

Specification for

Copper alloy globe, globe stop and check, check and gate valves

Committees responsible for this British Standard

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- Amalgamated Union of Engineering Workers
- Associated Offices Technical Committee
- Association of Bronze and Brass Founders
- Association of Building Component Manufacturers Ltd.
- British Chemical Engineering Contractors' Association
- British Compressed Gases Association
- British Foundry Association
- British Gas plc
- British Maritime Technology
- British Plumbing Fittings Manufacturers' Association
- British Shipbuilders
- British Valve and Actuator Manufacturers' Association
- Chartered Institution of Building Services Engineers
- Copper Development Association
- Department of the Environment (Property Services Agency)
- Electricity Supply Industry in England and Wales
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- Institution of Mechanical Engineers
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- Society of British Gas Industries
- Steel Casting Research and Trade Association
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- Water Companies Association

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Foreword

This edition of BS 5154 has been prepared under the direction of the Piping Systems Components Standards Policy Committee. It supersedes the 1989 edition, which is withdrawn.

BS 5154:1991 introduces technical changes to bring the standard up-to-date but it does not reflect a full review of the standard, which will be undertaken in due course. Revised text is indicated by a sideline in the margin. This edition reflects current manufacturing practice and recognizes the reclamation of valves through the impregnation of castings.

The satisfactory performance of any valve depends on design, manufacture, correct installation and maintenance; this standard specifies requirements for design and manufacture but not for installation and maintenance, guidance on which is given in BS 6683.

This standard allows options to the standard product, the preferred option being indicated by a note to the appropriate clause. Particular requirements should be indicated by the purchaser, as stated in Appendix A, otherwise the manufacturer will supply the product with the following preferred options:

- a) means of operation (see **9.9.2**);
- b) direction of operating effort to close (see **9.9.2**);
- c) trim materials (see **10.1**);
- d) flange ends drilled (see **8.1.1**).

Throughout this standard, all pressures specified are gauge pressures.

Safety Code. For purchasers of valves to BS 5154, it is emphasized that strict compliance with the manufacturer's instructions and recommendations for installation, usage and maintenance is necessary. Where there is an appropriate application standard or code of practice, it is the responsibility of the purchaser to ensure that such requirements are complied with, e.g. attention is drawn to BS 759-1.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 18, an inside back cover, and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

1 Scope

This British Standard specifies design, details of body ends, materials, test requirements, marking and preparation for storage and transportation, of copper alloy valves of globe, globe stop and check, check and gate types of the sizes specified in clause 5 and the pressure designation given in clause 6.

Two valve series, A and B, are specified (see clause 3), each series differing in its maximum temperature ratings.

The reclamation of valves through the impregnation of castings is a recognized practice within this standard but the impregnation process is not defined.

NOTE 1 The titles of the publications referred to in this standard are listed on the inside back cover.

NOTE 2 Valves which have failed the initial shell pressure test may be reclaimed, using an impregnation process which is permitted only by written approval of the purchaser and his acceptance of the manufacturer's proposed method of reclamation.

2 Definitions

For the purposes of this British Standard the following definitions apply.

2.1

nominal size (DN)

a numerical designation of size that is common to all components in piping systems other than those components designated by outside diameters or by thread size. It is a convenient round number for reference purposes and it is normally only loosely related to manufacturing dimensions

NOTE 1 Nominal size is designated by the letters DN followed by a number, e.g. DN 100.

NOTE 2 This definition is identical with that given in ISO 6708, published by the International Organization for Standardization (ISO).

2.2

nominal pressure (PN)

a numerical designation which is a convenient rounded number for reference purposes. All equipment of the same nominal size (DN) designated by the same PN number shall have compatible mating dimensions

NOTE 1 The maximum allowable working pressure depends on materials, design and working temperatures and should be selected from the tables of pressure/temperature ratings given in this standard.

NOTE 2 Nominal pressure is designated by the letters "PN" followed by the appropriate reference number, e.g. PN 10

NOTE 3 This definition is identical to the definition given in ISO 7268.

2.3

class

a numerical designation for reference purposes

NOTE 1 The maximum allowable working pressure depends on materials, design and working temperatures, and should be selected from the tables of pressure/temperature ratings given in this standard.

NOTE 2 Class is designated by the word Class followed by the appropriate reference number.

2.4

face-to-face dimensions (for straight pattern flanged valves)

the distance, expressed in millimetres, between the two planes perpendicular to the valve axis located at the extremities of the body end ports

2.5

centre-to-face dimensions (for angle pattern flanged valves)

the distance, expressed in millimetres, between the plane located at the extremity of either body end port and perpendicular to its axis and the other body end port axis

2.6

impregnation

the process whereby the porosity within a casting is impregnated with a fluid sealant which is subsequently polymerized to produce a solid seal

3 Valve series

3.1 Series A valves

The upper temperature limit for series A valves shall be (see Table 2 in respect of pressure/temperature ratings):

a) a temperature of 260 °C for flanged and threaded valves with metallic disk and seating surface materials;

or

b) the temperature limitation of the disk material or the impregnation process if such is below 260 °C, when the valve is fitted with renewable non-metallic disks and/or constructed from an impregnated casting.

NOTE 1 Series A valves are only specified with flanged or threaded ends.

NOTE 2 Temperature limitations of the disk material and/or impregnation process are marked by the manufacturer (see 12.2).

3.2 Series B valves

3.2.1 Valves with metallic disks and seats. Except where the valve has been constructed from an impregnated casting, pressure and temperature limitations for series B valves with metallic disk and seat materials shall be as specified in clause 7.

NOTE 1 The temperature limitations for series B valves with flanged or threaded ends are given in Table 2 and with capillary or compression ends in Table 3.

