BS EN 1171:2015

BSI Standards Publication

Industrial valves — Cast iron gate valves

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National foreword

This British Standard is the UK implementation of EN 1171:2015. It supersedes BS EN 1171:2002.

The UK participation in its preparation was entrusted to Technical Committee PSE/18/2, Industrial valves, steam traps, actuators and safety devices against excessive pressure - Gate, globe, diaphragm and check valves.

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

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Contents

Page

European foreword

This document (EN 1171:2015) 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of an identical text or by endorsement, at the latest by March 2016, and conflicting national standards shall be withdrawn at the latest by March 2016.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 1171:2002.

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 97/23/EC (PED).

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

In this new edition, the following modifications were made:

— the normative references were updated in Clause 2 and throughout the text;

— 4.1.1, 4.1.2.1, 4.1.2.3, 4.2.1, 8.1, Annex C and Table ZA.1 were revised to be in compliance with EU Directive 97/23/EC (PED).

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 gate valves with flanged ends, socket ends or spigot ends.

This European Standard is applicable to cast iron gate valves mainly used for industrial and general-purpose applications. However, they can be used for other applications provided the requirements of the relevant performance standards are met.

The range of nominal sizes covered is:

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 800 ; DN 900 ; DN 1 000.

The range of pressure designations covered is:

— isobaric PN 6; PN 10; PN 16; PN 25;

— isomorphic, PS 10 bar to PS 1 bar at room temperature.

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 19:2002, *Industrial valves — Marking of metallic valves*

EN 545:2010, *Ductile iron pipes, fittings, accessories and their joints for water pipelines — Requirements and test methods*

EN 558, *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 1092-2:1997, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated —Part 2: Cast iron flanges*

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

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

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

EN 12516-3:2002, *Valves — Shell design strength — Part 3: Experimental method*

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

EN 12570, *Industrial valves — Method for sizing the operating element*

EN ISO 5210, *Industrial valves — Multi-turn valve actuator attachments (ISO 5210)*

ISO 185:2005, *Grey cast irons — Classification*

ISO 1083:2004, *Spheroidal graphite cast irons — Classification*

ISO 2531:2009, *Ductile iron pipes, fittings, accessories and their joints for water applications*

ISO 5922:2005, *Malleable cast iron*

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 and the following apply.

NOTE The terms maximum allowable pressure, *PS*, and test pressure, *PT*, defined in EU Directive 97/23/EC (PED) are equivalent to the terms allowable pressure, p_s, and test pressure, p_t, defined in EN 736–3.

3.1
isomorphic series
series of cast iron gate valves of a specified type and design having maximum allowable pressures which tend to decrease as the nominal size increases (see Table 2) and having specific flanged end connections (see 4.1.3.2.1)

3.2
isobaric series
series of cast iron gate valves of a specified type and design having the same maximum allowable pressure for all nominal sizes

3.3
strength torque
torque applied directly to the operating mechanism or, when fitted, the operating device, which the valve is capable of withstanding

4 Requirements

4.1 Design

4.1.1 Materials

4.1.1.1 The body and bonnet materials shall be selected from Table 1 and designed in accordance with EN 12516-4:2014.

NOTE Materials listed in Table 1 comply with the requirements of EN 1561 for grey cast iron, EN 1562 for malleable cast iron and EN 1563 for spheroidal graphite cast iron.

Table 1 — Body and bonnet materials

Graphite structure	European Standard	Designation short name
Grey cast iron	EN 12516–4:2014	EN-GJL-200
	EN 12516–4:2014	EN-GJL-250
Spheroidal graphite cast iron	EN 12516–4:2014	EN-GJS-350-22-LT
	EN 12516–4:2014	EN-GJS-350–22-RT
	EN 12516–4:2014	EN-GJS-400–18-LT
	EN 12516–4:2014	EN-GJS-400–18-RT
	EN 12516–4:2014	EN-GJS-400–15
	EN 12516–4:2014	EN-GJS-500–7
	EN 12516–4:2014	EN-GJS-600–3
Malleable cast iron	EN 12516–4:2014	EN-GJMB-300–6
	EN 12516–4:2014	EN-GJMB-350–10

4.1.1.2 The body and bonnet materials may also be spheroidal graphite cast iron in accordance with the requirements of EN 545:2010, 4.4.

