length ratio (CLR) and crack-thickness ratio (CTR), shall be specified by the purchaser.

B.10 Double-block-and-bleed (DBB) valves

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 valve body vent valve opened to allow excess test fluid to overflow from the valve-cavity test connection. The test pressure shall be applied simultaneously from both valve ends.

Seat tightness shall be monitored via overflow through the valve cavity connection.

B.11 Double isolation and bleed DIB-1 (both seats bi-directional)

Each seat shall be tested in both directions.

Cavity-relief valves shall be removed if fitted. The valve and cavity shall be filled with test fluid, with the valve half-open, until the test fluid overflows through the cavity relief connection.

To test for seat leakage in the direction of the cavity, the valve shall be closed. The test pressure shall be applied successively to each valve end to test each seat separately from the upstream side. Leakage shall be monitored via the valve cavity pressure relief connection.

Thereafter, each seat shall be tested as a downstream seat. Both ends of the valve shall be drained and the valve cavity filled with test fluid. Pressure shall then be applied whilst monitoring leakage through each seat at both ends of the valve. Some valve designs can require the balancing of the upstream and valve cavity pressure during the downstream seat test.

B.12 Double isolation and bleed DIB-2 (one seat uni-directional and one seat bi-directional)

The bi-directional seat shall be tested in both directions.

Cavity-relief valves shall be removed if fitted. The valve and cavity shall be filled with test fluid, with the valve half-open, until the test fluid overflows through the cavity relief connection.

To test for seat leakage in the direction of the cavity, the valve shall be closed. The test pressure shall be applied successively to each valve end to test each seat separately from the upstream side. Leakage shall be monitored via the valve cavity pressure relief connection.

To test the bi-directional seat from the cavity test, pressure shall be applied simultaneously to the valve cavity and upstream end. Monitor leakage at the downstream end of the valve.

Annex C
(informative)

Supplementary documentation requirements

The purchaser may select supplementary documentation to be provided from the list below:

a) NDE records;

b) WPS;

c) PQR;

d) WPQ;

e) for sour service valves, certificate of compliance to ISO 15156 (all parts);

f) hardness test report on pressure-containing parts;

g) hardness test report on pressure-controlling parts;

h) certificate of conformance to this International Standard;

i) heat treatment certification records (e. g. charts);

j) design calculations for pressure-containing parts and/or the drive train;

k) design calculations for pressure-controlling parts;

l) pressure test report, (including pressure, test duration, test medium and acceptance criteria);

m) NDE personnel qualification records;

n) coating/plating certification;

o) NDE procedures;

p) calibration records (purchaser to identify requirements for equipment when ordering);

q) fire type-test certificate;

r) material inspection certificates in accordance with ISO 10474 or EN 10204, as applicable (the purchaser shall specify the type of certification, and for which parts, when ordering);

s) design verification by certification body/agency;

t) type approval by certification body/agency;

u) installation, operation and maintenance instructions/manuals;

v) general arrangements drawings;

w) cross-sectional drawings with parts and materials list;

x) flow coefficient, C_v or K_v;

y) current quality management system certificate.

Annex D
(informative)

Purchasing guidelines

D.1 General

This annex provides guidelines to assist the purchaser with valve type selection and specification of specific requirements when ordering valves.

D.2 Field testing

Pressures during the testing of installed valves should not exceed the pressure rating of the valve by more than 50 % when testing with the valve partially open or by more than 10 % when testing against a closed valve.

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.

NOTE The maximum test pressure for valves fitted with an external pressure relief can be lower (see 7.8).

D.3 Pressure relief

Certain valve designs trap pressure in the valve body cavity when the valve is in the fully open and/or closed position. High internal pressures can result from the thermal expansion of the fluid trapped in these confined areas.

If the valve has no self-relieving design provision, pressure-relief fittings shall be fitted in the valve body in accordance with 7.8.

D.4 Pigging

The purchaser should examine the valve design for piggability when ordering valves for use in pipelines requiring pigging.

NOTE 1 Venturi or reduced-bore valves are not suitable for most pigging operations, including intelligent pigging, but can allow the passage of foam pigs.

NOTE 2 A valve in which the drive member or the obturator obstructs the bore in the otherwise fully open position (e.g. a dual-plate check valve) is not piggable.

NOTE 3 Certain full-opening valves with pockets can allow bypass of fluid around a short pig or sphere.

D.5 Fire type-testing

The fire-resistance design of valves shall be qualified by fire type-testing in accordance with ISO 10497.

Fire resistance designs already qualified to ISO 10497, API 6FA, API 6FC, API 6FD or API 607 are also acceptable.

D.6 Additional testing

The purchaser shall specify any additional test requirements not covered by this International Standard.

D.7 Valve data sheet

The valve data sheet in Table D.1 can be used to assist with the specification of valves for ordering.

D.8 Information to be provided

Table D.2 provides a list of information that it is necessary for the purchaser and or manufacturer to provide.

Table D.1 — Valve data sheet

Materials of construction _____

Valve location and function _____

Nominal valve size _____

Maximum operating pressure _____

Maximum field test pressure (see Clause D.2) _____

Valve pressure class _____

Maximum service temperature _____

Minimum service temperature _____

Liquid or gas service _____

Flow medium composition _____

Special flow requirements: Blow down, solids, pigs, etc. _____

Valve

Type of valve: _____ Gate _____ Plug _____ Ball _____ Check _____

Design type _____

Full round opening required? _____ Minimum bore _____

End connections

Upstream pipe: OD _____ ID _____ Material _____

Flanged end? Yes _____ No _____

Plain raised face or ring joint? _____

If ring joint, flat or raised face? _____

Size and pressure class, as per ASME B16.5 or MSS SP-44 _____ or ASME B16.47, Series A _____

Ring gasket or other gasket type and size _____

Note Gaskets are not furnished as a part of the valve.

