

Specification for

**Steel check valves
(flanged and
butt-welding ends) for
the petroleum,
petrochemical and
allied industries**

UDC 665.6: 621.646.248: 669.14

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW



Co-operating organizations

The Petroleum Equipment Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government department and scientific and industrial organizations:

- British Gas Corporation
- British Mechanical Engineering Confederation
- British Rubber Manufacturers' Association Ltd.
- British Steel Industry*
- Council of British Manufacturers of Petroleum Equipment*
- Department of Energy
- Oil Companies Materials Association*

The industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the Committee entrusted with the preparation of this standard:

- Association of Hydraulic Equipment Manufacturers
- British Chemical Engineering Contractors Association
- British Industrial Measuring and Control Apparatus Manufacturers' Association
- British Plastics Federation
- British Ship Research Association
- British Valve Manufacturers' Association
- Engineering Equipment Users Association
- Steel Castings Association

This British Standard, having been approved by the Petroleum Equipment Industry Standards Committee, was published under the authority of the Executive Board on 28 November 1975

© BSI 02-1999
First published, June 1952
First revision, March 1960
Second revision, November 1975

The following BSI references relate to the work on this standard:
Committee reference PEE/1
Draft for comment 74/74150 DC

ISBN 0 580 08817 0

Amendments issued since publication

Amd. No.	Date of issue	Comments
6563	July 1990	Indicated by a sideline in the margin

Contents

	Page
Co-operating organizations	Inside front cover
Foreword	ii
Section 1. General	
1 Scope	1
2 References	1
3 Definitions	1
4 Pressure classification	1
5 Pressure/temperature ratings	1
6 Nominal sizes	1
7 Information to be supplied by the purchaser	2
Section 2. Design	
8 Body	2
9 Cover	5
10 Disk, piston or ball	5
11 Piston and ball guides	5
12 Hinge and hinge pin (swing type) and spindle support cage (disk type)	5
13 Special fitments	6
14 Cover bolting	6
15 Soft seal ring	6
Section 3. Materials	
16 Shell	6
17 Body seat ring	6
18 Body/cover gasket and pipe plug gasket	6
19 Disk, piston or ball	7
20 Trim	7
21 Hinge (swing type) and spindle support cage (disk type)	7
22 Plug	7
23 Cover bolting	7
24 Nameplate	7
25 Soft seal ring	7
26 Special fitments	7
27 Special applications	8
Section 4. Marking	
28 Required markings	10
29 Body and nameplate markings	10
30 Cover marking	10
31 Body marking	10
32 Direction of flow	10
33 Nameplate marking	10
34 Additional markings	11
35 Omission of markings	11
Section 5. Testing	
36 Production pressure testing	11

	Page
Section 6. Shipping	
37 Preliminary	11
38 Preparation for despatch	11
39 Packaging	12
Appendix A Application to piping systems with BS 4504-1 flanges	20
Figure 1 — Swing type check valves	13
Figure 2 — Piston type check valves	15
Figure 3 — Ball type check valves	16
Figure 4 — Ball type check valve	17
Figure 5 — Disk type check valves	18
Figure 6 — Butt-welding ends	19
Table 1 — Dimensions of check valves	4
Table 2 — Trim materials, hardness and acceptable specifications	9
Table 2(a) — Test durations	11
Table 3 — Nominal pressure and class ratings and nominal size range	20
Table 4 — Table deleted	22
Publications referred to	Inside back cover

Foreword

This British Standard is one of a series prepared under the authority of the Petroleum Equipment Industry Standards Committee. It was first published in 1952 when materials referred to in it were described by reference to ASTM specifications. In 1960 a revision of BS 1868 was published in order to bring it into alignment with the 1958 editions of BS 1501 to BS 1506 and BS 1560. This edition is the metric version of BS 1868, and wherever possible metric dimensions and references are given. The recognized metric nominal piping sizes have been used. The previous sections dealing with test have not been included in this standard as these are now the subject of a separate standard BS 6755 “Testing of valves. Part 1. Specification for production pressure testing requirements”.

NOTE Requirements for final inspection and supplementary inspection at all stages of manufacture, previously specified in BS 5146-1:1974 (now withdrawn) should be stated by the purchaser in his enquiry or order.

Disk type and angle pattern valves and butt-welding end versions of all types have been added and the range has been extended to incorporate larger sizes.

