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Industrial valves - Metallic butterfly valves

Robinetterie industrielle - Robinets métalliques à papillon

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Foreword

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

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

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

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

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

This document was prepared by Technical Committee ISO/TC 153, *Valves*.

This third edition cancels and replaces the second edition (ISO 10631:2013), which has been technically revised.

The main changes compared to the previous edition are as follows:

— the extension of the pressure ratings to include PN 63, PN 100, and Class 25, 250 and 600;

— update of the normative references and the terms and definitions;

— addition in Clause 4 of a requirement to mark the valve with any reduced pressure and/or temperature limits;

— addition of 5.6 for disc requirements;

— addition in 5.7 of a requirement to have a feature preventing shaft ejection from the valve in the shaft or shaft-to-disc connection fails;

— clarification of 5.8.2.3 regarding the way to secure adjustable stops;

— addition of specified minimum clearance between fully open disc and matching pipe in a new 5.10.6.

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

Industrial valves - Metallic butterfly valves

1 Scope

This document specifies the general requirements for design, materials (e.g. steel, cast iron, ductile iron, copper alloy), pressure/temperature ratings and testing for butterfly valves having metallic bodies for use in flanged or butt-welding piping systems.

This document applies to metallic butterfly valves used for all industrial applications.

Additional requirements given in the relevant application standards can apply to butterfly valves used for more specific applications (e.g. for the water industry, the chemical and petrochemical process industry, the oil and gas industry).

This document covers butterfly valves of the following nominal sizes, DN and NPS:

— DN 40; 50; 65; 80; 100; 125; 150; 200; 250; 300; 350; 400; 450; 500; (550); 600; (650); 700; 750; 800; 900; 1 000; 1 050; 1 200; 1 400; 1 500; 1 600; 1 800; 2 000; 2 200; 2 400.

— NPS 1 ½; 2; 2 ½; 3; 4; 5; 6; 8; 10; 12; 14; 16; 18; 20; (22); 24; (26); 28; 30; 32; 36; 40; 42; 48; 54; 56; 60; 64; 66; 72; 78; 80; 84; 88; 90; 96.

This document is applicable to butterfly valves of the following pressure designations, PN and Class:

— PN 2,5; PN 6; PN 10; PN 16; PN 25; PN 40; PN 63; PN 100;

— Class 25, 125; 150; 250; 300; 600.

NOTE 1 It is possible that the nominal sizes listed are not available for all pressure designations.

NOTE 2 Nominal sizes listed in parenthesis are not common industry sizes, but are used in some application standards.

2 Normative references

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

ISO 185, *Grey cast irons — Classification*

ISO 1083, *Spheroidal graphite cast irons — Classification*

ISO 4991, *Steel castings for pressure purposes*

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

ISO 5209:2019, *General purpose industrial valves — Marking*

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

ISO 5752, *Metal valves for use in flanged pipe systems — Face-to-face and centre-to-face dimensions*

ISO 5922, *Malleable cast iron*

ISO 7005-3, *Metallic flanges — Part 3: Copper alloy and composite flanges*

ISO 9327-1, *Steel forgings and rolled or forged bars for pressure purposes — Technical delivery conditions — Part 1: General requirements*

ISO 9327-2, *Steel forgings and rolled or forged bars for pressure purposes — Technical delivery conditions — Part 2: Non-alloy and alloy (Mo, Cr and CrMo) steels with specified elevated temperature properties*

ISO 9327-3, *Steel forgings and rolled or forged bars for pressure purposes — Technical delivery conditions — Part 3: Nickel steels with specified low temperature properties*

ISO 9327-4, *Steel forgings and rolled or forged bars for pressure purposes — Technical delivery conditions — Part 4: Weldable fine grain steels with high proof strength*

ISO 9327-5, *Steel forgings and rolled or forged bars for pressure purposes — Technical delivery conditions — Part 5: Stainless steels*

ISO 9328-1, *Steel flat products for pressure purposes — Technical delivery conditions — Part 1: General requirements*

ISO 9328-2, *Steel flat products for pressure purposes — Technical delivery conditions — Part 2: Non-alloy and alloy steels with specified elevated temperature properties*

ISO 9328-3, *Steel flat products for pressure purposes — Technical delivery conditions — Part 3: Weldable fine grain steels, normalized*

ISO 9328-4, *Steel flat products for pressure purposes — Technical delivery conditions — Part 4: Nickel-alloy steels with specified low temperature properties*

ISO 9328-5, *Steel flat products for pressure purposes — Technical delivery conditions — Part 5: Weldable fine grain steels, thermomechanically rolled*

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

ISO 14737, *Carbon and low alloy cast steels for general applications*

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

EN 1092-2, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 2: Cast iron flanges*

EN 1092-3, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 3: Copper alloy flanges*

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

EN 12516-2, *Industrial valves — Shell design strength — Part 2: Calculation method for steel valve shells*

EN 12516-4, *Industrial valves — Shell design strength — Part 4: Calculation method for valve shells manufactured in metallic materials other than steel*

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

ASME B16.1, *Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250*

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

ASME B16.24, *Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500*

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

ASME B16.42, *Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300*

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

3 Terms and definitions

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

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

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

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

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

3.2
PN
nominal pressure
numerical designation relating to pressure that is a convenient rounded number for reference purposes, and which comprises the letters PN followed by the appropriate reference number

Note 1 to entry: It is intended that all equipment of the same *nominal size (DN)* (3.1) designated by the same PN number have compatible mating dimensions.