Welding end? Yes _____ No _____

Attach specifications for welding-end configuration.

Special flanges or mechanical joints? _____

Downstream pipe: OD _____ ID _____ Material _____

Flanged end? Yes _____ No _____

Plain raised face or ring joint? _____

If ring joint, flat or raised face? _____

Size and pressure class, as per ASME B16.5 or MSS SP-44 _____ or ASME B16.47, Series A _____

Ring gasket or other gasket type and size _____

Note: Gaskets are not furnished as a part of the valve.

Welding end? Yes _____ No _____

Attach specifications for welding-end configuration.

Special flanges or mechanical joints? _____

Length: Any special requirements for end-to-end or face-to-face dimensions? _____

Table D.1 (*continued*)

Valve operation
Is gearbox with hand-wheel required? If so, give details: _____
For a hand-wheel on a horizontal shaft, give distance from centreline of valve opening to hand-wheel: _____ mm
Or, for a hand-wheel on a vertical shaft, give distance from centreline of valve opening to centre of rim of hand-wheel: _____ mm
NOTE For plug valves having loose wrenches, it is necessary to order wrenches separately.
Wrench required? _____
Locking device required? _____ Type _____
Valve support
Support ribs or legs required? _____
Other requirements
Supplementary requirements (see Annex B and Annex C) _____
Fire test design? Yes _____ No _____
ISO 15156 (all parts)? Yes _____ No _____
Pressure relief: If pressure relief devices are required, are there special requirements for these devices? _____
Drain connections: Any requirements? _____
Bypass connections: Any requirements? _____
Supplementary documentation required? (see Annex C) _____
Third-party witness of processes/testing _____
Painting or coating required? _____

Table D.2 — Summary of information needed to be provided by manufacturer and/or purchaser

Clause/subclause	Information	Provider [a]
6.2.2	Reduced bore sizes other than those shown in tables	P
6.2.2	Obturator size for non circular openings	A
6.2.2	Obturator openings in reduced bore valves above DN 600	A
7.1	Pressure vessel design	A
7.2	Intermediate design pressure and temperatures	P
7.2	Minimum design temperature	P
7.4	Face-to-face or end-to-end dimension	A
7.4	Tolerances other than those listed	A
7.5	Advise MPD	P
7.5	Valve operation data, torque/thrust, C_v, K_v or number-of-turns data	M-P
7.6	Requirements for piggability	P
7.7.1	Alternate standard for flanges	A
7.7.2	Weld bevels	A
7.7.2	Mating pipe data	P
7.7.3	Other end connections	P
7.8	Determination of whether fluid can become trapped in valve cavities	M
7.8	Pressure relief, if not required for liquid or condensing service	A
7.8	Pressure relief, if required for gas service	A
7.8	Requirements for in-service testing	P
7.9	Alternative vent/drain connections	P
7.9	Thread profiles	A
7.9	Connection sizes	A
7.10	Sealant injection	P
7.11	Requirement for extended drain, vent or injection points	P
7.11	Securing of drain, vent and sealant lines	A
7.11	Design pressure and size, etc., of extended drain, vent and sealant lines	P
7.11	Maximum injection pressure for extended injection lines, in absence of purchaser specification	M
7.11	Size of sealant lines	A
7.12	Requirement for valves in vent, drain and injection lines	P
7.13	Wrench head design	P
7.13	Handwheel diameter(s)	A
7.13	Number of turns	M
7.14	Locking devices	P
7.18.1	Actuator output, if greater than drive train strength	A

Table D.2 (*continued*)

Clause/subclause	Information	Provider [a]
7.19	Lifting points	A
7.19	Lifting procedure	M
7.20.3	Demonstration of valve function under pressure and pipe loads and moments	M
7.22	Requirements for fire-type-testing certification	P
7.22	Fire type-testing certificate if not in accordance with Clause D.5	A
7.23	Anti-static device, if not provided on soft seal valve	A
7.23	Anti-static device testing per Clause B.5	P
8.1	Material specification	A
8.2	Commissioning fluids	P
8.4	Composition limits	A
8.4	Chemical composition of welding end	A
8.4	Chemical composition of other materials	A
8.5	Charpy tests for other materials	A
8.6	Bolting for hydrogen embrittlement	A
8.7	Sour-service requirements	P
8.7.2	HIC acceptance criteria	A
9.1	Additional welding requirements to meet pipeline requirements	P
9.3	Use of other hardness test methods	A
9.4	Through-wall weld repairs	A
9.4	Weld repairs to correct defects in plates and forgings	A
9.4	Specification for defect removal and repair	M
10.1	NDE requirements	P
10.4	NDE before final heat treatment	A
10.4	NDE requirements for weld repair	P
10.5	NDE of weld ends	P
11.1	Supplementary tests in Annex B	P
11.1	Use of light oil as an alternative to water for test media	A
11.1	Test sequence	A
11.1	Use of antifreeze in test water	A
11.3	Method of closing ends	A
11.4.1	Lubricant removed for testing	A
11.4.3	Other leakage rates	A
11.4.4.3	Valve seat functionality	P
11.4.5	Cavity relief test	P-M
11.4.7	Alternative test: high-pressure gas in lieu of water	A
11.5	Pneumatic testing of drain, vent and sealing lines	A

Table D.2 (*continued*)

Clause/subclause	Information	Provider [a]
11.5	Test pressure of sealant injection lines	A
12	Coating requirements	A
13	Omission of marking requirements on valves NPS 2 and smaller	A
13	Marking requirements	P
15	Requirement for longer data-retention period	P
15	Requirement for supplementary information	P
Annex A	NDE requirements	P
Annex B	Supplementary test requirements	P
Annex C	Supplementary documentation requirements	P
Annex D	Purchasing guidelines	P

[a] M indicates information to be supplied by manufacturer;
M-P indicates information to be supplied by manufacturer when required by purchaser;
P indicates information to be supplied by purchaser;
A indicates information to be established by agreement.