The face-to-face and end-to-end dimensions of valves complying with the requirements of this standard, where applicable, are in accordance with ANSI B16-10 but are not now included here, as these are in BS 2080 “Specification for face-to-face, centre-to-face, end-to-end and centre-to-end dimensions of flanged and butt-welding end steel valves for the petroleum, petrochemical and allied industries”. End flanges are in accordance with BS 1560-2 (which corresponds to ANSI B16-5) and butt-welding ends are in accordance with ANSI B16-25.

NOTE User requirements for valves generally in accordance with this standard, but suitable for use in piping systems with flanges complying with the requirements of BS 4504-1, are dealt with in appendix A.

The range of shell materials has been extended to align with the latest edition of BS 1560-2; also the range of materials for the trim and other components has been extended.

This standard does not cover valves suitable for the passage of spheres or pig scrapers.

It is drawn to the reader’s attention that at the time of publication of this standard proposals are under discussion in CEN/WG74, “Flanges”, effectively recommending that the use of BS 4504 (DIN) flanges be limited to 40 bar maximum ratings. Such proposals may possibly result in the publication of a European Standard.

Acknowledgement is made to the American Petroleum Institute and to the American National Standards Institute for data used.

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 to iv, pages 1 to 20, 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.

Document provided by MS Licensee=Qatar Petroleum/5943408104, User=, 05/05/2003

Section 1. General

1 Scope

This British Standard specifies requirements for cast or forged steel check valves with flanged or butt-welding ends of the following types:

- a) swing, for vertical or horizontal flow (see Figure 1);
- b) lift:
 - i) piston type, for angle or horizontal flow (see Figure 2);
 - ii) ball type, for angle or horizontal flow (see Figure 3);
 - iii) ball type, for vertical flow (see Figure 4);
 - iv) disk type, for vertical flow (see Figure 5).

The terms “vertical”, “horizontal” and “angle” relate to the axes of the body ends.

When swing check valves are used in vertical lines the flow must be in an upward direction. For the purposes of this standard any line with a slope (upward or downward) of 5° or less is deemed to be horizontal. In the case of angle pattern valves the inlet should be vertical.

2 References

The titles of the British Standards referred to in this standard are listed on the inside back cover.

3 Definitions

nominal size

the nominal size (DN) is a numerical designation of size that is common to all components in a piping system other than those using valves, fittings, couplings or tubes that are designated by the outside diameter. It is a convenient round number for reference purposes and is normally only loosely related to manufacturing dimensions

4 Pressure classification

This standard applies to valves of the following class designations:

Classes 150, 300, 400, 600, 900, 1 500 and 2 500.

The numerals in these class designations represent the primary pressure ratings of the valves in pounds force per square inch.

5 Pressure/temperature ratings

The pressure/temperature ratings applicable to valves covered by this standard shall be in accordance with tables PE 1 to PE 12 as listed in BS 1560-2 for the particular shell material specified. There is, however, a temperature restriction on certain trim materials and soft seal ring (see clause 15 and 20.4).

If valves complying with the requirements of this standard are to be used at service temperatures below – 30 °C, reference should be made to BS 3351. (“Service temperature” refers to the temperature of the fluid in the line at the valve.)

6 Nominal sizes

This standard covers valves of the following nominal sizes.

mm	in	mm	in	mm	in	mm	in
15	(½)	50	(2)	200	(8)	450	(18)
20	(¾)	65	(2½) ^a	250	(10)	500	(20)
25	(1)	80	(3)	300	(12)	600	(24)
32	(1¼) ^a	100	(4)	350	(14)		
40	(1½)	150	(6)	400	(16)		

For each valve class and type, the range of sizes covered by this standard is shown in Table 1.

^a These sizes have been retained only for the purpose of replacing existing valves. Their use for new construction in piping systems using end flanges complying with the requirements of BS 1560-2 should be avoided.