4.1.1.3 All the internal parts in contact with the fluid shall be made of a material whose corrosion resistance to the fluid being carried is at least equal to the body and bonnet material.

4.1.1.4 Trim materials shall have a chemical composition and mechanical properties, which ensure the mechanical integrity of the valve and shall be stated in the manufacturer's technical documentation.

The trim comprises the following*:*

a) stem;

b) obturator seat;

c) body seat;

d) back seat (for valves DN 50 and above, when fitted).

4.1.1.5 Welding and impregnation of castings of all materials are not permitted.

4.1.2 Pressure/temperature ratings

4.1.2.1 Isobaric series

The pressure/temperature ratings shall be in accordance with EN 1092-2:1997 for the equivalent ISO material grade except that valves with metallic seats shall not be used above 230 °C and valves with soft seats shall not be used above 70 °C.

To determine the equivalent ISO material grades for the EN material grades specified in Table 1, refer to Annex C.

4.1.2.2 Isomorphic series

The pressure/temperature ratings shall be as given in Table 2.

Table 2 — Pressure/temperature ratings for isomorphic series

DN	Maximum allowable pressure *PS* (bar) at				
	– 10 °C/120 °C	**150 °C**	**180 °C**	**200 °C**	**230 °C**
40 to 80 100 125 150	10,0	9,0	8,4	8,0	7,4
200 250 300	6,0	5,4	5,0	4,8	4,4
350 400 450 500	4,0	3,6	3,4	3,2	3,0
600 700	2,5	2,3	2,1	2,0	1,9
800	1,6	1,4	1,3	1,3	1,2
900 1 000	1,0	0,9	0,8	0,8	0,7

4.1.2.3 For TS < - 10 °C, the body and bonnet material grades shall be EN-GJS-350-22-LT or EN-GJS-400-18-LT. In this case, the TS minimum shall be not less than the temperature specified in EN 12516-4:2014, Table 7.

4.1.3 Dimensions

4.1.3.1 Face-to-face and end-to-end dimensions

The face-to-face dimensions of flanged valves shall be in accordance with the basic series given in Table 3.

Table 3 — Basic series of face-to-face dimensions

Series	**DN**	**Basic series** (according to EN 558)
Isomorphic	40 to 1 000	14
PN 6, PN 10, PN 16	40 to 500	14
	40 to 1 000	3, 15, 29, 30
PN 25	40 to 600	19, 4, 15, 26
	40 to 400	45

The end-to-end dimensions of valves with socket or spigot ends are given in the manufacturer's technical documentation.

4.1.3.2 Body ends

4.1.3.2.1 General

The manufacturer's technical documentation shall indicate the type and dimensions of valve body ends, and reference to the relevant European Standard.

4.1.3.2.2 Flange end connections

Flanges shall be in accordance with EN 1092-2.

Flanges can be an integral part of the valve body or adjustable flanges on a collar. Flanges, which are an integral part of the body, may have supports, which permit a stable installation of the valve.

For isomorphic gate valves, the flange facing and mating dimensions shall be PN 10.

4.1.3.2.3 Spigot end connections

Spigot ends shall be compatible with the adjacent piping.

4.1.3.2.4 Socket end connections

The socket ends shall be compatible with the adjacent piping. They may have a seal housing with clearance to allow angular displacement after assembly.

4.1.3.3 Body end port inside diameter

The body end port shall be circular. For unlined valves, the body end port inside diameter shall be not less than the nominal inside diameter specified in Table 4.

For isomorphic gate valves the dimensions for PN 10 shall be used.