Annex E
(informative)

Marking example

To illustrate the requirements for marking specified in this International Standard, a 200 mm carbon steel gate valve, pressure class 600 (PN 100) with ring joint end flanges, a 664 mm face-to-face dimension, a maximum operating pressure rating of 10 MPa (100 bar), 13 % chromium steel trim and manufactured in April 2007 should be marked as follows:

On the body

ABCO	(Item 1: name of manufacturer)
PN 100 or 600	(Item 2: pressure class)
WCC	(Item 5: body material)
DN 200 or 8	(Item 6: nominal valve size) NOTE Item 6 can also be marked on nameplate or on both body and nameplate.
R49	(Item 9: ring joint identification on flange edge)
12345	(Item 13: serial number)

On the bonnet/cover

12345	(Item 6: bonnet/cover melt identification)

On nameplate

ABCO	(Item 1: manufacturer)
PN 100 or 600	(Item 2: pressure class)
10,4 MPa or 104 bar at – 29 °C; 1 500 psi at – 20 °F	(Item 3: maximum operating pressure at minimum operating temperature
10,2 MPa or 102 bar at 121 °C; 1 478 psi at 250 °F	maximum operating pressure at maximum operating temperature)
WCC	(Item 5: body material)
Stem CR13 Disc CR13 Seat CR13 or CR13 CR13 CR13 or CR13 CR13 CR13	(Item 7: trim identification)
664 mm or 26.13	(Item 4: face-to face/end-to end dimensions; see 7.4)

DN 200 or 8 or DN 200 × 150 or 8 × 6 or DN 200R or 8R SMYS 276MPa or 40KSI	(Item 8: nominal valve size for full-opening valve) (Item 8: nominal valve size for reduced-bore valve) (Item 8: nominal valve size for reduced-bore valve) (Item 10: SMYS)
DBB, DIB-1, or DIB-2, as applicable	(Item 13: When seat tests per Clause B.10, B.11 or B.12, respectively)
12345	(Item 14 serial number)
4-07 or 4/07	(Item 15: date of manufacture)
ISO 14313	(Item 16: number of this International Standard)

Annex F
(Informative)

API Monogram

F.1 Scope

The API Monogram Program allows an API Licensee to apply the API Monogram to products. The API Monogram Program delivers significant value to the international oil and gas industry by linking the verification of an organization's quality management system with the demonstrated ability to meet specific product specification requirements. The use of the Monogram on products constitutes a representation and warranty by the Licensee to purchasers of the products that, on the date indicated, the products were produced in accordance with a verified quality management system and in accordance with an API product specification.

When used in conjunction with the requirements of the API License Agreement, API Specification Q1, in its entirety, defines the requirements for those organizations who wish to voluntarily obtain an API License to provide API monogrammed products in accordance with an API product specification.

API Monogram Program Licenses are issued only after an on-site audit has verified that the Licensee conforms to the requirements described in API Specification Q1 in total, and the requirements of an API product specification. Customers/Users are requested to report to API all problems with API monogrammed products. The effectiveness of the API Monogram Program can be strengthened by Customers/Users reporting problems encountered with API monogrammed products. A nonconformance may be reported using the API Nonconformance Reporting System available at https://ncr.api.org. API solicits information on new product that is found to be nonconforming with API specified requirements, as well as field failures (or malfunctions), which are judged to be caused by either specification deficiencies or nonconformities with API specified requirements.

This Annex sets forth the API Monogram Program requirements necessary for a supplier to consistently produce products in accordance with API specified requirements For information on becoming an API Monogram Licensee, please contact API, Certification Programs, 1220 L Street, N. W., Washington, DC 20005 or call 202-962-4791 or by email at certification@api.org.

F.2 References

In addition to the referenced standards listed in Section 3, this Annex references the following standard:

API Specification Q1

For licensees under the Monogram Program, where cited these requirements are mandatory. Referenced standards used by the Manufacturer may be either the applicable revision shown in Section 3 and herein, or the latest revision.

F.3 API Monogram Program: Licensee Responsibilities

F.3.1 For all organizations desiring to acquire and maintain a license to use the API Monogram, conformance with the following shall be required at all times:

a. The quality management system requirements of API Specification Q1,

b. The API Monogram Program requirements of API Specification Q1, Annex A,

c. The requirements contained in the API product specification(s) for which the organization desires to be licensed,

d. The requirements contained in the API Monogram Program License Agreement.

F.3.2 When an API Licensed organization is providing an API monogrammed product, conformance with API specified requirements, described in API Specification Q1, including Annex A, is required.

F.3.3 Each Licensee shall control the application of the API Monogram in accordance with the following:

a. Each Licensee shall develop and maintain an API Monogram Marking Procedure that documents the marking / monogramming requirements specified by the API product specification to be used for application of the API Monogram by the Licensee. The marking procedure shall define the location(s) where the Licensee shall apply the API Monogram and require that the Licensee's license number and date of manufacture be marked on monogrammed products in conjunction with the API Monogram. At a minimum, the date of manufacture shall be two digits representing the month and two digits representing the year (e.g., 05-07 for May 2007) unless otherwise stipulated in the applicable API product specification. Where there are no API product specification marking requirements, the Licensee shall define the location(s) where this information is applied.

b. The API Monogram may be applied at any time appropriate during the production process but shall be removed in accordance with the Licensee's API Monogram Marking Procedure if the product is subsequently found to be nonconforming with API specified requirements. Products that do not conform to API specified requirements shall not bear the API Monogram.

c. Only an API Licensee may apply the API Monogram and its license to API monogrammable products. For certain manufacturing processes or types of products, alternative Monogram marking procedures may be acceptable. The current API requirements for Monogram Marking are detailed in the API Policy Document, *Monogram Marking Requirements*, available on the API Monogram Program website at http://www.api.org/certifications/monogram/.

d. The API Monogram shall be applied at the licensed facility.

e. The authority responsible for applying and removing the API Monogram shall be defined in the Licensee's API Monogram Marking Procedure.