7 Information to be supplied by the purchaser

Certain clauses of this standard permit alternatives. If the purchaser requires features that depart from the requirements of this standard, he shall state the following in his enquiry and purchase order:

- a) type class and nominal size. In the case of piston, ball and disk types [types i), ii) and iv)], state whether vertical, horizontal or angle pattern is required (see clauses 1, 4, 5 and 6).
- b) whether flanged or butt-welding ends are required:
 - 1) if flanged ends are required, state whether welded-on flanges are acceptable (see 8.6) and the type of facing (see 8.7);
 - 2) if butt-welding ends are required, state the pipe schedule number or wall thickness and outside diameter (see 8.8);
- c) whether shell tappings are required and, if so, the location and the type of thread if other than API Standard 5B (see 8.10);
- d) whether a loading spring is required (see clause 13);
- e) whether a locking ring is required for the hinge pin plug (see clause 12);
- f) whether an outside attachment is required; also if a non-slam or damping device is required (see clause 13);
- g) whether soft seals are required and if so, whether these are required to be in disk seats or body seats (see clause 15);
- h) the shell material (see clause 16);
- i) the nominal trim material symbol (see clause 20);
- j) material for cover bolting, if required for operation at process design temperatures below $-30\text{ }^{\circ}\text{C}$ or above $480\text{ }^{\circ}\text{C}$, or for other special operating conditions (see clause 23);
- k) whether any special packing is required for outside lever hinge pin; or the packing design temperature if above $400\text{ }^{\circ}\text{C}$ (see 26.1.2);
- l) special material requirements for valves in highly corrosive services or environment or for low temperature service (see clause 27);
- m) whether any additional markings are required (see clause 34);
- n) if a lower seat test leakage rate is required for metal seated valves (see clause 36);
- o) requirements for special packaging (see clause 39).

Section 2. Design

8 Body

8.1 The body design criteria specified in 8.2 to 8.11 shall be observed.

8.2 The body shall be designed to minimize pressure loss as well as corrosive and erosive effects. The body end port shall be circular.

8.3 In the case of swing type and combined horizontal and vertical ball type valves, the full port area shall be maintained without pockets from the inlet port to the valve seat to avoid turbulence. On the outlet side of the valve seat of swing type valves, the body shall be of such proportions that it allows sufficient swing of the disk to give a flow area at least equivalent to full port area.

8.4 The wall thickness of the body shall conform to the thickness as given in Table 1. Drilling of, or pinning to, the wall of a pressure-containing part, e.g. for nameplate fixing, is not permissible where such drilling or pinning would reduce the effective thickness below the minimum permitted value.

8.5 Face-to-face and centre-to-face dimensions for raised face flange end valves and end-to-end and centre-to-end dimensions for butt-welding end and ring-joint flange and valves shall conform to the dimensions specified in BS 2080.

8.6 End flanges shall be cast or forged integral with the body except that flanges may be attached by welding if so specified in the purchase order. The welds of end flanges attached by butt-welding shall comply with the requirements of BS 3351 and shall have any necessary heat treatment as required by BS 3351 to ensure that they are suitable for service temperatures down to -30°C . Flange attachment by other welding processes shall be the subject of agreement between the manufacturer and the purchaser. All heat treatment after welding on of flanges shall be carried out before machining of the body.

8.7 End flanges shall comply with the requirements of BS 1560-2. End flanges shall be one of the types shown in Figure 1 and Figure 2 of BS 2080:1974. The purchaser shall specify the type of facing required.

Valves generally in accordance with this standard but suitable for use in piping systems with flanges complying with the requirements of BS 4504-1 shall comply with the requirements of Appendix A.

8.8 Butt-welding ends shall conform to the details shown in Figure 6.

For butt-welding end valves the minimum inside diameter of the body end port shall comply with the details given in Figure 6. Pipe schedule number, or pipe wall thickness and outside diameter of the pipe, shall be specified by the purchaser.

When welding butt-welding end valves into piping systems, the welds and any necessary heat treatment shall comply with the requirements of BS 3351.

8.9 For flanged valves the minimum inside diameter of the body end port shall be as specified in Table 1.

8.10 With the exception of ball and angle type valves for vertical/horizontal flow (see Figure 4), valves of sizes 50 mm and above shall have provision for a drain tapping in the body on the bottom centre line. Any other provision for tapping swing or lift pattern check valves shall be as specified by the purchaser and shall comply with Figure 1 as regards location. If the metal thickness of the body is insufficient to provide the effective length of the thread for body tapping, or if the body presents an uneven surface, bosses shall be provided.

Provision should be made for the body tappings below.

Nominal valve size	Pipe tapping size		Minimum diameter of boss
mm	mm	(in)	mm
50 to 100	15	($\frac{1}{2}$)	38
150 and 200	20	($\frac{3}{4}$)	44
250 and 300	25	(1)	54
350 and larger	40	($1\frac{1}{2}$)	70

If tapped holes are required, plugs shall be fitted.