Note 2 to entry: The maximum allowable pressure depends on materials, design and working temperature, and is to be selected from the tables of pressure/temperature ratings given in the appropriate standards.

3.3
NPS
alphanumeric designation of size for components of a pipework system, which is used for reference purposes, and which comprises the letters "NPS" followed by a dimensionless number indirectly related to the physical size of the bore or outside diameter of the end connections

Note 1 to entry: The number following the letters "NPS" does not represent a measurable value and is not intended to be used for calculation purposes except where specified in the relevant standard.

3.4
Class
alphanumeric designation used for reference purposes related to a combination of mechanical and dimensional characteristics of a component of a pipework system, which comprises the word “Class” followed by a dimensionless whole number

Note 1 to entry: The number following the word “Class” does not represent a measurable value and is not intended to be used for calculation purposes except where specified in the relevant standard.

3.5
face-to-face dimension
distance between the two planes perpendicular to the valve axis located at the extremities of the body end ports in the installed condition

Note 1 to entry: Face-to-face dimension is expressed in millimetres.

3.6
design differential pressure
Δp
limiting pressure difference across the upstream and downstream sides of the closure element seals when the valve is in the closed position

Note 1 to entry: Differential pressure is expressed in bar.[1)]

Note 2 to entry: While the standard is for this to be equal to the *cold working pressure (CWP)* (3.7), there may be circumstances that dictate a lesser pressure difference.

3.7
CWP
cold working pressure
maximum fluid pressure assigned to a valve for operation at a fluid temperature between -20 °C and 38 °C

3.8
resilient seat
broad category of materials that make up a pliable seat, including elastomeric, polymeric, and graphitic seals, either used individually, in combination(s), or in conjunction with mating metallic component(s)

3.9
bidirectional valve
valve designed for blocking the flow in both directions

3.10
unidirectional valve
valve designed for blocking the flow in one direction only

4 Pressure/temperature ratings

The pressure/temperature ratings of the valve shall meet the specification given in the appropriate pressure/temperature tables of the standards listed in Table 1.

Table 1 — Pressure/temperature rating standards

Body material	PN-designated valve	Class-designated valve	
		Standard	Class ratings
Steel	EN 12516-1	EN 12516-1 ASME B16.34	150, 300, 600
Cast iron	EN 1092-2	ASME B16.1	25, 125, 250
Ductile iron		ASME B16.42	150, 300
Copper alloy	EN 1092-3	ASME B16.24	150, 300, 600

The maximum allowable temperature and/or the design differential pressure may be limited by restrictions in the pressure/temperature ratings of materials used for certain components.

Where components in the valve limit the pressure or temperature capability below the rating in the specified standard, the maximum allowable pressure and/or temperature shall be marked on the valve (see Clause 8).

For temperatures below the lowest temperature listed in the pressure/temperature tables, the working pressure shall be no greater than the pressure for the lowest listed temperature. The use of valves at lower temperatures is the responsibility of the user. Consideration should be given to the loss of ductility and impact strength of materials at low temperature.

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

5 Design

5.1 Wall thickness

The minimum wall thickness shall be determined using the standards indicated in Table 2.

For pressure-temperature ratings of the valve bodies outside the size ranges of the referenced standards of Table 2, design and calculations for pressure-containing elements shall be in accordance with an internationally recognised design code or standards with consideration of pipe loads, operating forces, etc. The choice of standard shall be by agreement between the manufacturer and the purchaser.