F.3.4 Records required by API product specifications shall be retained for the period of time specified therein. Records specified to demonstrate achievement of the effective operation of the quality system shall be maintained for a minimum of 5 years.

F.3.5 Any proposed change to the Licensee's quality program to a degree requiring changes to the quality manual shall be submitted to API for acceptance prior to incorporation into the Licensee's quality program.

F.3.6 Licensee shall not use the API Monogram on letterheads or in any advertising (including company-sponsored web sites) without an express statement of fact describing the scope of Licensee's authorization (license number).

F.4 Marking Requirements

These marking requirements apply only to those API licensees wishing to mark their products with the API Monogram.

F.4.1 Manufacturers shall either mark equipment on the nameplate with "API 6D" alone or "API 6D" in addition to the marking requirements of Item 16 in Table 12 of Section 13.

F.4.2 As a minimum, equipment should be marked with English (Imperial) Units.

F.4.3 The API Monogram shall be marked on the nameplate, in addition to the marking requirements of Section 13. For valves smaller than DN 50 (NPS 2), the nameplate shall not be omitted, but may be attached to the valve with stainless steel wire.

F.4.4 The API Monogram License number shall not be used unless it is marked in conjunction with the API Monogram.

F.5 API Monogram Program: API Responsibilities

F.5.1 The API shall maintain records of reported problems encountered with API monogrammed products. Documented cases of nonconformity with API specified requirements may be reason for an audit of the Licensee involved, (also known as Audit for "cause").

F.5.2 Documented cases of specification deficiencies shall be reported, without reference to Licensees, Customers or Users, to API Subcommittee 18 (Quality) and to the applicable API Standards Subcommittee for corrective actions.

Bibliography

[1] API 6FA, *Specification for Fire Test for Valves*

[2] API 6FC, *Specification for Fire Test for Valve with Automatic Backseats*

[3] API 6FD, *Specification for Fire Test for Check Valves*

[4] API 607, *Specification for Testing of Valves — Fire Type-Testing Requirements*

[5] API Spec 6D, *Pipeline Valves*

[6] ISO 14723, *Petroleum and natural gas industries — Pipeline transportation systems — Subsea pipeline valves*

[7] ISO/TS 29001, *Petroleum, petrochemical and natural gas industries — Sector-specific quality management systems — Requirements for product and service supply organizations*

[8] ISO 5211, *Industrial valves — Part-turn actuator attachments*

[9] ISO 13623, *Petroleum and natural gas industries — Pipeline transportation systems*

[10] MSS SP-25-1998, *Standard Marking System for Valves, Fittings, Flanges and Unions*

[11] EN 12516-1, *Industrial valves — Shell design strength — Part 1: Tabulation method for steel valve shells*

[12] EN 13445-3, *Unfired pressure vessels — Part 3: Design*

[13] ASTM E18, *Standard Test Methods for Rockwell Hardness of Metallic Materials*

[14] ASTM E92, *Standard Test Method for Vickers Hardness of Metallic Materials*

[15] ASME B16.25-2003, *Buttwelding Ends*

Date of Issue: August 2011
Affected Publication: API Specification 6D/ISO 14313, *Specification for Pipeline Valves,* 23rd Edition, April 2008

ERRATA 6

(Includes Errata 1, Errata 2, Errata 3, Errata 4, and Errata 5)

These errata correct editorial errors in the 23rd Edition of API Spec 6D.

Page 2, Section 3, Normative references, replace:

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

with

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

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

with

ASME B31.8-2007, *Gas Transmission and Distribution Piping Systems*

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

with

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

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

with

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

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

with

ASME B16.47, *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*

with

ASME B31.4-2009, *Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids*

ASME B31.8-2007, *Gas Transmission and Distribution Piping Systems*

with

ASME B31.8-2010, *Gas Transmission and Distribution Piping Systems*

Page 3, Section 3, Normative references, replace:

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

with

ASME Boiler and Pressure Vessel Code — Section VIII: *Rules for Construction of Pressure Vessels* — Division 2-2004: *Alternative Rules*

Page 34, Table 4, under subheading "PN 50 (class 300)," for "DN 150 (NPS 6):"

replace the value of "457" *in the column "**Raised face** (A)" with* "403" *such that the line reads:*

150	6	403	457	419	—	—	—

Page 36, Table 4, under subheading "PN 420 (class 2500)," line for "DN 65 (NPS 2 1/2):"

replace the value of "540" *in the column "**Ring joint**" with* "514" *such that the line reads:*

65	2 1/2	508	508	514

Page 41, Section 7.7.2, replace:

ASME B31.8-2003

with

ASME B31.8-2007

and

Figures 14 and 15

with

Figures I-4 and I-5

Page 45, Section 7.20.2, second sentence, replace:

ASME Code Section VIII, Division 2, Part AD-132

with

ASME Code Section VIII, Division 2-2004, Part AD-132

Page 49, Section 9.3, Note, delete:

by agreement

Page 49, Section 9.4, second paragraph, second sentence, add:

"pipe pups to valve" after "Repairs of fabrication welds"