NOTE 2 Temperature limitations of valves constructed from impregnated castings are marked by the manufacturer (see 12.2)

3.2.2 Valves with non-metallic disks. The pressure and temperature limitations for series B valves with renewable non-metallic disks and/or impregnated castings shall be the temperature limitation of the disk material and/or the impregnation process when such is lower than that specified in clause 7.

4 Types of valves

4.1 General

Valves shall be one of the types specified in 4.2 to 4.4, having flanged, threaded, capillary or compression ends, integral or renewable body seats and screwed, union or bolted bonnets or covers.

4.2 Globe valves and globe stop and check valves

The valves shall be of the rising stem type with inside or outside screw of one of the following body patterns:

- a) straight;
- b) angle;
- c) oblique, or Y pattern.

4.3 Check valves

Check valves shall be one of the following types:

- a) swing type, for use with the axis of the body ports horizontal or vertical¹⁾;
- b) lift type of the following designs and body patterns:
 - 1) piston:
 - i) straight;
 - ii) angle;
 - 2) disk:
 - i) straight;
 - ii) vertical;
 - iii) angle.

4.4 Gate valves

Gate valves shall be either of the inside screw type with rising or non-rising stem or of the outside screw type with rising stem. In either case they shall be of one of the following types:

- a) solid or split wedge;
- b) double disk;
- c) parallel slide.

5 Size ranges

5.1 Flanged ends

The nominal sizes of flanged ends for valves designated by nominal pressure (PN) and Class shall be as shown in Table 1.

¹⁾ Swing check valves can only be used in vertical lines when the flow is in an upward direction.

5.2 Threaded ends

Threaded ends in accordance with either BS 21 or ANSI/ASME B1.20.1 shall be as follows:

$\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3, 4.

5.3 Capillary or compression ends in accordance with BS 864-2

The pipe outside diameters, expressed in millimetres, for use with capillary or compression ends in accordance with BS 864-2, shall be as follows:

8, 10, 12, 15, 18, 22, 28, 35, 42, 54, 67.

6 Pressure designations

6.1 Flanged ends

Flanged valves shall be designated by nominal pressure (PN) or Class, as appropriate, and selected from the following:

PN 16, Class 150, PN 25, PN 40, Class 300.

6.2 Threaded ends

Threaded valves shall be designated by nominal pressure (PN) and selected from the following:

PN 16, PN 20, PN 25, PN 32, PN 40.

6.3 Capillary and compression ends

Valves with capillary or compression ends shall not have pressure designations.

7 Pressure/temperature ratings

Valves with flanged or threaded ends shall have the maximum pressure/temperature ratings for fluids given in Table 2. Valves with capillary or compression ends shall have the maximum pressure/temperature rating for fluids given in Table 3.

Subject to the limitations of clause 3, valves with non-metallic disks and/or impregnated castings shall have the maximum temperature limitation of the non-metallic disk and/or the impregnation process. The marking of such valves shall be in accordance with clause 12.

8 Dimensions and tolerances of body ends

8.1 Flanged ends

8.1.1 Dimensions of flanges. Dimensions of flanges shall be in accordance with BS 4504-3.3 for PN 16, PN 25, and PN 40 valves and in accordance with BS 1560-3.3 for Class 150 and Class 300 valves.

NOTE 1 Flanged ends may be supplied undrilled (see Appendix A).

NOTE 2 Attention is drawn to requirements for joint faces in BS 4504-3.3 and BS 1560-3.3.

8.1.2 Face-to-face and centre-to-face dimensions.

Face-to-face and centre-to-face dimensions of flanged valves shall be as given in Table 4 for other than oblique pattern globe or oblique pattern lift check valves.

NOTE Face-to-face and centre-to-face dimensions for oblique pattern valves are not specified; they are at the manufacturer's option.

8.1.3 Tolerances on face-to-face and centre-to-face dimensions. The tolerances on face-to-face dimensions and centre-to-face dimensions of flanged valves shall be ± 2.0 mm.

8.1.4 Tolerance on alignment

8.1.4.1 Straight and oblique pattern valves. Jointing faces of body end flanges shall be machine finished at $90 \pm 0.5^\circ$ and concentric to a common centre line passing through the body end ports.

8.1.4.2 Angle pattern valves. Jointing faces of body end flanges shall be machine finished at $90 \pm 0.5^\circ$ and concentric to the centre line of the body end ports, and at right angles to each other.

8.2 Threaded ends

8.2.1 Threads. Internal thread dimensions shall be in accordance with BS 21, BS 2779 or ANSI/ASME B1.20.1, published by the American National Standards Institute.

8.2.2 End sealing faces. End sealing faces for parallel threads in accordance with BS 2779 shall have a smooth finish at 90° to the thread axis and shall have minimum outside diameters in accordance with Table 5.

8.2.3 Alignment. The axes of the threaded inlet and outlet ends shall be within 1.0° of the angle specified.

8.2.4 Thread chamfer. The lead-in of all body end threads shall be chamfered at an angle of approximately 45° to the axis of the thread, the diameter of chamfer at the face being not less than the major diameter of the thread.

The chamfer shall be concentric with the thread and shall be included in the measurement of the thread length.

8.2.5 Body end shapes. Body ends shall incorporate a method of holding the valve securely during installation, e.g. hexagon or provision for a C spanner.