Holes shall not be drilled or tapped unless specified in the purchase order, which should then state the thread required (if other than API Standard 5B) and the location (see Figure 1).

On valves of sizes below 50 mm, provision for tapping shall be as specified by the purchaser and shall comply with Figure 1 as regards location.

8.11 Separate seat rings in the body shall be employed except in the two cases below.

- a) Austenitic steel valves may have integral seats.
- b) Austenitic or hard-facing (body) seat materials may be deposited directly on the valve body; the minimum finished thickness of the deposit shall then be 1.6 mm.

13 % chromium seat material may be directly deposited only on separate steel seat rings; the minimum finished thickness of the deposit shall then be 1.6 mm.

Seat rings may be shoulder seated or bottom seated at the option of the manufacturer and may be screwed in, rolled in, or welded in unless one particular method is specified by the purchaser. Threaded seat rings shall be provided with lugs or slots to facilitate removal. Shoulder-seated rings shall be designed so that any clearance between the back of the ring and the bottom of the ring recess shall not be greater than 1.6 mm for sizes 300 mm (12 in) and smaller, and 3.2 mm for sizes 350 mm (14 in) and larger.

For swing type valves the body seat shall be inclined at an angle of approximately 5° from the vertical to facilitate closing and to prevent chatter.

Tack welding may be employed to prevent loosening (see BS 3351).

The use of a sealing medium on the threads is not permissible.

Table 1 — Dimensions of check valves^a

Nominal size		Inside diameter at flanges (minimum)							Body thickness (minimum) ^c							Ring number for ring joints						
		Class 150	Class 300	Class 400	Class 600	Class 900	Class 1 500	Class 2 500	Class 150	Class 300	Class 400	Class 600	Class 900	Class 1 500	Class 2 500	Class 150	Class 300	Class 400	Class 600	Class 900	Class 1 500	Class 2 500
mm	in	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm							
15	½	15	15	—	15	—	13	13	4.8	4.8	—	6.4	—	9.5	11.1	—	R11	—	R11	—	R12	R13
20	¾	20	20	—	20	—	19	19	4.8	4.8	—	7.9	—	11.1	13.5	—	R13	—	R13	—	R14	R16
25	1	25	25	—	25	—	22	19	6.4	6.4	—	7.9	—	12.7	15.1	R15	R16	—	R16	—	R16	R18
32	1¼ ^b	32	32	—	32	—	29	25	6.4	6.4	—	8.6	—	14.2	17.5	R17	R18	—	R18	—	R18	R21
40	1½	38	38	—	38	—	35	29	6.4	7.9	—	9.3	—	15.0	19.0	R19	R20	—	R20	—	R20	R23
50	2	51	51	—	51	—	48	38	8.7	9.5	—	11.1	—	19.0	22.2	R22	R23	—	R23	—	R24	R26
65	2½ ^b	64	64	—	64	—	57	48	9.5	11.1	—	11.9	—	22.2	25.4	R25	R26	—	R26	—	R27	R28
80	3	76	76	—	76	73	70	57	10.3	11.9	—	12.7	19.0	23.8	30.2	R29	R31 ^d	—	R31 ^d	R31	R35	R32
100	4	102	102	102	102	98	92	73	11.1	12.7	12.7	15.9	21.4	28.6	35.7	R36	R37	R37	R37	R37	R39	R38
150	6	152	152	152	152	146	137	111	11.9	15.9	16.7	19.0	26.2	38.1	48.4	R43	R45	R45	R45	R45	R46	R47
200	8	203	203	203	200	190	178	146	12.7	17.5	19.0	25.4	31.8	47.5	61.9	R48	R49	R49	R49	R49	R50	R51
250	10	254	254	254	248	238	222	184	14.3	19.0	21.4	28.6	36.5	57.2	67.5	R52	R53	R53	R53	R53	R54	R55
300	12	305	305	305	298	283	264	219	15.9	20.6	23.8	31.8	42.1	66.7	86.5	R56	R57	R57	R57	R57	R58	R60
350	14	337	337	333	327	311	289	—	16.7	22.2	27.0	34.9	46.0	69.8	—	R59	R61	R61	R61	R62	R63	—
400	16	387	387	381	375	356	330	—	17.5	23.8	28.6	38.1	52.4	79.4	—	R64	R65	R65	R65	R66	R67	—
450	18	438	432	432	419	400	371	—	18.3	25.4	30.2	41.3	57.2	88.9	—	R68	R69	R69	R69	R70	R71	—
500	20	489	483	479	464	444	416	—	19.0	27.0	33.3	44.4	63.5	98.4	—	R72	R73	R73	R73	R74	R75	—
600	24	591	584	575	559	533	498	—	20.6	30.2	36.5	50.8	73.0	114.3	—	R76	R77	R77	R77	R78	R79	—