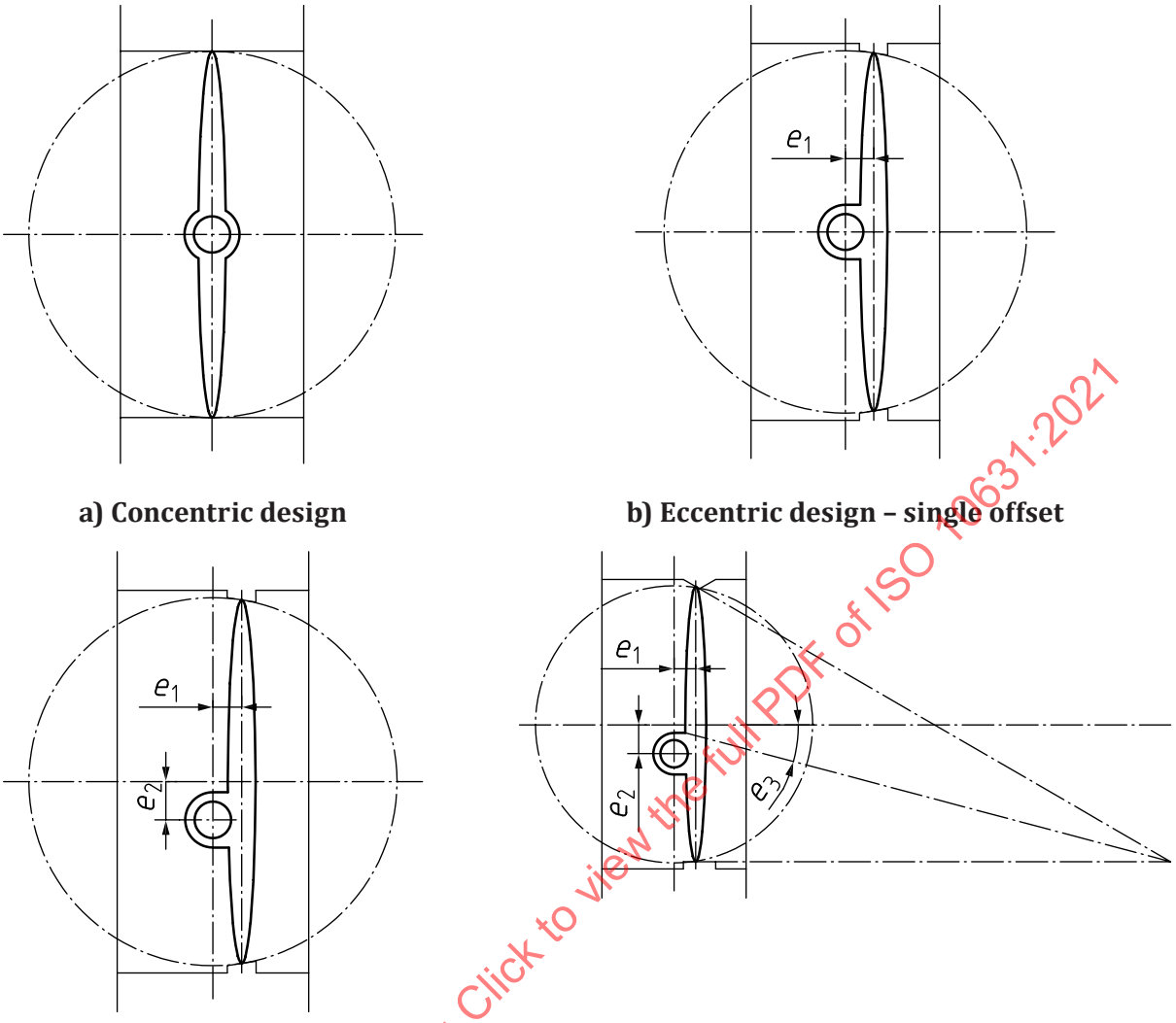
NOTE Examples of internationally recognised design codes or standards are ASME Section VIII, Division 1, or Division 2, and EN 13445-3.

Table 2 — Wall thickness

Body material	PN-designated valve	Class-designated valve
Steel	EN 12516-1 EN 12516-2	EN 12516-1 ASME B16.34
Cast iron	EN 12516-4	ASME B16.1
Ductile iron		ASME B16.42
Copper alloy		ASME B16.24

5.2 Construction examples

The valve shall be of either concentric disc design [see Figure 1 a)] or eccentric disc design [see Figures 1 b), 1 c), and 1 d)]. The eccentric offset may be single, double or triple.



a) Concentric design

b) Eccentric design – single offset

c) Eccentric design – double offset

d) Eccentric design - triple offset

Key

e_1 eccentricity 1
e_2 eccentricity 2
e_3 eccentricity 3

Figure 1 — Construction illustrations (for reference only)

5.3 Face-to-face dimensions

The face-to-face dimensions shall be in accordance with ISO 5752, unless otherwise specified by the purchaser.

In case of valve configurations outside the ranges covered by ISO 5752, the face-to-face dimensions shall be defined by agreement between the manufacturer and the purchaser.

5.4 Face-to-face dimension tolerance

Tolerances on face-to-face dimensions shall be in accordance with ISO 5752, or shall be agreed between the manufacturer and the purchaser.

5.5 End connections

5.5.1 Double-flanged valves

End connections of double-flanged valves shall be in accordance with 5.10.2. See Figure 2.

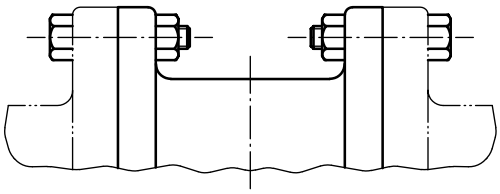


Figure 2 — End connections of double-flanged valves

5.5.2 Wafer-type valves

5.5.2.1 General

The PN-designated valves are for installation between pipe flanges that are in accordance with EN 1092-1, EN 1092-2 and EN 1092-3.