Table 1 — Nominal sizes of valves according to PN or Class designation

PN designated valves	DN 10	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50	DN 65	DN 80	DN 100
Class designated valves	—	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	4

Table 2 — Pressure/temperature ratings for valves with flanged or threaded ends

1	2	3	4	5	6	7	8	9	10	11	12
Service temperature	Maximum permissible working pressure (bar) ^a										
	PN 16		Class 150		PN 20	PN 25		PN 32		Class 300	PN 40
	Flanged or threaded		Flanged		Threaded	Flanged or threaded		Threaded		Flanged	Flanged or threaded
	Series A	Series B	Series A	Series B	Series B	Series A	Series B	Series A	Series B	Series A	Series A
°C											
– 10 to 66	16.0	16.0	15.5	15.5	20.0	25.0	25.0	32.0	32.0	34.5	40.0
100	16.0	16.0	14.5	14.3	20.0	25.0	25.0	32.0	32.0	32.3	40.0
120	16.0	13.5	13.9	13.5	17.2	25.0	21.8	32.0	28.3	31.1	40.0
150	16.0	9.5	13.2	12.4	13.0	25.0	16.5	31.4	22.8	29.2	38.5
170	16.0	7.0	12.6	11.7	10.3	25.0	12.8	29.3	19.2	28.0	35.5
180	16.0	—	12.4	11.3	9.0	25.0	11.3	27.5	17.4	27.4	34.0
186	15.3	—	12.2	11.1	—	24.1	10.5	26.7	16.2	27.0	32.8
198	13.7	—	11.9	—	—	21.7	—	24.0	14.0	26.2	30.4
200	13.5	—	11.8	—	—	21.2	—	23.0	—	26.1	30.0
220	11.3	—	11.3	—	—	17.5	—	19.6	—	24.9	25.5
250	8.0	—	10.6	—	—	12.2	—	15.5	—	23.0	19.5
260	7.0	—	10.3	—	—	10.5	—	14.0	—	22.4	17.5

NOTE 1 Intermediate values may be interpolated.

NOTE 2 For pressure/temperature ratings below – 10 °C, the purchaser should refer to the manufacturer.

^a 1 bar = 10⁵ N/m² = 10² kPa.

Table 3 — Pressure/temperature ratings for valves with capillary or compression ends to BS 864-2

Service temperature	Maximum permissible working pressure			
	Capillary fittings		Compression fittings	
	Size 8 mm to 54 mm	Size 67 mm	Size 8 mm to 54 mm	Size 67 mm
°C	bar	bar	bar	bar
20	16	10	16	10
30	16	10	16	10
65	10	6	10	6
110	6	4	6	4
120	—	—	5	3

NOTE 1 Intermediate values may be interpolated.

NOTE 2 Reference should be made to BS 864-2 for criteria which may permit the use of special fittings at higher temperatures and pressures.

NOTE 3 For pressure/temperature ratings below 20 °C, the purchaser should refer to the manufacturer.

Table 4 — Face-to-face and centre-to-face dimensions of flanged valves

1	2	3	4	5
Nominal size	Face-to-face dimensions for straight pattern ^b		Centre-to-face dimensions for angle pattern	
	Short ^c Basic series 18	Long ^d Basic series 7	Short ^c Basic series 63	Long ^d Basic series 64
	mm	mm	mm	mm
DN				
10	80	108	65	70
15	80	108	65	70
20	90	117	70	75
25	100	127	80	85
32	110	146	90	95
40	120	159	95	100
50	135	190	105	115
65	165	216	115	125
80	185	254	125	135
100	229	305	135	146

NOTE Basic series of dimensions are given in BS 2080.

^a For comparable nominal sizes of Class designated valves see Table 1.^b Face-to-face dimensions for nominal sizes up to and including DN 80 are in accordance with ISO 5752:1982.^c Short dimensions are preferred for all PN 16, Class 150 and PN 25 valves with screwed bonnets and integral seats.^d Long dimensions are preferred for:

- a) all PN 40 and Class 300 valves;
- b) parallel slide and double disk gate valves;
- c) valves with renewable seats;
- d) valves with union or bolted bonnets.

**Table 5 — Minimum outside diameters of
sealing faces for parallel threaded ends to
BS 2779**

Thread size	Outside diameter of sealing face (min.)
	mm
$\frac{1}{4}$	18
$\frac{3}{8}$	22
$\frac{1}{2}$	26
$\frac{3}{4}$	32
1	39
$1\frac{1}{4}$	49
$1\frac{1}{2}$	55
2	68
$2\frac{1}{2}$	85
3	98
4	126

Section 2. Design

9 Design

9.1 Flow-way area

The flow-way area at any point in a valve shall be not less than that of a circle having an equivalent diameter to that given in Table 6, except in the following cases.

- a) Globe, globe stop and check and check valves with plug-type disks or disks guided from below shall have a flow-way area of not less than 85 % of that given in Table 6.
- b) Gate valves with body seat rings shall have a flow-way area of not less than 85 % of that given in Table 6.

Table 6 — Minimum flow-way area

1	2	3	4
Valve			Minimum flow-way area given by equivalent circle of a diameter of
Flanged ^a ends	Threaded ends	Capillary or compression ends to BS 864-2	
DN		mm	mm
—	¼	8	6.3
10	⅜	10 and 12	9.5
15	½	15 and 18	12.7
20	¾	22	19.0
25	1	28	25.0
32	1¼	35	31.7
40	1½	42	38.1
50	2	54	50.0
65	2½	67	63.5
80	3	—	76.2
100	4	—	100.0

NOTE The purpose of Table 6 is to indicate only the minimum flow-way area appropriate to the valve size. Columns 2 and 3 of this table should not be used for correlation of nominal valve sizes to outside tube diameters. For this purpose reference should be made to the appropriate British Standards.

^a For comparable nominal sizes of Class designated valves see Table 1.

9.2 Body seat rings

Body seat rings, when fitted, shall be of such a design as to prevent them from coming loose in service.