On page 51, withdraw:

Section **10.2.3.2 Gauge range**

Renumber:

10.2.3.3 (from Addendum 1) as **10.2.3.2**

Page 63, Section B.3.3, replace:

0,55 MPa ± 00,7 MPa

with

0,55 MPa ± 0,07 MPa

On page 64, add to the end of Section B.4.2

"Acceptance criteria shall be per the requirements of 11.4.3"

On page 66, add to the end of Section B.10

"Acceptance criteria shall be per the requirements of 11.4.3"

On page 66, add to the end of Section B.11

"Acceptance criteria shall be per the requirements of 11.4.3"

On page 66, add to the end of Section B.12

"Acceptance criteria shall be per the requirements of 11.4.3"

Page 71, Table D.1, beginning of last box, replace:

Other requirements

with

Other requirements

Page 71, Table D.1, after "ISO 15156 (all parts)? Yes ___ No ___" add the following line:

If yes, specify % mass fraction of H_2S ___; pH ___; % mass fraction of chlorides ___; temperature ___

Date of Addendum Issue: October 2009
Effective Addendum Date: April 1, 2010
Affected Publication: API Specification 6D, *Specification for Pipeline Valves*, 23rd Edition, April 2009, Effective Date: October 1, 2008

ADDENDUM 1

Annex G
(normative)

This addendum replaces all revisions to the text of API 6D, 23rd Edition

API Regional Annex

Page 1, Section 2, add the following text:

2.4 Processes requiring validation

The following operations performed during manufacturing shall be validated as the resulting output cannot be verified by subsequent monitoring or measurement.

The following processes shall be validated, by the manufacturer, in accordance with their quality system:

— Nondestructive Examination (NDE)—reference 10.1;

— Welding—reference Section 9.0;

— Heat Treating—reference 8.1;

— Plating/coating that may impact product performance, by agreement.

Page 3, Section 3, add the following reference:

EN 473, *Nondestructive testing—Qualification and certification of NDT personnel—General principles*

Page 44, Section 7.20.1, replace with the following text:

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

Page 48, Section 8, add the following text:

8.9 Heat-treating equipment qualification

All heat treating of parts and test coupons shall be performed with "production type" equipment meeting the requirements specified by the manufacturer. A recommended

practice for heat-treating furnace calibration can be found in Annex H of this international standard.

"Production type" heat-treating equipment shall be considered equipment that is routinely used to process production parts.

Page 51, Section 10.2.1, replace with the following text:

Equipment used to inspect, test, or examine material or other equipment used for acceptance shall be identified, controlled, calibrated and adjusted at specified intervals in accordance with documented manufacturer instructions, and consistent with nationally or internationally recognized standards specified by the manufacturer, to maintain the accuracy required by this international standard.

Page 51, Section 10.2.3.1, replace with the following text:

Test pressure-measuring devices shall be accurate to at least ± 2,0 % of full scale. If pressure gauges are used in lieu of pressure transducers; they shall be selected such that the test pressure is indicated within 20 % and 80 % of the full-scale value.

Pressure recording devices are outside the scope of 10.2.3.1 unless used for both measurement and recording.

Page 51, Section 10.2.3.3, replace with the following text:

Pressure-measuring devices shall be periodically calibrated with a master pressure-measuring device or dead-weight tester to at least three equidistant points of full scale (excluding zero and full scale as required points of calibration).

Page 51, add the following to Section 10.2.3:

10.2.3.4 Calibration intervals

Calibration intervals shall be established for calibrations based on repeatability and degree of usage.

Intervals may be lengthened and shall be shortened based on recorded calibration history. Calibration intervals shall be a maximum of three months until recorded calibration history can be established by the manufacturer and new longer intervals (three months maximum increment) established.

Page 51, Section 10.3, replace with the following text:

10.3 Qualification of personnel

10.3.1 Nondestructive examination (NDE) personnel

NDE personnel shall be qualified in accordance with the manufacturer's documented training program which is based on the requirements specified in ISO 9712, EN 473 or ASNT SNT-TC-1A.

10.3.2 Visual examination personnel

Personnel performing visual inspection for acceptance shall take and pass an annual vision examination in accordance with the manufacturer's documented procedures which meet the applicable requirements of ISO 9712, EN 473, or ASNT SNT-TC-1A.

10.3.3 Other personnel

All personnel performing other quality control activities directly affecting material and product quality shall be qualified in accordance with manufacturer's documented requirements.

10.3.4 Welding inspectors

Personnel performing visual inspections of welding operations and completed welds shall be qualified and certified as:

— AWS certified welding inspector,

— AWS senior certified welding inspector,

— AWS certified associate welding inspector, or

— welding inspector certified by the manufacturer's documented training program.

Page 79, add the following reference to the Bibliography:

[16] SAE AMS-H-6875G

Add Annex H to the document:

Annex H
(informative)

Recommended practice for qualification of heat-treating equipment

H.1 General

All heat treatment of parts and test coupons shall be performed with equipment meeting the requirements of this annex.

H.2 Temperature tolerance

The temperature at any point in the working zone shall not vary by more than ± 13 °C (± 25 °F) from the furnace set-point temperature after the furnace working zone has been brought up to temperature. Furnaces which are used for tempering, ageing and/or stress-relieving shall not vary by more than ± 8 °C (± 15 °F) from the furnace set-point temperature after the furnace working zone has been brought up to temperature.

H.3 Furnace calibration

H.3.1 General

Heat treatment of production parts shall be performed with heat-treating equipment that has been calibrated and surveyed.

H.3.2 Records

Records of furnace calibration and surveys shall be maintained for a period not less than two years.