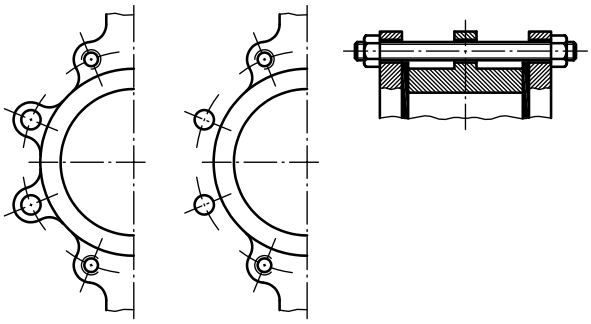
The Class-designated valves are for installation between pipe flanges that are in accordance with ASME B16.5 for NPS ≤ 24 or ASME B16.47 for NPS > 24.

Where through bolting is used with the result that the valve shaft holes are too close to the bolt holes, threaded bolt holes may be substituted.

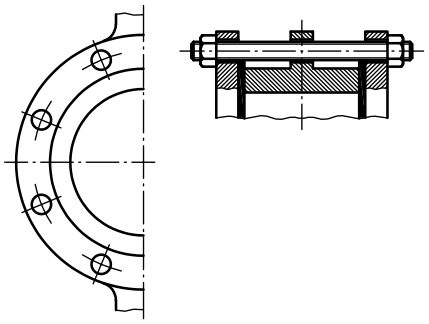
In case of valve size outside the scope of EN 1092, ASME B16.5 or ASME B16.47, another flange standard may be used by agreement between the manufacturer and the purchaser. The wall thickness is to be calculated by linear interpolation from standards specified in Table 2.

5.5.2.2 Wafer valve bodies with or without lugs

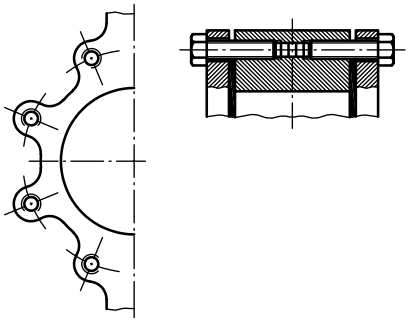
Configurations of valves covered by this subclause are illustrated in Figure 3.



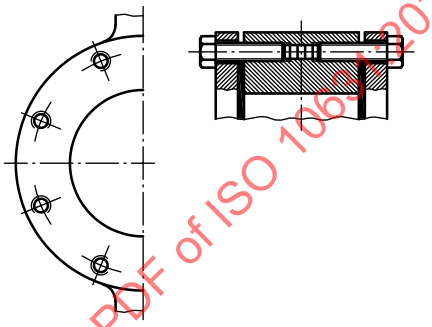
a) Valve with central lugs



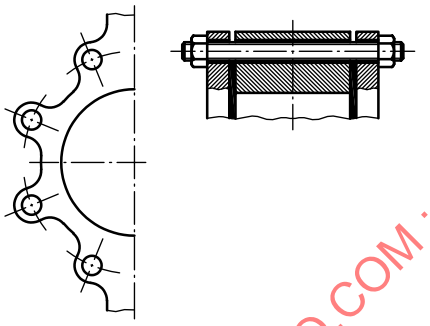
b) Central single-flange valve



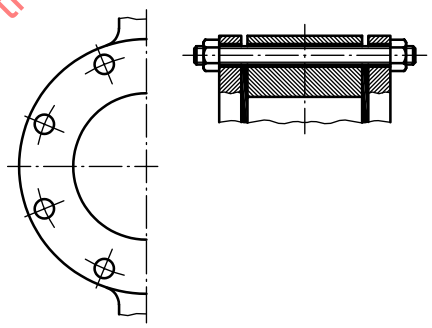
c) Valve with lugs with internally threaded holes



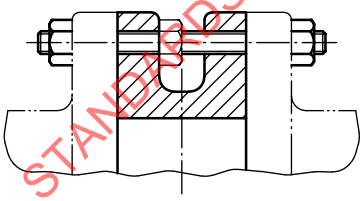
d) Single-flange valve with internally threaded holes

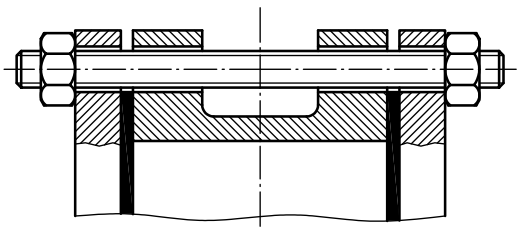


e) Valve with lugs with drilled holes

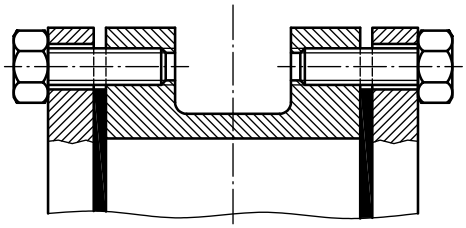


f) Single-flange valve with drilled holes





g) Valve with U-section **h) Valve with double lugs with drilled holes**



i) Valve with double lugs with internally threaded hole

Figure 3 — Wafer valve bodies bolting configurations

5.5.2.3 Flangeless valves

Configurations of flangeless valves covered by this subclause are illustrated in Figure 4.

