BS EN 16767:2016

BSI Standards Publication

Industrial valves — Steel and cast iron check valves

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National foreword

This British Standard is the UK implementation of EN 16767:2016. It supersedes BS EN 14341:2006 and BS EN 12334:2001 which are withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PSE/18, Industrial valves, steam traps, actuators and safety devices against excessive pressure.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Industrial valves - Steel and cast iron check valves

Robinetterie industrielle - Clapets de non-retour en acier et en fonte

Industriearmaturen - Rückflussverhinderer aus Gusseisen und Stahl

This European Standard was approved by CEN on 12 February 2016.

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European foreword

This document (EN 16767:2016) has been prepared by Technical Committee CEN/TC 69 “Industrial valves”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2016, and conflicting national standards shall be withdrawn at the latest by October 2016.

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

This document supersedes EN 12334:2001 and EN 14341:2006.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

The main changes to the previous version of EN 12334:2001 and EN 14341:2006 are the following:

— combined content from previous version of EN 12334:2001 and EN 14341:2006;

— materials referenced to EN 12516-1 and/or to EN 12516-4;

— from EN 12334:2001, removal of informative Annex B “Comparison between EN and ISO cast iron material grades”;

— from EN 14341:2006, removal of Table 1 “Nominal inside diameter of the body end port” and Table 2 “Sizes of auxiliary connections”;

— revision of the normative references;

— the technical content was considerably revised.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies the requirements for cast iron or steel check valves, which are forged, cast or fabricated in straight, angle or oblique pattern (see EN 736-2) with end connections flanged or wafer, butt welding, socket welding, or threaded.

This European Standard applies to check valves mainly used for industrial and general purpose applications. However, they may be used for other applications provided the requirements of the relevant performance standards are met.

Back flow prevention anti-pollution check valves are outside the scope of this European standard.

The range of nominal sizes covered is:

DN 8, DN 10; DN 12, DN 15; DN 20; DN 25; DN 32; DN 40; DN 50; DN 65; DN 80; DN 100; DN 125; DN 150; DN 200; DN 250; DN 300; DN 350; DN 400; DN 450; DN 500; DN 600; DN 700; DN 750; DN 800; DN 900; DN 1 000.

DN 8 and DN 12 are not used for PN designated flanged end connections.

DN 8, DN 10 and DN 12 are not used for Class designated flanged end connections.

DN 750 is used for Class designated valves only.

Socket welding end valves and threaded end valves are limited to the range DN 8 to DN 65.

The range of pressure designations covered is:

a) for flanged end and wafer type end cast iron bodies:

   — PN 2,5; PN 6; PN 10; PN 16; PN 25;

   — Class 125; Class 250;

b) for flanged end, wafer type and butt welding end steel bodies:

   — PN 40; PN 63; PN 100;

   — Class 150; Class 300; Class 600;

c) for socket welding end and threaded end steel bodies:

   — PN 40; PN 63; PN 100;

   — Class 600; Class 800.

NOTE Class 800 is a widely used Class designation for socket welding and threaded end valves.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 19:2016, *Industrial valves — Marking of metallic valves*

prEN 558:2015[1)], *Industrial valves — Face-to-face and centre-to-face dimensions of metal valves for use in flanged pipe systems — PN and Class designated valves*

EN 736-1, *Valves — Terminology — Part 1: Definition of types of valves*

EN 736-2, *Valves — Terminology — Part 2: Definition of components of valves*

EN 736-3, *Valves — Terminology — Part 3: Definition of terms*

EN 1092-1:2007+A1:2013, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 1: Steel flanges*

EN 1092-2:1997, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 2: Cast iron flanges*

EN 1759-1:2004, *Flanges and their joint — Circular flanges for pipes, valves, fittings and accessories, Class designated — Part 1: Steel flanges, NPS 1/2 to 24*

EN 10269:2013, *Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties*

EN 12266-1, *Industrial valves — Testing of metallic valves — Part 1: Pressure tests, test procedures and acceptance criteria — Mandatory requirements*