^a The range of dimensions for all patterns of check valves is restricted to those covered in BS 2080.

^b These sizes have been retained only for the purpose of replacing existing valves (see clause 6).

^c Minimum body thickness at any point upon inspection.

^d For valves of 80 mm nominal size, if intended for use with lapped flanges, the ring number should be R30.

9 Cover

9.1 For covers the design criteria specified in **9.2** to **9.5** shall be observed.

9.2 The cover thickness shall conform with the requirements given in Table 1.

9.3 The body-to-cover connection shall be male-and-female, tongue-and-groove, or ring-joint type. Where possible all body/cover connections and gaskets shall be of standard dimensions in accordance with BS 1560-2, except for Class 150, which may be flat face.

9.4 The cover flange and mating body flange shall be of circular form, except that for valves of all classes below 80 mm they may be square or rectangular. Flanges shall be spot faced or back faced as specified in BS 1560-2.

9.5 The body-to-cover joint shall have at least four through-bolts of the following minimum size, except that for nominal sizes below 40 mm studs may be used. (See also clause 14.)

Nominal size of valve	Minimum nominal bolt size
mm	in
15 to 50	$\frac{3}{8}$
80 to 200	$\frac{1}{2}$
250 and larger	$\frac{5}{8}$

10 Disk, piston or ball

10.1 Disk (swing or lift type)

10.1.1 The disk shall be of the renewable type with a flat seating face.

10.1.2 Disks may have integral faces or may be fitted with separate facing rings rolled in, directly deposited or welded on. Directly deposited facings shall have a minimum finished thickness of 1.6 mm. In the case of swing type valves the disk shall be secured to the hinge by a nut so as to allow for the self-seating of the disk on the body seat. The nut shall be locked by drilling and pinning.

10.1.3 In the case of lift type valves the disk shall be fitted on, or integral with, the disk spindle so as to guide the disk on to the body seat.

10.1.4 The use of a soft seal ring in the disk seat is dealt with in clause 15.

10.2 Piston. The piston shall be in the form of a cylinder, which may be hollow, the lower end of which is shaped to form a seating disk. The cylindrical part shall fit into a guide so as to make an effective dashpot and for this purpose shall be provided with a bleed hole of proper size near the seating disk. Alternatively, the hole may be provided in the piston guide. The piston and guide shall be of sufficient length to provide effective guidance over the whole length of its travel. The seating face may be weld-deposited, in which case it shall have a minimum finished thickness of 1.6 mm.

10.3 Ball. In horizontal pattern valves the ball shall be constrained in the guide so that a cushioning effect is obtained at the top end of travel.

11 Piston and ball guides

11.1 Piston and horizontal pattern ball type check valves shall be provided with a removable guide to guide the piston or ball throughout its entire travel. If the guide is independent of the cover, the upper part of the guide shall be closed and the guide shall be locked in position between the cover flange of the body and the cover; the top of the guide shall be provided with a UNC tapped hole or other means to facilitate removal. The lower part of the guide, whether integral with or independent of the cover, shall be a hollow cylinder or cage to accommodate the piston or ball, permitting it to travel upwards for a sufficient distance to provide adequate flow under the piston or ball when in the highest position.

11.2 Vertical or horizontal pattern ball type check valves shall be provided with guides that may be integral with the seat, with a grid that limits the travel of the ball but allows adequate flow when the ball is in the fully open position.

12 Hinge and hinge pin (swing type) and spindle support cage (disk type)

12.1 A hinge and hinge pin shall be provided and mounted in the body so as to permit full movement of the disk (see Figure 1).