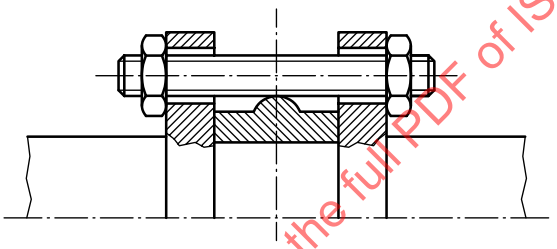


Figure 4 — Typical flangeless valves

The external diameter of a wafer-type valve body shall be such that the valve body is made to align with the flange bolting and the gasket surfaces.

5.5.3 Butt-welded ends

Configurations of butt-welded ends covered by this subclause are illustrated in Figure 5.

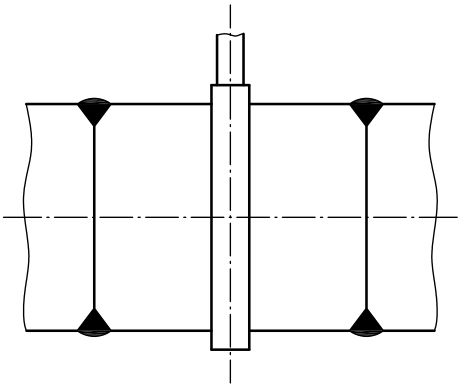


Figure 5 — Butt-welded ends

NOTE Weld ends are limited to steel valve bodies.

5.6 Disc

The disc thickness and the shaft-to-disc connection shall be capable of withstanding 1,1 times the design differential pressure in both directions without permanent deformation of the disc or shaft

that affects subsequent sealing performance or operation. Reduction in sealing performance caused by deformation of resilient seats does not constitute a non-compliance with 5.6.

NOTE High pressure testing of resilient seated valves can deform the seat and degrade subsequent sealing performance in low-pressure applications (ISO 5208:2015, Table 1).

5.7 Shaft

The valve shall include a feature, so that in the event of a structural failure of the shaft or the shaft-to-disc attachment, the shaft shall not be ejected through the pressure boundary from internal pressure in the valve.

If removal of external parts from the valve becomes necessary while the valve is under pressure,

— the shaft shall not be ejected out of the valve, and

— the shaft tightness to the atmosphere shall remain.

NOTE External parts (bracket, lever, actuator, etc.) are parts which are not included in the bare shaft valve.

The valve, without external parts, shall be designed, so that in the event of a structural failure of the shaft or the shaft-to-disc attachment, the shaft shall not be ejected through the pressure boundary from internal pressure in the valve.

The shaft-to-disc connection and all portions of the shaft within the pressure boundary shall be at least 10 % stronger in torsion than the drive connection. Verification of shaft torsional strength can be carried out by calculation or by testing.

At the maximum valve operating torque and applied differential pressure, the combined tensile stress caused by torsion and bending at any location on the shaft shall not exceed 75 % of the specified material minimum yield strength.

5.8 Operation

5.8.1 Direction of rotation

Unless otherwise specified in the valve data sheet, the valve shall be closed by operating the handwheel, lever or T-wrench in the clockwise direction when facing the top of shaft.

5.8.2 Actuating devices

5.8.2.1 General

Unless otherwise agreed between the manufacturer and the purchaser, the actuating device shall be capable of functioning between the fully open and fully closed positions.

5.8.2.2 Direct actuation

5.8.2.2.1 Direct manual actuation

Direct manual actuation may be lever, handwheel or T-wrench.

Where a lever is used, the valve shall be open when the lever is parallel to the pipe.

When an intermediate position is specified, means of securing the valve disc in intermediate positions shall be provided.

5.8.2.2.2 Direct actuation by power actuator

When the direct actuation is pneumatic, hydraulic or electric, the design of the valve shall be such that either with or without an intermediate part, mounting of the part-turn actuator with a plate complying with ISO 5211 shall be possible.

5.8.2.3 Gear actuation

The manual gear actuator shall be of self-locking movement design (in any position) and shall be provided with stops in the two extreme travel positions.

The adjustable stops shall be set and secured in a reliable way by a locking element to prevent loosening by vibration or inadvertent contact.

The gear actuator shall be fitted with a position indicator.

On request, the manufacturer shall supply the number of turns that are necessary to complete a full opening or closing operation.

The design of the valve shall allow, with or without an intermediate part, mounting of a gear actuator with a plate complying with ISO 5211.