EN 12351, *Industrial valves — Protective caps for valves with flanged connections*

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

EN 12516-2:2014, *Industrial valves — Shell design strength — Part 2: Calculation method for steel valve shells*

EN 12516-4:2014, *Industrial valves — Shell design strength — Part 4: Calculation method for valve shells manufactured in metallic materials other than steel*

EN 12627:1999, *Industrial valves — Butt welding ends for steel valves*

prEN 12760:2015[1)], *Valves — Socket welding ends for steel valves*

EN 12982:2009, *Industrial valves — End-to-end and centre-to-end dimensions for butt welding end valves*

EN 16722, *Industrial valves — End-to-end and centre-to-end dimensions for valves with threaded ends*

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1) Under preparation.

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

EN ISO 9606-1, *Qualification testing of welders — Fusion welding — Part 1: Steels (ISO 9606-1)*

EN ISO 14732, *Welding personnel — Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials (ISO 14732)*

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

ISO 7-1:1994, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 736-1, EN 736-2 and EN 736-3 apply.

NOTE 1 The terms maximum allowable pressure, PS, and test pressure, PT, defined in Directive 2014/68/EU (PED) are equivalent to the terms allowable pressure, p_s, and test pressure, p_t, defined in EN 736–3.

NOTE 2 EN 736–1 illustrates four basic check valve types:

— the axial and lift types are based on the globe valve;

— the swing type is based on the butterfly valve and

— the diaphragm type is based on the diaphragm valve.

Other check valve types are possible and are considered to be within the scope of this European standard.

4 Requirements

4.1 General

For information to be supplied by the purchaser see Annex A.

4.2 Design

4.2.1 Materials

4.2.1.1 The body and cover (if any) materials shall be selected from EN 12516-1:2014 and/or EN 12516-4:2014. Bolting (if any) materials shall be selected from EN 10269:2013. A selection of bolts and nuts for flange connections, which may be used for the body and cover connection, is indicated in EN 1515-4.

4.2.1.2 All the internal parts in contact with the fluid shall be made of a material or coated with a material whose corrosion resistance to the fluid being carried is at least equal to the body and bonnet material. The manufacturer shall declare the materials of construction and any coatings of components in contact with the line fluid from which the suitability of the valve for the application can be determined.

4.2.2 Pressure/temperature ratings

4.2.2.1 Steel body

The pressure/temperature ratings shall be in accordance with EN 12516-1:2014 for the particular body/bonnet material group.

The pressure/temperature ratings applicable to Class 800 socket welding and threaded end valves shall be the Class 600 rating for the applicable material group multiplied by the ratio of 800/600.

4.2.2.2 Cast iron body

The pressure/temperature ratings shall be in accordance with EN 12516-4:2014 for the particular body/bonnet material group.

4.2.2.3 Other parts

Other parts of the valve (cover, bolts etc.) shall have such dimensions, so that they fulfil the body rating.

4.2.2.4 Low temperature applications

4.2.2.4.1 Steel check valves

For temperatures below the lowest temperature given in the pressure/temperature rating tables of EN 12516-1:2014, the maximum allowable pressure shall be not greater than the pressure corresponding to the lowest temperature in the rating tables. The use of valves at lower temperatures than shown in the rating tables is permitted providing the bending rupture energy of the body and cover material measured on three 10 mm × 10 mm specimens in accordance with EN ISO 148-1, shall be not less than an average of 27 J at a temperature no higher than the lowest scheduled operating temperature.

4.2.2.4.2 Cast iron check valves

Temperatures lower than those given in the pressure/temperature ratings tables of EN 12516-4:2014 can be used only if the shells and bonnets are manufactured in spheroidal graphite cast iron of grades EN-GJS-350-22-LT or EN-GJS-400-18-LT (see Table 1).