NOTE The purchaser should specify on the order and/or enquiry if renewable seat rings are required (see Appendix A).

9.3 Disks and wedges

Disks which are detachable or of two-piece construction shall be of such a design that they cannot become detached in service.

Disks of globe stop and check valves and lift check valves shall be guided to ensure correct alignment.

To allow for wear, wedges of wedge gate valves, when new, shall “ride high” in the body seats when the valve is closed.

9.4 Back seat

Series A valves with rising stems shall have a back seating surface in the bonnet with which a corresponding seating surface on the stem or disk assembly contacts when the valve is fully open.

9.5 Stems

9.5.1 *Stem type.* Stems shall be one of the following types:

- a) inside screw, having the actuating thread within the pressure containing components;
- b) outside screw, having the actuating thread outside the pressure containing components.

9.5.2 *Stem diameters.* Valve stem diameters shall be not less than those given in Table 7. The diameters shall be measured at the following locations:

- a) parallel slide gate valves: at the major diameter of the actuating thread;
- b) other valve types:
 - 1) outside screw valves: at the minor diameter of the actuating thread;
 - 2) inside screw valves:
 - i) rising stem: at the gland;
 - ii) non-rising stem: at the gland and at the major diameter of the actuating thread.

9.6 Direction of flow for globe valves

For globe stop and check valves, the direction of flow shall be with the upstream pressure under the disk. Other forms of globe valve shall be suitable for flow in either direction.

NOTE The preferred direction is with the upstream pressure under the disk.

9.7 Body tapping for drain plugs

Where drain plugs are fitted (see Appendix A) the body tappings shall be in accordance with BS 21 or ANSI/ASME B1.20.1.

9.8 Position indicators

Position indicators (see Appendix A) shall be marked to show both OPEN and SHUT positions.

9.9 Operation

9.9.1 *General.* All valves, excluding check valves, shall be capable of being operated by one of the appropriate devices, as specified in 9.9.2 and 9.9.3, when a differential pressure equal to the maximum pressure to which the valve can be subjected within its nominal rating exists across the wedge or disk.

9.9.2 Valves designed for operation by handwheel or key. A handwheel or key, as appropriate, shall be provided with each valve, except in those cases where a valve is specified to be supplied in lockshield form, whereby the stem end is designed for key operation, but has fitted to it a shroud. In such instances, the manufacturer shall make available a suitable key.

NOTE 1 Valves will be supplied for operation by handwheel or key unless the purchaser exercises his option in accordance with Appendix A.

Handwheels shall be securely fitted yet allow for removal and replacement when necessary.

The design of the handwheel, or the method of handwheel to stem attachment, on valves of DN 50 and above, shall permit the fitting of a 1.5 mm thick service nameplate.

Manually operated valves shall be closed by turning the handwheel or key in a clockwise or anticlockwise direction when facing the handwheel or key (see Appendix A).

NOTE 2 Clockwise closing will always be supplied unless the purchaser specifically requests an anticlockwise closing and it is therefore essential that the purchaser specifies such operation in accordance with Appendix A.

9.9.3 Valves designed for operation by chainwheel, gear or actuator. When valves are specified for chainwheel, gear or actuator operation, they shall be supplied without handwheel or key.

NOTE If actuator operation is required, the details of the actuator and its power supply together with the maximum operating differential pressure across the valve should be specified in the enquiry and/or order (see Appendix A). Dimensions for actuator attachment should comply with BS 5840-1, when appropriate.

9.10 Wall thickness

The wall thickness of any pressure-containing component of the valve, i.e. body, bonnet or cover, shall be not less than that given in Table 8.

9.11 Bolting

Bolting threads shall be in accordance with ISO metric or unified inch standards. The dimensions and finish of bolting shall be in accordance with the following British Standards, as appropriate:

Metric	Inch
BS 3692	BS 1768 (sizes below ½ in only)
BS 4190	BS 1769
BS 4439	BS 2693-1
BS 4882	BS 4882

Table 7 — Minimum stem diameters

1	2	3	4	5	6	7	8	9				
Body ends			Minimum stem diameter for valves having flanged ends							Minimum stem diameter for valves having capillary or compression ends		
Flanged ends	Threaded ends (internal)	Capillary and compression ends	PN 16	—	PN 25 Class 150	—	PN 40 Class 300					
			Minimum stem diameter for valves having threaded ends									
			PN 16	PN 20	PN 25	PN 32	PN 40					
Valve size			Valve type									
			Gate and globe	Gate	Globe	Gate	Globe	Gate	Globe	Gate	Globe	Gate and globe
DN ^a		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
—	¼	8	5.5	5.5	6.0	6.0	6.0	6.0	6.0	6.5	6.5	5.5
10	⅜	10, 12	6.0	6.0	6.5	6.5	6.5	7.0	7.0	7.5	7.5	6.0
15	½	15, 16, 18	6.5	6.5	7.0	7.0	7.0	7.5	7.5	8.0	8.0	6.5
20	¾	20, 22, 25	7.5	7.5	8.0	8.0	8.0	8.5	8.5	9.5	9.5	7.5
25	1	28, 30	8.5	8.5	9.5	9.5	9.5	10.0	10.0	11.0	11.0	8.5
32	1¼	35, 38	9.5	9.5	10.5	10.5	10.5	11.0	11.0	12.0	12.0	9.5
40	1½	42	10.5	10.5	11.0	11.0	12.0	12.0	12.5	12.5	14.0	10.5
50	2	54	12.0	12.0	12.5	12.5	13.5	13.5	14.0	14.0	15.5	12.0
65	2½	67	13.5	13.5	14.0	14.0	15.0	15.0	16.0	16.0	17.5	13.5
80	3	—	15.0	15.0	15.5	15.5	16.5	16.5	17.5	17.5	19.0	—
100	4	—	17.0	17.0	18.0	18.0	19.0	19.0	20.0	20.0	22.0	—

NOTE The purpose of Table 7 is to indicate only the minimum stem diameters appropriate to the valve size. Columns 2 and 3 of this table should not be used for correlation of nominal valve sizes to outside tube diameters. For this purpose reference should be made to the appropriate British Standards.