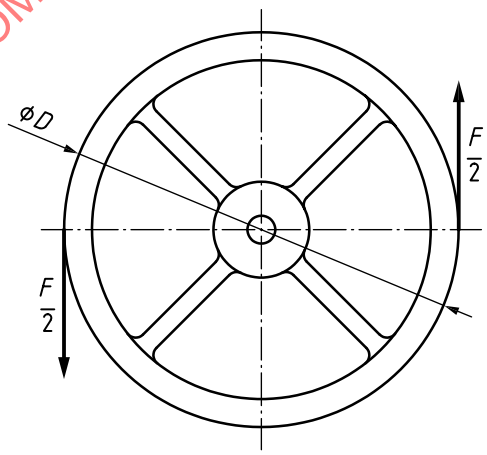
5.8.2.4 Disc position indication

The shaft end of the valve shall indicate the position of the disc, either by a permanent, non-erasable mark or by its shape.

5.9 Force or torque to be applied to manually actuated valves

5.9.1 Actuating force for handwheel or lever-actuated valves

At the CWP and the maximum flow velocity (see Table 8), the tangential force, *F*, to be applied to the handwheel (see Figure 6) or the lever (see Figure 7) to actuate the valve shall not exceed the values indicated in Tables 3 and 4.



Key

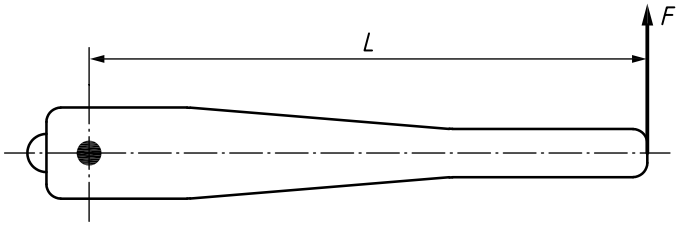
F tangential force

D diameter of the handwheel

Figure 6 — Tangential force to be applied to the handwheel

Table 3 — Tangential force to be applied to the handwheel

Diameter of the handwheel *D* (mm)	Tangential force *F* (N)
$D \leq 125$	200
$125 < D \leq 250$	300
$250 < D \leq 500$	400



Key

F tangential force

L length of the lever

Figure 7 — Tangential force to be applied to the lever

Table 4 — Tangential force to be applied to the lever

Length of the lever *L* (mm)	Tangential force *F* (N)
$L \leq 250$	300
$250 < L \leq 500$	400

5.9.2 Actuating torque for T-wrench-actuated valves

The valves can be actuated using a gear reducer fitted with stops at the two extreme positions (for example buried valves). The stops shall be calculated to withstand the input torque resistance given in Table 5.

Table 5 — Gear reducer travel stop input torque resistance

Nominal dimensions of square drive end (mm)	Input torque resistance (N·m)
14	120
30	250
50	450

5.10 Dimensions and tolerances of body ends

5.10.1 General

When applied, threaded body flange holes shall allow full thread engagement to a depth at least equal to the nominal bolt diameter and at least 0,67 of the bolt diameter when the bolt hole is adjacent to the valve shaft.

For Class-designated valves, threaded body flange holes for bolts 1 inch or less in diameter shall be drilled and tapped in accordance with ASME B1.1, UNC coarse thread series, Class 2B. For bolts 1⅛

inches or more in diameter, such holes shall be drilled and tapped in accordance with ASME B1.1, UN 8 eight thread series, Class 2B.

The technical documents of the valve manufacture shall specify the Figure 3 valve configuration and whether or not a shut-off valve in an end-of-pipeline service is allowed. Any limitation regarding end-of-pipeline service shall be indicated.

5.10.2 Double-flanged ends - Dimensions of flanges

PN-designated valves shall have bolt holes in accordance with EN 1092-1, EN 1092-2 or EN 1092-3 as appropriate.

Class-designated valves shall have bolt holes in accordance with ASME B16.5 for NPS ≤ 24 or ASME B16.47 for NPS > 24.

In case of valve size outside the scope of EN 1092, ASME B16.5 or ASME B16.47, another flange standard may be used by agreement between the manufacturer and the purchaser. The wall thickness is to be calculated by linear interpolation from standards specified in Table 2.

5.10.3 Body ends (wafer and flangeless valves) - Dimensions of flanges

Body end of PN-designated valves shall be capable of mating with connecting flanges complying with the requirements of EN 1092-1, EN 1092-2 and EN 1092-3.

Body end of Class-designated steel valves shall be capable of mating with connecting flanges complying with the requirements of ASME B16.5 for NPS ≤ 24 or ASME B16.47 for NPS > 24.

Body end of Class-designated cast iron valves shall be capable of mating with connecting flanges complying with the requirements of ASME B16.1.

Body end of Class-designated ductile iron valves shall be capable of mating with connecting flanges complying with the requirements of ASME B16.42.

Body end of Class-designated copper alloy valves shall be capable of mating with connecting flanges complying with the requirements of ASME B16.24.

In case of valve size outside the scope of EN 1092-1, EN 1092-2, EN 1092-3, ASME B16.1, ASME B16.5, ASME B16.24, ASME B16.42 or ASME B16.47, another flange standard may be used by agreement between the manufacturer and the purchaser. The wall thickness is to be calculated by linear interpolation from standards specified in Table 2.