Table 1 — Allowable material grades for low temperature (LT) design conditions

Symbol	Number	Temperature limits
EN-GJS-350–22-LT	5.3100	–40 °C to 350 °C
EN-GJS-400–18-LT	5.3103	–20 °C to 350 °C

4.2.2.5 Restrictions

Any restrictions of temperature or pressure below those specified in 4.2.2.1 to 4.2.2.4, for example, those imposed by soft seals, special trims, shall be indicated on the valve (see 8.1 a).

4.2.3 Dimensions

4.2.3.1 Face-to-face (FTF), centre-to-face (CTF), end-to-end (ETE) and centre-to-end (CTE) dimensions

Face-to-face (FTF) and centre-to-face (CTF) dimensions for PN or Class designated flanged end and wafer type valves shall be in accordance with prEN 558:2015.

The end-to-end (ETE) and centre-to-end (CTE) dimensions of butt welding end valves shall be selected from EN 12982:2009.

The end-to-end (ETE) and centre-to-end (CTE) dimensions of threaded end valves shall be selected from EN 16722.

The end-to-end and centre-to-end dimensions of socket welding end valves are at the choice of the manufacturer.

4.2.3.2 Body ends

4.2.3.2.1 Flanged ends of PN designated valves shall comply with the requirements of EN 1092-1:2007+A1:2013 for steel shells or EN 1092-2:1997 for cast iron shells.

Flanged ends of Class designated valves shall comply with the requirements of EN 1759-1:2004 for steel shells.

NOTE Flanged ends of ISO PN designated valves may comply with the requirements of ISO 7005-2 for cast iron shells.

Steel flanged ends shall be cast or forged integral with the body except that steel flanges at steel bodies may be attached by welding in accordance with 4.2.6.

4.2.3.2.2 Wafer bodies, flangeless, lugged or single flanged bodies shall be such that they can be clamped between flanges in accordance with:

a) EN 1092-1:2007+A1:2013, EN 1092-2:1997 for PN designated check valves;

b) EN 1759-1:2004 for Class designated check valves.

4.2.3.2.3 Butt welding end profiles prepared for steel tubes according to ISO 4200 shall be in accordance with EN 12627:1999. The bevel form may be selected from EN ISO 9692-1.

NOTE Butt welding end profiles and the bevel form prepared for steel pipes according to ASME B36.10M may be in accordance with ASME B16.25.

4.2.3.2.4 Socket welding end dimensions shall be in accordance with prEN 12760:2015. The minimum thickness of the pressure retaining material shall be in accordance with EN 12516-1:2014 or EN 12516-2:2014.

4.2.3.2.5 Threaded ends shall be of the internal form in accordance with Type R_c and R_p to ISO 7-1 or Type G to EN ISO 228-1 or Type NPT to ASME B1.20.1. The minimum thickness of the pressure retaining material shall be in accordance with EN 12516-1:2014 or EN 12516-2:2014.

4.2.4 Operation

A check valve automatically opens by fluid flow in a defined direction and automatically closes to prevent fluid flow in the reverse direction. The manufacturer's recommendations given in 4.3.2 shall be considered.

The seat bore may either be full bore or reduced bore.

It is permissible for any lugs required to facilitate the fitting of seat rings to intrude into the bore of a full bore or reduced bore valve. As well it is permissible to have means to restrict the degree of opening and/or influence the speed of opening or closing.

To prevent hydraulic shock or mechanical damage on the valve or pipe, means may be provided to restrict the degree of opening and/or influence the speed of opening or closing.

Wafer type obturators shall be capable of operation when the valve is connected to tubes according to ISO 4200 or pipes according to ASME B36.10M. The obturator shall not be restricted in its movement and shall not strike against the pipe.

Depending upon obturator type, check valves operate in horizontal and/or vertical pipe, or in an oblique position depending on the pipework.

4.2.5 Auxiliary connections

When auxiliary connections are required, they shall be in accordance with the requirements given in EN 12516-1:2014.