^a For comparable nominal sizes of Class designated valves see Table 1.

Table 8 — Minimum wall thicknesses

1	2	3	4	5	6	7	8	9
Valve size			Minimum wall thickness for valves having flanged ends					Minimum wall thickness for valves having capillary or compression ends
Flanged ends	Threaded ends (internal)	Capillary and compression ends	PN 16	—	PN 25 Class 150	—	PN 40 Class 300	
			Minimum wall thickness for valves having threaded ends					
			PN 16	PN 20	PN 25	PN 32	PN 40	
DN ^a		mm	mm	mm	mm	mm	mm	mm
—	¼	8	1.5	1.6	1.7	1.8	2.0	1.5
10	⅜	10, 12	1.6	1.7	1.8	1.9	2.1	1.6
15	½	15, 16, 18	1.7	1.8	1.9	2.1	2.4	1.7
20	¾	20, 22, 25	1.8	2.0	2.1	2.3	2.6	1.8
25	1	28, 30	2.0	2.1	2.4	2.6	3.0	2.0
32	1¼	35, 38	2.2	2.4	2.6	3.0	3.4	2.2
40	1½	42	2.3	2.5	2.8	3.2	3.7	2.3
50	2	54	2.5	2.8	3.2	3.7	4.3	2.5
65	2½	67	2.8	3.2	3.7	4.3	5.1	2.8
80	3	—	3.1	3.6	4.1	4.8	5.7	—
100	4	—	3.5	4.0	4.6	5.4	6.4	—

NOTE The purpose of Table 8 is to indicate only the minimum wall thicknesses appropriate to the valve size and pressure designation. Columns 2 and 3 of this table should not be used for correlation of nominal valve sizes to outside tube diameters. For this purpose reference should be made to the appropriate British Standards.

^a For comparable nominal sizes of Class designated valves see Table 1.

Section 3. Materials

10 Materials

10.1 Metals

The metallic materials for the components of series A valves shall be selected from those given in Table 9.

The metallic materials for the components of series B valves shall be selected from those given in Table 10 or, if required by the manufacturer, from the materials given in Table 9.

The material of bolting for pressure containing purposes shall comply with BS 4882.

NOTE If the purchaser requires a specific material given in Table 9 or Table 10 then this should be stated on the enquiry and/or order, otherwise the manufacturer will decide the materials to be used (see Appendix A).

10.2 Non-metals

The specification of non-metallic materials, e.g. for renewable disks or seats and the impregnation process, where used is outside the scope of this standard. However where non-metallic materials are used and come, or are likely to come, into contact with potable water, then the materials shall comply with BS 6920-1.

NOTE 1 The purchaser should indicate on his enquiry and/or order if valves are to be used with potable water-supply (see Appendix A).

NOTE 2 The purchaser should specify on the enquiry and/or order if non-metallic renewable disks or seats are required (see Appendix A).

Table 9 — Metallic materials for the manufacture of series A valves

Component	Material	BS reference	Grade or designation
Body Bonnet Cover	Leaded gunmetal	1 400	LG2 LG4
Disk Wedge Piston Ball Body seat and disk ^a facing ring, where renewable	Leaded gunmetal	1 400	LG2 LG4
	Nickel copper alloy	—	32 % Ni minimum
		3 071	NA1 NA2 NA3
		3 076	NA13
	Stainless steel	Martensitic stainless steel or austenitic stainless steel complying with BS 970-1, BS 1503 or BS 1504	
Stem Hinge Hinge-pin Disk stem nut Stem bush Belt ring Stuffing box Gland Union nut Disk nut	Brass	2 872 and 2 874	CZ112 CZ114 CZ116
	Aluminium bronze	—	NES 834, Parts 1 and 2
		2 872 and 2 874	CA 104
		1 400	AB2
	Stainless steel	Martensitic stainless steel or austenitic stainless steel complying with BS 970-1, BS 1503 or BS 1504	
	Leaded gunmetal ^b	1 400	LG2 LG4
Internal fasteners (where applicable)	Brass	2 870 and 2 873	CZ106, CZ107, CZ108
	Phosphor bronze	2 870 2 873 2 874 2 875 1 400	PB102 PB1
Handwheel	Grey cast iron	1 452	Grade 180
	Steel	—	Any grade
	Aluminium alloy	1 490	LM6
	Zinc alloy	1 004	Grade A
	Malleable iron	6 681	B30 – 06
	Ductile iron	2 789	500/7,420/12 400/18, 350/22
^a It is permissible for renewable disk facing rings to be supplied in non-metallic materials.			
^b Preferably produced by the continuous casting process when used for stems.			

Table 10 — Metallic materials for the manufacture of series B valves

Component	Material	BS reference	Grade or designation
Body	Copper alloy	1 400	DCB1
Bonnet			DCB3
Cover			PCB1
Stuffing box		2 872 and 2 874	CZ121
Gland			CZ122
Union nut			CZ132
Disk		5 154 ^a	Alloy A
Wedge			Alloy B
Piston			
Ball			
Body seat where renewable			
Stem		2 872 and 2 874	CZ121
Hinge			CZ122
Hinge pin			CZ132
Disk stem nut		5 154 ^a	Alloy B
Stem bush			
Belt ring			

^a See Appendix B for specifications.