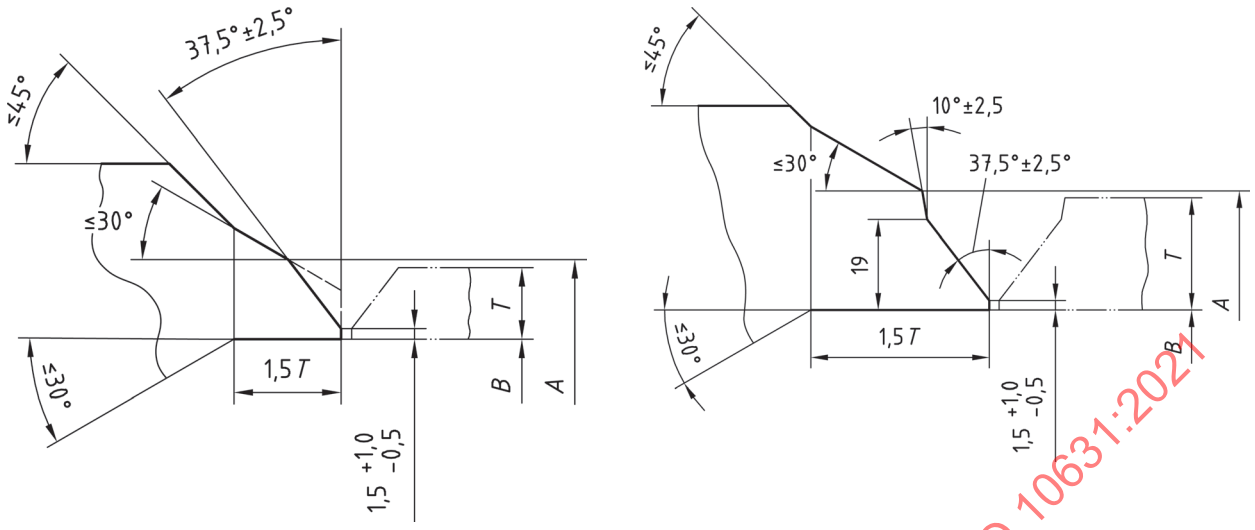
5.10.4 Surface finish of flanged and wafer valve ends requiring gasket

The gasket surface finish shall comply with the requirements of EN 1092-1, EN 1092-2 and EN 1092-3 for PN-designated valves, or ASME B16.5 for NPS ≤ 24 and ASME B16.47 for NPS > 24 for Class-designated valves.

5.10.5 Valves with welded ends

Butt-welding end dimensions shall be in accordance with Figure 8 and Table 6 unless otherwise specified by the purchaser. Butt-welding end dimensions for valve sizes not listed in Table 6 shall be per agreement between the manufacturer and purchaser.

Dimensions in millimetres



a) Welding end for connection to pipe of wall thickness $T \leq 22$ mm

b) Welding end for connection to pipe of wall thickness $T > 22$ mm

Key

A nominal outside diameter of welding end (see Table 6)

B nominal inside diameter of pipe (for tolerance on *B*, see Table 6)

T nominal wall thickness of pipe

Intersections should be slightly rounded.

NOTE 1 The inside and outside surfaces of valve welding ends are machine finished overall. The contour within the envelope is at the option of the manufacturer, unless specifically ordered otherwise.

NOTE 2 Valves having a minimum wall thickness $t_m \leq 3$ mm can have ends cut square or slightly chamfered.

NOTE 3 For the nominal outside diameters and wall thicknesses of standard steel pipes, see ISO 4200.

Figure 8 — Butt-welding end dimensions

Table 6 — Dimensions and tolerances of weld ends

Dimensions in millimetres

DN		40	50	65	80	100	125	150	200	250	300	350	400	450	500	550	600	650	700	750	800	900	1 000
NPS		1½	2	2½	3	4	5	6	8	10	12	14	16	18	20	22	24	26	28	30	32	36	40
A	Nom.	50	62	78	91	117	144	172	223	278	329	362	413	464	516	567	619	670	721	772	825	927	1029
	Tol.	+2,5 −1,0					+4 −1																
B	Tol.	+1 −1										+2 −2			+3 −2								

5.10.6 Disc to pipe clearance

Butterfly valve discs may project beyond the body flange faces. User shall insure there is no interference between the butterfly valve disc and adjacent components, such as flanges, piping, strainers, and adjacent valves or equipment. The valve manufacturer's technical documentation shall specify the minimum diameter required for clearance around the fully open disc.

Valves shall be designed to provide at least the minimum clearance specified in Table 7 when the valve is fully open, and valve is perfectly aligned with the pipe.