Threaded connections shall be according to 4.2.3.2.5 and socket welding connections according to 4.2.3.2.4.

4.2.6 Permanent joining of the steel body

4.2.6.1 Welding

Welding as part of the valve shell shall be carried out to approved welding procedures in accordance with EN ISO 15607. Welders shall be approved to EN ISO 9606-1 and welding operators shall be approved to EN ISO 14732.

4.2.6.2 Non-destructive tests

Non-destructive test requirements of welded joints, which are part of the valve shell, shall be detailed in the approved welding procedure.

4.2.6.3 Heat treatment

Heat treatment requirements of welded joints, which are part of the valve shell, shall be detailed in the approved welding procedure.

4.3 Functional characteristics

4.3.1 Shell design strength

The minimum body and bonnet wall thickness, the body/bonnet joint and bonnet bolting shall be determined as follows:

a) for steel valves designated by the tabulation method, it shall be according to EN 12516-1:2014;

b) for steel valves designated by the calculation method, it shall be according to EN 12516-2:2014;

c) for cast iron valves designated by the calculation method, it shall be according to EN 12516-4:2014;

d) for $PS \times DN < 3\,000$ a validation by an experimental method according to EN 12516-3:2002 is possible, otherwise the experimental method shall only be applied in addition to the tabulation or calculation method.

4.3.2 Flow characteristics

Manufacturers shall give guidance in their literature in respect of the following:

— the required minimum differential pressure at which the valve begins opening;

— the required differential pressure (or the minimum flow rate) at which the disc reaches a stable full opening position (if required);

— the maximum allowable differential pressure (or the maximum flow rate) for which the valve is designed;

— the flow coefficient (K_V) or the flow resistance coefficient (ζ).

4.3.3 Seat leakage

The allowable rate for seat leakage tests specified in EN 12266-1 shall be specified by the purchaser.

4.3.4 Anti-blow out design

The valve designs shall ensure that the shaft or stem of the obturator hinge mechanism cannot be fully blown out of the shell when the valve is under pressure:

— by disassembly of any external part; or

— by failure of the connection between obturator and shaft or stem even when external parts are removed.

5 Test procedures

5.1 Valves shall be pressure tested by the manufacturer prior to dispatch in accordance with EN 12266-1.

5.2 Additional tests of finished valves can also be carried out to the requirements of EN 12266-2. The customer shall specify which additional tests are required except that tests F21 and P21 shall not be applied to cast iron check valves.

6 Declaration of compliance

The manufacturer shall declare compliance to this European Standard in his documentation.

7 Designation

Check valves in accordance with this European standard shall be designated by the following elements in the same order:

— check valve type (see EN 736-1);

— EN 16767 (this European Standard);

— body pattern, i.e. straight, angle or oblique;

— body end type, i.e. flanged, wafer, butt welding, socket welding or threaded ends;

— body end declaration, i.e. flange type and form, or thread type;

— symbol DN and number;

— pressure designation;

— material of the body and cover (if any);

— restrictions on maximum allowable temperature and/or maximum allowable pressure (see 4.2.2.4);

— the face-to-face or centre-to-face or end-to-end or centre-to-end dimensions (see 4.2.3.1);

— permissible orientation of the pipework i.e. horizontal or vertical or all;

— seat test leakage rate (see 4.3.3).

EXAMPLE A flanged check valve to EN 16767, with straight pattern body, flange PN 16 Form B1, DN 50, made of steel type 1.0619 EN 12516–1, Face-to-face series (FTF) 11 (of prEN 558:2015).

8 Marking, preparation for storage and transportation

8.1 Marking

Marking shall be in accordance with EN 19:2016.

The pressure Class or the maximum allowable pressure of the weakest component of the valve shall be marked on the valve (EN 19:2016, item 20).

Supplementary markings, if any, are the following:

a) item 7 and 9 according to the requirements given in 4.2.2.4;

b) rubber and plastic seat material according to EN ISO 1043-1 or ISO 1629 (item 15);

c) required minimum differential pressure at which the valve begins opening; if the manufacturer sells different variations under the same product / type marking (item 10).