H.3.3 Temperature survey method for calibration of batch-type furnaces

A temperature survey within the furnace working zone(s) shall be performed on each furnace at the maximum and minimum temperatures for which each furnace is to be used.

A minimum of nine thermocouple test locations shall be used for all furnaces having a working zone greater than 0,3 m^3 (10 ft^3).

For each 3,5 m^3 (125 ft^3) of furnace working zone surveyed, at least one thermocouple test location shall be used, up to a maximum of 40 thermocouples. See Figure H.1 and Figure H.2 for examples of thermocouple locations.

For furnaces having a working zone less than 0,3 m^3 (10 ft^3), the temperature survey may be made with a minimum of three thermocouples located either at the front, centre and rear, or at the top, centre and bottom of the furnace working zone.

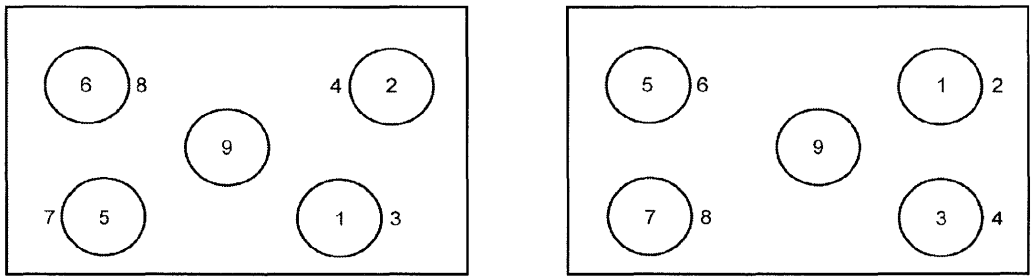
After insertion of the temperature-sensing devices, readings shall be taken at least once every 3 min to determine when the temperature of the furnace working zone approaches the bottom of the temperature range being surveyed.

Once the furnace temperature has reached the set-point temperature, the temperature of all test locations shall be recorded at 2-min intervals, maximum, for at least 10 min. Then readings shall be taken at 5-min intervals, maximum, for sufficient time (at least 30 min) to determine the recurrent temperature pattern of the furnace working zone.

Before the furnace set-point temperature is reached, none of the temperature readings shall exceed the set-point temperature by more than 13 °C (25 °F).

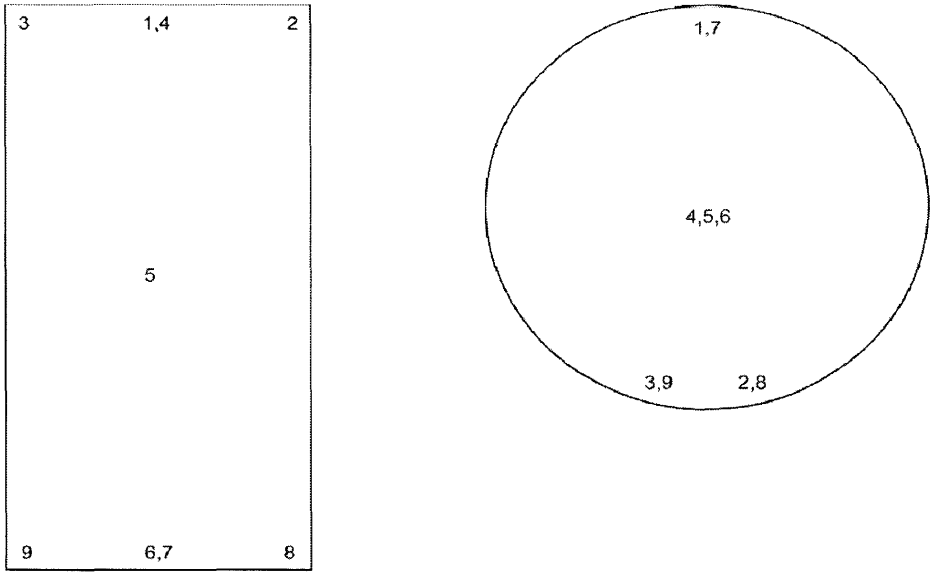
After the furnace control set-point temperature is reached, no temperature reading shall vary beyond the limits specified. The temperatures within each furnace shall be surveyed within one year prior to use of the furnace for heat treatment.

When a furnace is repaired or rebuilt, a new temperature survey shall be carried out before the furnace is used for heat treatment.



a) Top view b) Side view

Figure H.1—Thermocouple location—Rectangular furnace (working zone)



a) Side view b) Top view

Figure H.2—Thermocouple locations—Cylindrical furnace (working zone)

H.3.4 Continuous-type furnaces method

Furnaces used for continuous heat treatment shall be calibrated in accordance with procedures specified in SAE AMS-H-6875G.

H.4 Instruments

H.4.1 General

Automatic controlling and recording instruments shall be used.

Thermocouples shall be located in the furnace working zone(s) and protected from furnace atmospheres by means of suitable protective devices.

H.4.2 Accuracy

The controlling and recording instruments used for the heat-treatment processes shall be accurate to ± 1 % of their full-scale range.

H.4.3 Calibration

Temperature-controlling and -recording instruments shall be calibrated at least once every three months.

Equipment used to calibrate the production equipment shall be accurate to ± 0,25 % of full-scale range.

Date of Addendum Issue: August 2011
Effective Addendum Date: February 1, 2012
Affected Publication: API Specification 6D, *Specification for Pipeline Valves*, 23rd Edition, April 2009, Effective Date: October 1, 2008

ADDENDUM 2

Insert Annex I and Annex J at the end of the document.