Table 7 — Disc-to-pipe minimum clearance

Valve size		Minimum clearance with valve perfectly aligned with pipe (mm)
DN	NPS	
40 to 150	1½ to 6	1,5
200 to 500	8 to 20	3,0
600 to 2 400	24 to 96	6,5

5.11 Optional design features

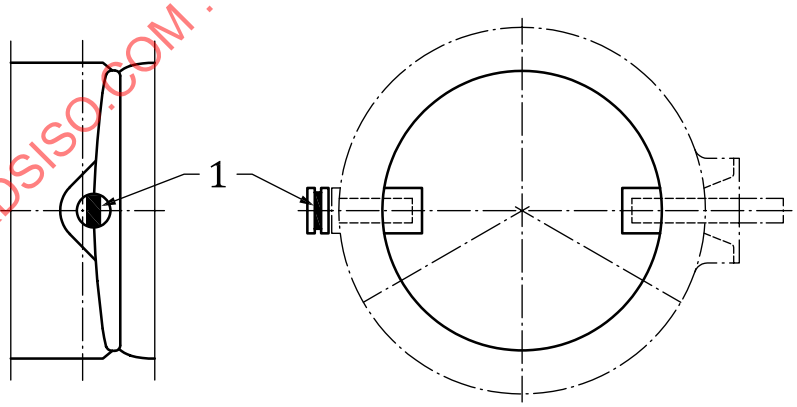
The following design features are optional.

a) Fire type-tested design: valves designated as fire type-tested design shall be tested in accordance with ISO 10497. If valves are required to be a fire type-tested design, this requirement shall be specified by the purchaser (see Annex A for example).

b) Anti-static design: valves with anti-static design shall have electrical continuity between the shaft, disc, and body. The electrical resistance between the shaft and body, and the disc and body shall be less than 10 Ω when measured using a power source not exceeding 12 V d.c. If valves are required to be an anti-static design, this requirement shall be specified by the purchaser (see Annex A for example).

c) Shaft blocking device: when requested by the purchaser (see Annex A for example), valves shall be designed with an external blocking device of the shaft which fixes the open or closed position for maintenance purposes of the gearbox. See Figure 9.

d) Disc blocking device: when requested by the purchaser (see Annex A for example), valves shall be designed with a blocking device which fixes the disc in the closed position independently of the function of the actuator. The blocking device acts as a safety device. See Figure 10.



Key

1 external blocking device

Figure 9 — Blocking device of the shaft

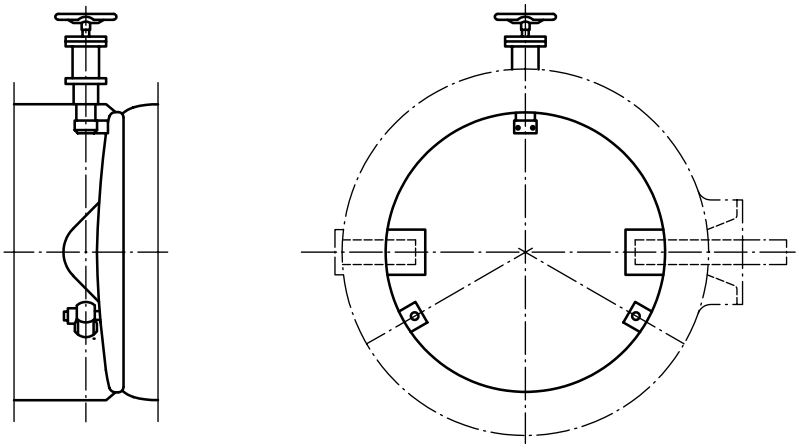


Figure 10 — Blocking device of the disc

6 Materials

6.1 Body

The materials to be used shall be the following:

— steel in accordance with ISO 4991, ISO 9327-1, ISO 9327-2, ISO 9327-3, ISO 9327-4, ISO 9327-5, ISO 9328-1, ISO 9328-2, ISO 9328-3, ISO 9328-4, ISO 9328-5, ISO 14737, EN 12516-1 or ASME B16.34;

— cast or ductile iron in accordance with ISO 185, ISO 1083, ISO 5922, EN 12516-4, ASME B16.1 or ASME B16.42;

— copper alloy in accordance with ISO 7005-3, EN 12516-4 or ASME B16.24.

The valve body may be coated, fully or partially, with an elastomer, polymer, composite material, plating or wear resistant coating, as shown in the manufacturer's technical documents.

6.2 Disc

The materials to be used shall be the following:

— stainless steels;

— steel for pressure vessel in accordance with ISO 4991, ISO 9327-1, ISO 9327-2, ISO 9327-3, ISO 9327-4, ISO 9327-5, ISO 9328-1, ISO 9328-2, ISO 9328-3, ISO 9328-4, ISO 9328-5, ISO 14737, EN 12516-1 or ASME B16.34;

— cast or ductile iron in accordance with ISO 185, ISO 1083, ISO 5922, EN 12516-4, ASME B16.1 or ASME B16.42;

— copper alloy in accordance with ISO 7005-3, EN 12516-4 or ASME B16.24.

The valve disc may be coated, fully or partially, with an elastomer, polymer, composite material, plating or wear resistant coating, as shown in the manufacturer's technical documents.

6.3 Shaft

The materials to be used shall be the following:

— stainless steel with minimum 13 % Cr;

— copper alloys.