Table 4 — Nominal inside diameter of the body end port

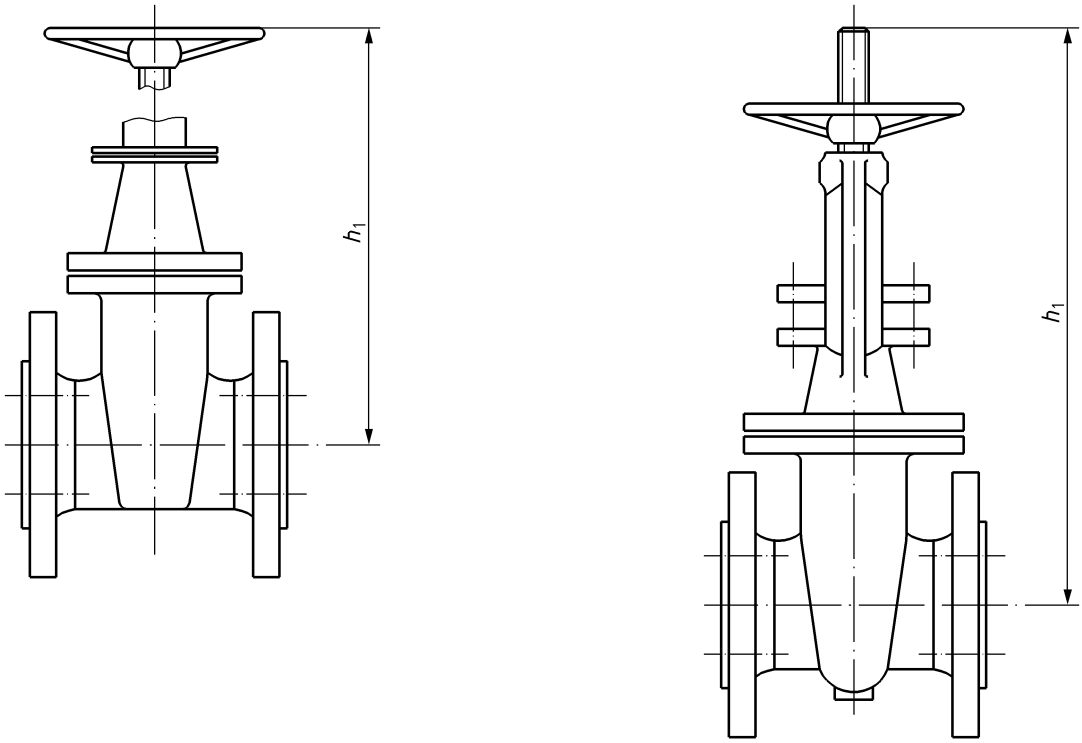
Dimensions in millimetres

DN	PN 6, PN 10	PN 16	PN 25
40	40	40	38
50	50	50	50
65	63	63	63
80	78	78	76
100	100	100	100
125	125	125	125
150	150	150	150
200	200	200	200
250	250	250	250
300	300	300	300
350	343	343	336
400	394	394	387
450	445	445	438
500	495	495	488
600	597	597	590
700	695	695	692
800	800	793	788
900	900	889	889
1 000	1 000	991	991

4.1.4 Operation

4.1.4.1 Maximum height

The maximum height of gate valves without gearbox, actuator or position indicator (see Figure 1), shall be as given in Table 5.



a) Valve with non-rising stem **b) Valve with rising stem (in fully open position)**

Figure 1 — Valve

Table 5 — Maximum height

Dimensions in millimetres

DN	h_1	h_2
40	350	480
50	400	510
65	425	560
80	475	610
100	575	720
125	650	875
150	700	950
200	850	1 200
250	1 025	1 440
300	1 125	1 675
350	1 150	1 900
400	1 275	2 070
450	1 350	2 250
500	1 500	2 430
600	1 700	2 850
700	1 800	3 250
800	2 000	3 750
900	2 400	4 150
1 000	2 500	4 450

4.1.4.2 Operating device

If the valve is to be operated by an actuator then the valve/actuator attachment shall be in accordance with EN ISO 5210.

4.1.4.3 Operating direction

The valve shall be closed by turning the handwheel in a clockwise direction when viewed from above the top of the valve.

4.2 Functional characteristics

4.2.1 Shell design strength

The shell strength resistance shall be in accordance with EN 12516-4:2014.

If the shell strength resistance is validated by an experimental method, it shall be according to EN 12516-3:2002. The experimental test pressure $p_{t,\,exp}$ shall be the greatest value of $p_{t,\,exp}$ calculated along the P/T rating.