Section 4. Pressure testing

11 Pressure test requirements

All valves shall be pressure tested by the manufacturer before dispatch to the production pressure testing requirements given in BS 6755-1, except as qualified by this clause, as follows:

either:

- a) hydrostatic shell and seat tests applicable for all sizes of both series A and series B valves; or
- b) pneumatic shell and seat tests applicable for series B valves only of size 2 or DN 50 and smaller;

and the appropriate test durations shall be given as in Table 11.

The maximum allowable seat leakage rates shall be as follows:

- 1) rate B (as given in BS 6755-1) for metal seated check valves and for the seat integrity of globe stop and check valves as metal seated check valves;

- 2) rate A (as given in BS 6755-1, i.e. no visually detectable leakage) for all other valves, including the seat integrity of globe stop and check valves as stop valves.

For series A valves having a rising stem and back seat (see 9.4) there shall be no visually detectable leakage during the back seat test.

Valves which have failed the initial shell pressure test and which have porous castings subsequently reclaimed by an impregnation process shall have the shell and seat retested hydrostatically in accordance with BS 6755-1. The pneumatic test shall not be used.

NOTE 1 There is no requirement to determine back seat leakage rates on other types of valves incorporating a back seat.

NOTE 2 If a test certificate is required this should be requested on the enquiry and/or order for the valves (see Appendix A).

Table 11 — Duration for production pressure test

Flanged body ends nominal size	Threaded capillary and compression body ends	Minimum test duration for:									
		Hydrostatic						Pneumatic			
		Shell		Seat		Back seat (where applicable)		Shell		Seat	
		Series		Series		Series		Series		Series	
		A	B	A	B	A	B	A	B	A	B
DN Up to and including 50	Up to and including 2, or 54 mm	^s 15	^s 5	^s 15	^s 5	^s 15	^s —	^s —	^s 5	^s —	^s 5
65 up to and including 100	2½ up to and including 4, or 67 mm	60	5	30	5	30	—	—	—	—	—

Section 5. Marking

12 Marking

NOTE Additional markings may be used at the option of the manufacturer provided that they do not conflict with any of the markings specified in this clause.

12.1 Body markings

Body marking shall be as follows:

- a) nominal size, thread size or pipe outside diameter (see clause 5);
- b) nominal pressure designation, if applicable, (see clause 6);

NOTE For Class 150 and Class 300 valves where, due to the small size of the valve it is impracticable to incorporate the word "Class", it is permissible to omit "Class".

- c) body material designation (see 12.3) for:
 - 1) flanged end valves nominal size DN 50 (2 in) and greater;
 - 2) threaded end valves size 2 and above;
 - 3) capillary or compression ends of size 2 or outside diameter 54 mm or 67 mm;

NOTE On valves of smaller sizes, the body material designation may be omitted.
- d) manufacturer's name or trade mark;
- e) for uni-directional flow valves only, an arrow to indicate direction of flow.

Body markings, with the exception of the nominal pressure designations on valves with flanged ends of nominal size DN 50 (2 in) and smaller, shall be either integral with the body or on a plate securely fixed to the body. If on a plate, this shall be separate and distinct from the identification plate specified in 12.2. Valves with flanged ends of nominal size DN 50 (2 in) and smaller shall be deemed to comply with the requirements of this standard if the nominal pressure designation is clearly marked on the rim of the flange.

12.2 Body or identification plate markings

Body or identification plate markings shall be as follows.

- a) An identification number comprising:
 - 1) the number of this British Standard, i.e. BS 5154²⁾;
 - 2) designation of the valve series (A or B);
 - 3) symbol for a renewable non-metallic disk (NM), if fitted, e.g. BS 5154/B/NM.
- b) When the manufacturer is required by the purchaser to identify trim materials (see Appendix A), the marking shall indicate the trim in the following order:

STEM OR HINGE PIN;

DISK;

SEAT.

Symbols indicating trim material shall be in accordance with 12.3 and shall be either preceded by the word "stem" or "hinge pin", "disk" or "seat", or simply used in the order indicated above.

c) Any limiting temperature when the valve is not suitable for the range of temperatures given in Table 2 or Table 3, as appropriate. Valves constructed from impregnated castings shall be marked IMP followed by the temperature limitation in degrees Celsius of the impregnation process.

d) The letters AT, for valves provided with pipe end threads in accordance with ANSI/ASME B1.20.1.

12.3 Material symbols

The following symbols shall be used for body material designation [see 12.1 c)] and trim materials identification [see 12.2 b)]:

Gunmetal	GM;
Brass	BR;
Dezincification-resistant brass	CR, DR or CR (see note);
Aluminium bronze	AB;
Stainless steel	SS;
13 % chromium steel	CR 13;
Non-metallic disk	NM;
Nickel-copper alloy	NICU.

NOTE The symbol CR applies only to valves manufactured from CZ 132.

12.4 Handwheel markings

Handwheels shall be marked CLOSE or SHUT with an arrow to indicate the direction of closure. In addition, handwheels are permitted to be marked OPEN with an arrow to indicate the direction of opening. Alternatively, these markings are permitted to be shown on a name-plate secured below the handwheel nut.

12.5 End fittings to BS 864-2

Valves having capillary or compression ends shall be marked to indicate that the end fittings comply with BS 864-2.

²⁾ Marking BS 5154 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

Section 6. Preparation for storage and transportation

13 General

13.1 Protection

After testing, each valve shall be drained of test liquid, cleaned of any extraneous matter and suitably protected in preparation for storage and transportation.

NOTE Painting is not a requirement of this standard (see Appendix A).

13.2 Wedge or disk position (other than check)

All metallic valve wedges or disks shall be in the closed position when the valves are dispatched. Valves with non-metallic renewable disks shall be in the open position.