Annex I
(informative)

API Regional Annex

Requirements for Extended Hydrostatic Shell Test duration and Records Retention for Valves in Jurisdictional Pipeline Systems

I.1 General

This annex provides a recommended practice pertaining to valves used in jurisdictional pipeline systems. Valves used in transportation of natural and other gas and hazardous liquids or carbon dioxide by pipeline are usually regulated by the national governments of the countries in which the pipeline is located. This annex specifies the requirements for extended hydrostatic shell testing that shall be performed by the manufacturer if specified by the purchaser. This annex also specifies the test records to be provided to the purchaser and record retention requirements.

I.2 Hydrostatic shell testing requirements:

The hydrostatic shell test shall be in accordance with 11.1 and 11.3 of this specification with a test duration of at least four (4) hours, unless otherwise agreed.

I.2.1 Test record requirements:

Test records shall contain the following as a minimum and be provided to the purchaser.

I.2.1.1 The name of the manufacturer , name of the organization that performs testing (if other than the valve manufacturer), the identification of the individual responsible for performing the test, date, time and location of test.

I.2.1.2 Serial number, size, class and end connection.

I.2.1.3 Test medium (fluid) used.

I.2.1.4 The beginning, ending, and actual test pressure and temperature readings, unless otherwise agreed.

I.2.1.5 The test duration.

I.2.1.6 A chart recording or digital record of the pressure showing the raise from zero to pressure at the beginning of the test and return to zero at the end.

I.2.1.7 Any significant variations in pressure or temperature for the particular test.

I.2.1.8 Any leaks or failures and their disposition.

I.2.1.9 Certificates of calibration for all instrumentations used in the test, such as pressure transducers, pressure gauges, temperature devices and chart recorders.

I.2.2 Minimum requirements for pressure transducers, pressure gauges, temperature devices and chart recorders

I.2.2.1 Pressure transducers, pressure gauges, temperature devices and chart recorders shall be calibrated in accordance with section 10 of this specification, but at an interval not greater than 12 months.

I.2.3 Record retention requirement:

I.2.3.1 Test records in I.2.1 shall be shall be provided to the purchaser and maintained by the manufacturer in accordance with section15 of this specification, unless otherwise agreed.

Annex J
(informative)

Quality Specification Level (QSL) for pipeline valves

J.0 General

This annex specifies quality levels for pipeline valves. QSL 1 is the quality level as specificed in API 6D. QSL 2 to 4 are quality levels are optional and may be specified by the purchaser. The QSLs increase in stringency of requirements with the QSL number. The QSLs include specific requirements for non-destructive examination (NDE), pressure testing, and documentation of the manufacturing process.

J.1 Specification of quality levels for NDE

Table J.1 specifies the additional NDE requirements by inspection code for QSL 3 and QSL 4. These requirements vary by the type of raw material for the item being inspected. There are no additional NDE requirements for QSL 1 and 2. Table J.2 specifies the extent, method, and acceptance criteria for the various inspection codes used in Table J.1.

Table J.1 — NDE requirements

Part	QSL 3			QSL 4		
	Cast	Forged	Plate	Cast	Forged	Plate
Body or Closures and end connections or Bonnet or cover or Gland housing	VT1 and RT1 [a]	VT2	VT2 and UT2	VT1 and RT1 [a,f] and UT1 [g] and MT1 or PT1	VT2 and UT2 and MT1 or PT1	VT2 and UT2 and MT1 or PT1
Welding ends [b]	VT1 and RT3 or UT4 and MT1 or PT1	VT2 and UT2 and MT1 or PT1	VT2 and UT2 and MT1 or PT1	VT1 and RT3 or UT4 and MT1 or PT1	VT2 and UT2 and MT1 or PT1	VT2 and UT2 and MT1 or PT1
Stem or shaft [c, g]	N/A	VT2 and MT1 or PT1	N/A	N/A	VT2 and UT2 and MT1 or PT1	N/A
Trunnion [d, g] Or Trunnion/bearing plates	VT1	VT2	VT2	VT1 and UT1 and MT1 or PT1	VT2 and MT1 or PT1	VT2 and UT2 and MT1 or PT1
Bolting-pressure containing	N/A	VT2	N/A	N/A	VT2 and MT1 or PT1	N/A
Ball or gate [c]	VT1	VT2	VT2	VT1 and MT1 or PT1	VT2 and MT1 or PT1	VT2 and MT1 or PT1
Plug or clapper disc [c, g]	VT1	VT2	VT2	VT1 and RT3 or UT4 and MT1 or PT1	VT2 and MT1 or PT1	VT2 and MT1 or PT1
Clapper disc arm	VT1	VT2	VT2	VT1 and UT4 and MT1 or PT1	VT2 and MT1 or PT1	VT2 and MT1 or PT1 and UT2
Seat rings [c, g]	VT1	VT2	VT2	VT1 and MT1 or PT1	VT2 and MT1 or PT1	VT2 and MT1 or PT1
Corrosion –resistant overlay	VT4 and PT1			VT4 and UT3 and PT1		

Part	QSL 3			QSL 4		
	Cast	Forged	Plate	Cast	Forged	Plate
Seals Gaskets	VT4					
Seat springs	VT4					
Pressure-containing welds	VT3 and RT2 and MT1 or PT1 or VT3 and UT3 and MT1 or PT1					
Reinforcement and stiffening welds	VT4					
Fillet and attachment welds to pressure-containing parts	VT3 and MT1 or PT1					
Pipe pup to valve welds or Pipe pups [e]	VT3 and RT2 and MT1 or PT1					
Plating	VT4					
Hardfacing	VT4 and PT1					
Sealing surfaces	MT2 or PT2					

NOTE 1 See Table J.2 for specification of the examinations referred to in this table.

NOTE 2 N/A means that the manufacturer is not allowed to use this material form for that specific part

NOTE 3 All the NDE activities listed above for a specific product form or forms shall be conducted.