NOTE To comply with Directive 97/23/EC (PED), the use of EN 12516–3 is limited to valves for which PS x DN < 3 000 bar.

4.2.2 Flow characteristics

4.2.2.1 General

The seat bore shall be either full bore or reduced bore. When the gate valve is fully open, no internal part shall influence the flow of fluid.

If any lugs, required to facilitate the fitting of seat rings, intrude into the bore, it shall be clearly indicated in the manufacturer's technical documentation.

4.2.2.2 Gate valves with obturator recess in the body

The obturator of a wedge gate valve shall be designed so that the obturator seating surfaces do not contact the body seats until near the point of closure. When a wedge gate valve obturator is closed, the wedge shall ride high on the body seats to allow for wear and deformation under pressure.

The seating surfaces can be:

a) metallic seats

   1) body and/or obturator seat;

   2) body and/or obturator seat ring;

   3) body and/or obturator hard facing;

b) soft seats

   1) the soft seats can be fixed on the obturator or on the body.

4.2.2.3 Gate valves without obturator recess in the body

The seating surfaces shall be formed by a resilient coating on the obturator.

The coating shall enable the performance required in the relevant performance standards.

4.2.3 Seat tightness

The allowable rate for seat tightness tests specified in EN 12266-1 shall be:

— elastomeric or polymeric seating – Rate A;

— other seatings – Rate B.

The allowable rate for the back seat tightness test specified in EN 12266-2 shall be Rate A.

4.2.4 Sizing the operating element

For handwheel operated valves, the minimum size of the handwheel shall be determined in accordance with EN 12570. The handwheel size shall be selected such that the valve can be operated when the fluid pressure is equal to the maximum allowable pressure at 20 °C and can be seated or unseated against a differential pressure of not less than the maximum allowable pressure at 20 °C.

When specified by the customer it is permitted to use a lower fluid pressure and differential pressure than the maximum allowable pressure at 20 °C.

4.3 Strength torque

When tested in accordance with Annex B, the minimum strength torque shall correspond to one of the four categories given in Table 6, to be specified by the purchaser.

Table 6 — Minimum strength torque

In Newton metres

DN	Category 1	Category 2	Category 3	Category 4
40	80	90	180	500
50	90	100	180	550
65	100	130	225	625
80	150	160	225	700
100	190	200	300	800
125	190	250	375	925
150	190	300	450	1 050
200	240	400	600	1 300
250	240	500	750	1 550
300	300	600	900	1 800
350	300	700	975	2 050
400	390	800	1 050	2 300
450	390	900	1 275	2 550
500	390	1 000	1 575	2 800
NOTE Category 1 is intended for valves operated by handwheel, Category 2 and 3 for valves operated by T-key and Category 4 for valves operated by ring key and bar.				

5 Test procedures

5.1 Each valve shall be pressure tested by the manufacturer prior to despatch 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 tests are required.

6 Declaration of compliance

The manufacturer shall declare compliance to this standard by marking the valves with the number of this standard.

7 Designation

Gate valves complying with this European Standard shall be designated by the following elements in the same order:

— “gate valve”;

— “EN 1171”;

— body end type i.e. flanged, spigot, socket;

— symbol “DN” and the number;

— pressure designation;

— material of the body and bonnet;

— for flanged valves, the face-to-face dimensions basic series number;

— restrictions of maximum service temperature or pressure (see 4.1.2).

8 Marking, preparation for storage and transportation

8.1 Marking

8.1.1 The marking shall be in accordance with EN 19.

8.1.2 The pressure Class or the maximum allowable pressure of the weakest component of the valve shall be marked on the valve.

8.1.3 The following supplementary markings shall be marked on the valve:

a) maximum service temperature (°C) only if above 70 °C (item 7);

b) standard number (item 11);

c) year of manufacture (item 18).

If the markings are on a plate, this plate shall be in a corrosion resistant material and it shall be securely fixed to the body by adhesive or fastening.

8.2 Preparation for storage and transportation

Each valve shall be drained of any test liquid. The body ends shall be protected to prevent the introduction of foreign materials and moisture. In the case of polymeric or elastomeric seated valves the seatings shall also be protected from ultraviolet light.