13.3 Body ends

Body ends shall be protected to exclude foreign matter during storage and transportation.

NOTE Suitable protection may be in the form of plugs, perforated plastic bags, cartons or boxes.

Appendix A Information to be supplied by the purchaser

The following information should be supplied by the purchaser in his enquiry or order.

- a) Valve series (see clause 3).
- b) Type of valve (see clause 4).
- c) Nominal size (DN) or size (see clause 5).
- d) Nominal pressure (PN) or Class, if appropriate (see clause 6).
- e) Body ends required (see clause 5) and the following details.
 - 1) If flanged, state whether in accordance with BS 4504-3.3 or BS 1560-3.3 (see 8.1), and if flanges are to be undrilled (see 8.1); also whether short or long face-to-face or centre-to-face dimensions are required (see 8.1.2).
 - 2) If threaded state whether a specific thread (parallel or taper) is required (see 8.2) and whether thread form shall be in accordance with BS 21, BS 2779 or ANSI/ASME B1.20.1 (see 8.2.1).
 - 3) If capillary or compression, state the essential requirements, cross referenced to BS 864-2.
- f) If anticlockwise closing is required (see 9.9.2).
- g) Method of operation, if other than the handwheel or key (see 9.9.3).
- h) If the actuator operation is required, details of the actuator and its power supply and the maximum operating differential pressure across the valve (see note to 9.9.3).
- i) If specific trim materials are required (see note to 10.1) and, in particular, if valve is required for use with potable water (see 10.2).
- j) State if any of the following is required:
 - 1) metallic or non-metallic renewable seat and disk rings (see 9.2 and 10.2);
 - 2) a drain plug (see 9.7);
 - 3) a position indicator (see 9.8);
 - 4) test certificate (see note 2 to clause 11);
 - 5) valve painting (see 13.1);
 - 6) trim material identification [see 12.2 b)].
- k) The acceptance of valves constructed from impregnated castings (see clause 1).

Appendix B Specification for Alloy A and Alloy B (as given in Table 10)

B.1 General

This appendix specifies requirements for the chemical compositions and mechanical properties of the following two copper alloys.

- a) Alloy A which is a leaded gunmetal produced as sand castings.
- b) Alloy B which is a dezincification-resistant (DZR) brass produced as pressure die castings or extruded rod.

B.2 Chemical composition

The chemical compositions of alloy A and alloy B shall be as given in Table 12.

Table 12 — Chemical composition of alloy A and alloy B

Elements	Material	
	Alloy A	Alloy B
	%	%
Copper	Remainder	64.0 to 65.5 ^a
Tin	2.0 to 4.5	0.80 max.
Zinc	7.0 to 11.0	Remainder
Lead	4.0 to 9.0	1.5 to 2.2
Phosphorus	0.02 max.	—
Nickel	2.0 max.	0.80 max. ^a
Iron	—	0.50 max.
Aluminium	0.01 max.	—
Manganese	—	0.15 max.
Antimony	0.5 max.	—
Iron + arsenic	0.75 max.	—
+ antimony	0.02 max.	0.65 to 0.80
Silicon	0.10 max.	—
Bismuth	0.10 max.	—
Sulphur	—	—
Total of impurities	1.0 max.	0.5 max.
NOTE Specified impurities are shown in light type.		
^a Nickel content is included in total copper content.		

B.3 Mechanical properties

For alloy A castings the mechanical properties, determined by the method given in B.4.4 on samples taken in accordance with B.4.1, B.4.2 and B.4.3 shall be as given in Table 13.

NOTE No mechanical properties are specified for pressure die castings in alloy B but typical properties derived from separately chill cast samples from the same cast as the castings they represent are included in Table 13 for information.

Table 13 — Mechanical properties of castings

Material	Tensile strength R_m min.	0.2 % Proof stress $R_{p0.2}$ min.	Elongation $5.65 \sqrt{S_0}^b$ A min.
Alloy A	N/mm ² 180	N/mm ² 80 ^a	% 11
Alloy B	350 ^a	270 ^a	12 ^a

^a For information only.
^b S_0 is the original cross-sectional area of the parallel length of the test piece.

For alloy B extrusions the mechanical properties determined by the method given in B.5 shall be as given in Table 14.

Table 14 — Mechanical properties of alloy B extrusions

Form	Tensile strength R_m min.	0.2 % Proof stress $R_{p0.2}$ min.	Elongation $5.65 \sqrt{S_0}^a$ A min.
Extruded rod diameter mm	N/mm ²	N/mm ²	%
> 9 ≤ 15	430	280	17
> 15 ≤ 25	380	220	20

^a S_0 is the original cross-sectional area of the parallel length of the test piece.

B.4 Cast test samples and tensile test

B.4.1 For determination of mechanical properties, tensile tests shall be carried out in accordance with either (a) or (b), whichever yields the less frequent rate of testing:

- a) one test piece per cast; or
- b) one test for the maximum mass of 5 000 kg of fettled castings.

B.4.2 Test samples shall be of suitable size for machining to the dimensions of standard proportional tensile test pieces in accordance with BS 18-1.

B.4.3 The test samples shall be separately cast into sand moulds from the same cast as the castings they represent. If the castings are to be subsequently heat treated, test samples shall be heat treated with the castings they represent.

NOTE Shapes of test bars are given in Appendix E of BS 1400:1985.

B.4.4 From test samples, tensile test bars shall be machined to the dimensions of proportional test pieces in accordance with BS 18-1.

The testing machine shall be calibrated in accordance with BS 1610 and shall comply with the requirements for grade A.

The tests shall be carried out in accordance with BS 18-1.