[a] RT1 may be replaced by UT4 by agreement.

[b] NDE back 50 mm from weld end.

[c] MT/PT to be performed prior to coating, plating or overlay.

[d] Trunnion may be pressure-containing or pressure-controlling, depending on design type. If the trunnion is a pressure-containing part then the requirements for body apply.

[e] NDE requirements of pipe pups shall be established by agreement.

[f] RT1 plus UT1 may be replaced by RT3.

[g] Requirements for examination of bar material shall be as for forgings

Table J.2 — Extent, method and acceptance criteria of NDE/Item examination code

Examination	NDE	Extent	Method	Acceptance
RT1	RT casting	Critical areas per ASME B16.34	ASME Section V, Article 2	ASME Section VIII Div.1, Appendix 7
RT2	RT weldments	100 % where practicable	ASME Section V, Article 2	ASME Section VIII Div. 1, UW51 (linear indications); ASME Section VIII Div.1, Appendix 4 (round indications)
RT3	RT casting	100 %	ASME Section V, Article 2	ASME Section VIII Div. 1, Appendix 7
UT1	UT casting	Remaining areas not covered by RT1	ASME Section V, Article 5 (direct and shear wave)	ASTM A 609/A 609M, Table 2, Quality Level 2
UT2	UT forging and plate	All surfaces	ASME Section V, Article 5	Forgings : ASME Section VIII Div. 1-UF 55 for angle bean and ASME B16.34 for straight beam. Plate: ASTM A578/A578M Acceptance standard level B
UT3	UT weldments	100 % where weld joint geometry allows acceptable test results	ASME Section V, Article 4 (direct and shear wave); Article 23	ASME Section VIII Div. 1, Appendix 12
	UT overlay	100 % where part geometry allows acceptable test results		ASTM A578/A 578M Acceptance standard level C
UT4	casting	100 %	ASME Section V, Article 5	ASTM A 609/A 609M, Table 2, Quality Level 1
MT1	MT	100 % accessible surfaces	ASME Section V, Article 7	ASME Section VIII Div.1, Appendix 6
MT2	MT	100 % sealing surfaces	ASME Section V, Article 7	No rounded or linear indications
PT1	PT	100 % accessible surfaces	ASME Section V, Article 6	ASME Section VIII Div. 1, Appendix 8
PT2	PT	100 % sealing surfaces	ASME Section V, Article 6	No rounded or linear indications
VT1	VT casting	100% accessible surfaces	MSS SP-55	Type 1 none acceptable; Type 2 to 12 – A and B
VT2	VT forging and plate	100% accessible surfaces	As required by ASTM product specification	As required by ASTM product specification
VT3	VT weldments	100% accessible surfaces	ASME Section V, Article 9	Undercut shall not reduce the thickness in the area (considering both sides) to below the minimum thickness. Surface porosity and exposed slag are not permitted on or within 45 mm of seating surfaces.
VT4	VT weldments and others	All accessible surfaces	ASME Section V, Article 9	No visible defects

J.2 Hydrostatic/Pneumatic testing

Table J.3 defines the additional test requirements for QSL2, QSL 3 and QSL 4. All QSL 4 pressure tests shall be recorded on time-based equipment. There are no additional testing requirements for QSL 1.

Table J.3 – Additional pressure testing requirements

	Quality Specification Level				
	QSL 1	**QSL 2**	**QSL 3**	**QSL 4**	
High Pressure Shell Test @ 1.5 times the rated pressure per clause 11.3	Test per clause 11.3	Test per clause 11.3	2 tests required. After 1st test reduce pressure to zero and repeat test.	3 tests are required. Reduce pressure to zero between each test.	Test 1 and 3 shall have a test duration as specified in Table 10. Test 2 shall have an extended duration of four times that stated in Table 10.
High pressure Seat Test@ 1.1 times the rated pressure per clause 11.4	Test per clause 11.4	Test per clause 11.4	2 tests each seat required. After 1st test reduce pressure to zero and cycle fully open and fully closed and repeat test.	3 tests each seat are required. Reduce pressure to zero and cycle fully open and fully closed after each test.	Test 1 and 3 shall have test duration as specified in Table 11 Test 2 shall have an extended duration of four times that stated in Table 11.
Low pressure air seat test at 80psi per clause B.3.3 Type II	None	Test each seat per clause B.3.3	2 tests each seat required. Reduce pressure to zero and cycle valve fully open and fully closed and repeat test of each seat.	3 tests each seat are required. Reduce pressure to zero and cycle fully open and fully closed after each test.	Test 1 and 3 shall have test duration as specified in Table 11. Test 2 shall have an extended duration of four times that stated in Table 11.

J.3 Documentation

Table J.4 specifies the final assembly documentation requirements for QSL2, QSL3, and QSL 4. There are no additional documentation requirements for QSL 1.

Table J.4 – Documentation requirements

Required documentation to be sent with the valve(-s)	QSL 2	QSL 3	QSL 4
Certificate of conformance to this specification and QSL	X	X	X
Hardness test report on pressure-controlling parts			X
Hardness test report on pressure-containing parts		X	X
Pressure test report, (including pressure, test duration, test medium, and acceptance criteria) including copy of chart recorder used on pressure test	X	X	X
Calibration certificates on pressure test equipment used (e.g. pressure gauges, transducers and chart recorders)			X
Heat treatment records including times and temperatures, e.g. charts			X
Material test reports on all pressure containing and pressure controlling parts.	X	X	X
For sour service valves, certificate of conformance to ANSI/NACE MR0175/ISO 15156	X	X	X
General arrangements drawings;			X
NDE records		X	X
Cross-sectional assembly drawings with parts list and materials list;		X	X
Installation, operation and maintenance instructions/manuals		X	X