When protective caps are used for valves with flanged end connections they shall be in accordance with EN 12351.

Polymeric or elastomeric seated valves shall be delivered such that the seating material is not in compression. All other valves shall be delivered with the obturator in the closed position.

Annex A
(informative)

Information to be supplied by the customer

The following information should be provided in the enquiry and/or order:

a) this standard i.e. EN 1171;

b) body ends i.e. flange, spigot or socket (see 4.1.3.2);

c) the nominal valve size (see Clause 1);

d) the pressure designation (see Clause 1);

e) the material of the body and bonnet (see 4.1.1.1 and 4.1.1.2);

f) for flanged end valves, the basic series number of the face-to-face dimensions (see 4.1.3.1);

for spigot or socket ends valves the type of pipes (outside diameter) (see 4.1.3.2.3 or 4.1.3.2.4);

g) the type of operating device (see 4.1.4.2);

h) the differential pressure across the obturator if less than the maximum at 20 °C for the particular pressure designation (see 4.2.4);

i) the strength torque category (see 4.3).

Annex B
(normative)

Strength torque test

B.1 The number of operating turns corresponding with the maximum travel of the obturator shall be determined before testing.

B.2 The fully closed obturator shall be submitted to a differential pressure equal to the maximum allowable pressure (*PS*) of the valve. Under this pressure, the relevant torque specified in Table 6 shall be applied gradually. For category 4 strength torque this test shall include simultaneously a bending moment of 1 500 Nm at the stem cap.

B.3 The same torque(s) shall be applied to the valve with the obturator in the fully open position.

B.4 The valve with the obturator fully closed shall then be subject to a seat tightness test as described in 4.2.3.

B.5 After these tests, the number of operating turns corresponding with the maximum travel of the obturator shall remain within + 5 % of the number determined before testing and no damage shall be perceptible during operation of the valve over the maximum travel.

Annex C
(normative)

Equivalence between EN and ISO cast iron material grades

For the purposes of determining the applicable pressure/temperature rating in EN 1092-2:1997, the following EN material grades shall be considered equivalent to the ISO grades specified.

Table C.1 — Body and bonnet materials — ISO grades equivalent to EN material grades

Graphite structure	European Standard	Grade	International Standard	Grade
Grey cast iron	EN 12516–4:2014	EN-GJL-200	ISO 185:2005	200
	EN 12516–4:2014	EN-GJL-250	ISO 185:2005	250
Spheroidal graphite cast iron	EN 12516–4:2014	EN-GJS-350–22-LT	ISO 1083:2004	350–22
	EN 12516–4:2014	EN-GJS-350–22-RT	ISO 1083:2004	350–22
	EN 12516–4:2014	EN-GJS-400–18-LT	ISO 1083:2004	400–18
	EN 12516–4:2014	EN-GJS-400–18-RT	ISO 1083:2004	400–18
	EN 12516–4:2014	EN-GJS-400–15	ISO 1083:2004	400–15
	EN 12516–4:2014	EN-GJS-500–7	ISO 1083:2004	500–7
	EN 12516–4:2014	EN-GJS-600–3	ISO 1083:2004	600–3
	EN 545:2010	EN-545–420–5	ISO 2531:2009	420–5
Malleable cast iron	EN 12516–4:2014	EN-GJMB-300–6	ISO 5922:2005	B30–06
	EN 12516–4:2014	EN-GJMB-350–10	ISO 5922:2005	B35–10

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 97/23/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 97/23/EC (Pressure Equipment Directive).

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the 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 Directive 97/23/EC

Clause(s)/sub-clause(s) of this European Standard	Essential Safety Requirements Annex I of Directive 97/23/EC (PED)	Nature of requirement
4.1.2, 4.2.1	2.1	General design
4.1.1.1, 4.2.1	2.2.3	Calculation method
4.2.1	2.2.4	Experimental design method
8.1	3.3	Marking and labelling

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

[1] EN 1561, *Founding — Grey cast irons*

[2] EN 1562, *Founding — Malleable cast irons*

[3] EN 1563, *Founding — Spheroidal graphite cast irons*

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