For valves equal to or smaller than nominal size DN 50, where due to the physical size of the valve it is not practical to apply the mandatory markings as specified in EN 19:2016, the following markings may be omitted with the following sequence:

— nominal size (item 1);

— minimum differential pressure c);

— seat material b) – or marking 7 according to a).

8.2 Preparation for storage and transportation

Each valve shall be drained of any test fluid.

The valve shall be packaged or the body ends covered to prevent the ingress of foreign matter.

Protective caps for valves with flanged end connections shall be in accordance with EN 12351.

The weld profile of butt welding end valves shall be suitably protected to prevent mechanical damage or corrosion to the machined profile.

In the case of polymeric or elastomeric seated valves the seating shall also be protected from ultraviolet light.

The obturator of valves that can be damaged in transit shall be provided with some means of temporary restraint.

Annex A
(informative)

Information to be supplied by the purchaser

The following information shall be provided in the enquiry and order:

a) a reference to this European Standard, i.e. EN 16767;

b) check valve type (see EN 736-1);

c) body pattern, i.e. straight, angle, oblique;

d) body end type, i.e. flanged, wafer, butt welding, socket welding, or threaded (see 4.2.3.2);

e) body end declaration, i.e. flange type and form, or thread type;

f) maximum allowable temperature, in °C (see 4.2.2);

g) nominal size (see Clause 1);

h) pressure rating designation (see Clause 1);

i) the fluid to be transported and the flow velocity or the volume flow rate (see 4.2.1.2);

j) the material of the body and cover (if any) (see 4.2.1);

k) the face-to-face or centre-to-face or end-to-end or centre-to-end dimensions basic series (see 4.2.3.1);

l) if auxiliary connections are required, their size and type (see 4.2.5);

m) orientation of pipework (see 4.2.4).

Annex ZA
(informative)

Relationship between this European Standard and the essential requirements of Directive 2014/68/EU (Pressure equipment Directive) aimed to be covered

This European Standard has been prepared under a Commission's standardization request M/071 to provide one voluntary means of conforming to essential requirements of Directive 2014/68/EU (Pressure equipment Directive).

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding essential requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Annex I of Directive 2014/68/EU (Pressure Equipment Directive)

Essential Requirements Directive 2014/68/EU	Clauses/sub-clauses of this European Standard	Remarks/Notes
2.1	4.2.1.1, 4.2.2.1, 4.2.2.2, 4.2.2.4, 4.3.1	General design
3.3	8.1	Marking and labelling

WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2 — Other Union legislation may be applicable to the product(s) falling within the scope of this standard.

Bibliography

[1] EN ISO 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method (ISO 148-1)*

[2] EN ISO 1043-1, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics (ISO 1043-1)*

[3] EN 1515-4, *Flanges and their joints — Bolting — Part 4: Selection of bolting for equipment subject to the Pressure Equipment Directive 97/23/EC*

[4] EN ISO 9692-1, *Welding and allied processes — Types of joint preparation — Part 1: Manual metal arc welding, gas-shielded metal arc welding, gas welding, TIG welding and beam welding of steels (ISO 9692-1)*

[5] EN 12266-2, *Industrial valves — Testing of metallic valves — Part 2: Tests, test procedures and acceptance criteria — Supplementary requirements*

[6] EN 12516-3, *Valves — Shell design strength — Part 3: Experimental method*

[7] ISO 1629, *Rubber and latices — Nomenclature*

[8] ISO 4200, *Plain end steel tubes, welded and seamless — General tables of dimensions and masses per unit length*

[9] ISO 7005-2, *Metallic flanges — Part 2: Cast iron flanges*

[10] ASME B16.25, *Buttwelding Ends*

[11] ASME B36.10M, *Welded and Seamless Wrought Steel Pipe*

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