B.5 Wrought (extruded) test samples and tensile test

B.5.1 For determination of mechanical properties, tensile tests shall be carried out on samples selected and prepared in accordance with 11.2 of BS 2874:1986.

B.5.2 From test samples, tensile test pieces shall be prepared and tensile tested in accordance with Appendix E of BS 2874:1986.

B.6 Resistance to dezincification

When tested in accordance with Appendix G of BS 2874:1986, the maximum depth of dezincification of alloy B shall be:

- a) for rod and section after heat treatment at 550 ± 25 °C for 2 hours between extrusion and drawing:
 - 1) 100 µm in the direction perpendicular to the extrusion or rolling direction; and
 - 2) 200 µm in the direction parallel to the extrusion or rolling direction.
- b) for castings: 100 µm.

Publications referred to

- BS 18, *Method for tensile testing of metals (including aerospace materials)*.
- BS 18-1, *Non-ferrous metals*.
- BS 21, *Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions)*.
- BS 759, *Valves, gauges and other safety fittings for application to boilers and to piping installations for and in connection with boilers*³⁾.
- BS 759-1, *Specification for valves, mountings and fittings*.
- BS 864, *Capillary and compression tube fittings of copper and copper alloy*.
- BS 864-2, *Specification for capillary and compression fitting for copper tubes*.
- BS 864-3, *Compression fittings for polyethylene pipes*³⁾.
- BS 970, *Specification for wrought steels for mechanical and allied engineering purposes*.
- BS 970-1, *General inspection and testing procedures and specific requirements for carbon, carbon manganese, alloy and stainless steels*.
- BS 1004, *Specification for zinc alloys for die casting and zinc alloy die castings*.
- BS 1400, *Specification for copper alloy ingots and copper and copper alloy and high conductivity copper castings*.
- BS 1452, *Specification for grey iron castings*.
- BS 1490, *Specification for aluminium and aluminium alloy ingots and castings*.
- BS 1503, *Specification for steel forgings (including semi-finished forged products) for pressure purposes*.
- BS 1504, *Specification for steel castings for pressure purposes*.
- BS 1506, *Specification for carbon, low alloy and stainless steel bars and billets for bolting material to be used in pressure retaining applications*.
- BS 1560, *Circular flanges for pipes, valves and fittings (Class designated)*.
- BS 1560-3, *Steel, cast iron and copper alloy flanges*.
- BS 1560-3.3, *Specification for copper alloy and composite flanges*.
- BS 1610, *Materials testing machines and force verification equipment*.
- BS 1768, *Specification for Unified precision hexagon bolts, screws and nuts (UNC and UNF threads). Normal series*.
- BS 1769, *Specification. Unified black hexagon bolts, screws and nuts (UNC and UNF threads). Heavy series (obsolescent)*.
- BS 2051, *Tube and pipe fittings for engineering purposes*³⁾.
- BS 2051-1, *Copper and copper alloys capillary and compression tube fittings for engineering purposes*.
- BS 2080, *Specification for face-to-face, centre-to-face, end-to-end and centre-to-end dimensions of valves*.
- BS 2693, *Specification for screwed studs*.
- BS 2693-1, *General purpose studs*.
- BS 2779, *Specification for pipe threads for tubes and fittings where pressure-tight joints are not made on the threads (metric dimensions)*.
- BS 2789, *Specification for spheroidal graphite or nodular graphite cast iron*.
- BS 2870, *Specification for rolled copper and copper alloys: sheet, strip and foil*.
- BS 2872, *Specification for copper and copper alloys. Forging stock and forgings*.
- BS 2873, *Specification for copper and copper alloys. Wire*.
- BS 2874, *Specification for copper and copper alloy rods and sections (other than forging stock)*.
- BS 2875, *Specification for copper and copper alloys. Plate*.
- BS 3071, *Specification for nickel-copper alloy castings*.
- BS 3076, *Specification for nickel and nickel alloys: bar*.
- BS 3692, *Specification for ISO metric precision hexagon bolts, screws and nuts. Metric units*.
- BS 4190, *Specification for ISO metric black hexagon bolts, screws and nuts*.

³⁾ Referred to in the foreword only.

- BS 4439, *Specification for screwed studs for general purposes. Metric series.*
- BS 4504, *Circular flanges for pipes, valves and fittings (PN designated).*
- BS 4504-3, *Steel, cast iron and copper alloy flanges.*
- BS 4504-3.3, *Specification for copper alloy and composite flanges.*
- BS 4882, *Specification for bolting for flanges and pressure containing purposes.*
- BS 5840, *Valve mating details for actuator operation.*
- BS 5840-1, *Specification for flange dimensions and characteristics.*
- BS 6681, *Specification for malleable cast iron.*
- BS 6683, *Guide to installation and use of valves*⁴⁾.
- BS 6755, *Testing of valves.*
- BS 6755-1, *Specification for production pressure testing requirements.*
- BS 6920, *Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water.*
- BS 6920-1, *Specification.*
- NES 834, *Requirements for aluminium silicon bronze.*
- NES 834-1, *Sheet, strip and plate.*
- BS 834-2, *Forgings, forging stock, rods and sections*⁵⁾.
- ISO 5752, *Metal valves for use in flanged pipe systems — face-to-face and centre-to-face dimensions.*
- ISO 6708, *Pipe components — Definition of nominal size.*
- ISO 7268, *Pipe components — Definition of nominal pressure.*
- ANSI/ASME B1.20.1, *Pipe threads, general purpose (inch).*

⁴⁾ Published by Procurement Executive, Ministry of Defence, Foxhill, Bath.

⁵⁾ Published by Procurement Executive, Ministry of Defence, Foxhill, Bath.

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