12.2 A cage shall be provided complete with bearing bush to guide the disk spindle.

12.3 Hinge pin plugs, where fitted, shall be suitably secured to prevent loosening in service.

13 Special fitments

13.1 Outside attachment. If specified in the purchase order and if the design will permit, the hinge pin may be extended through the body of the valve. An outside lever with adjustable weights, damping device, fusible link or locking device etc. to control the movement of the disk may be fitted.

13.2 Loading spring. Consideration should be given to providing a spring to ensure more positive closing of the valve where there is a low differential pressure or when the process fluid is highly viscous.

14 Cover bolting

14.1 The allowable working stress in bolting material for cover flanges at the primary service pressures in clause 4 shall not exceed 62 MPa¹⁾, assuming that the pressure acts upon an area circumscribed by the outside periphery of the gasket or, for a ring joint, that the pressure acts through the pitch circle of the ring joint.

14.2 Cover flange bolting shall be by stud bolts with a nut at each end of each stud bolt. Stud bolts and nuts shall comply with the requirements of sections 1 and 3 of BS 4882:1973.

14.3 For valves of 40 mm nominal size and below, studs in accordance with BS 2693-1 may be used.

15 Soft seal ring

15.1 A soft seal ring may be fitted in either the body seat or the disk seat as specified by the purchaser. The ring shall be designed to give a full metal-to-metal seal if the soft seal is inoperative or removed.

15.2 The seal ring shall be designed to withstand a minimum of 2 000 cycles of operation in dry atmospheric conditions, there shall be no evidence of damage or cold flow, as revealed by spreading over the metal seat, and the valve shall meet the hydrostatic and air tests specified in BS 5146.

15.3 The effective operating temperature range of soft seal valves will be limited by the service temperature of the seal material.

Section 3. Materials

16 Shell

The body and cover shall be of the material specified in the purchase order, the selection being made from those listed in BS 1560-2, except that flat covers may be made from plate complying with the requirements of BS 1501 and having the same nominal composition as the body. The shell of butt-welding end valves of carbon and carbon-molybdenum steels shall have the carbon content restricted as follows:

- a) 0.25 % maximum for carbon or carbon-molybdenum steels;
- b) 0.15 % maximum for 5 % Cr ½ % Mo steel.

17 Body seat ring

A body seat ring made of a material different from its seating surface shall not be inferior to the shell material.

18 Body/cover gasket and pipe plug gasket

These shall be metallic spiral wound as specified in BS 3381, or alternatively steel or soft iron, or, for Class 150 valves only, compressed asbestos fibre as specified in BS 1832. They shall be suitable for the pressure/temperature rating of the valve. Any metallic part of the gasket shall have at least the same corrosion resistance as that of the shell.

NOTE Free chlorides in compressed asbestos fibre materials, when used with low alloy or austenitic stainless steels, may cause stress corrosion cracking in the flange. The use of alternative gasket materials should be considered.

¹⁾ 1MPa = 1 N/mm²

19 Disk, piston or ball

19.1 A disk, piston or ball made of material different from its seating surface shall be of material not inferior to that of the shell.

19.2 In swing type valves disk-retaining components such as studs, nuts, washers or pins shall be of material not inferior to that of the nominal trim.

19.3 Grid plates, disk guides in piston type valves, and ball guides in ball type valves shall be of material not inferior to that of the nominal trim.

20 Trim

20.1 Trim comprises the following:

- a) body seat surface;
- b) disk or piston or ball seat surface;
- c) hinge pin (swing type only);
- d) disk spindle and bushes (disk type only).

20.2 The trim material shall be selected from among those listed in Table 2 under nominal trim symbols.

20.3 If a combination trim, e.g. CR13 and Cu-Ni, is specified, either material may be used for the body seat surface. The other material of the combination shall be used for the disk seat surface.

20.4 The temperature limitations of certain trim materials may restrict the pressure/temperature ratings of the valve to which they are fitted.

20.5 The hinge pin shall be of wrought material.

21 Hinge (swing type) and spindle support cage (disk type)

21.1 In the case of swing type valves any hinge and, where provided, a bearing bracket shall be of material at least equal to that of the shell. Any studs, nuts, washers, pins etc. used to retain the bearing bracket shall be of material at least equal to that of the nominal trim material.

21.2 In the case of disk type valves, the spindle support cage shall be of a material at least equal to that of the shell.

22 Plug

Material for plugs for hinge pins (see clause 12) and any plugs for body tapping, including any locking device that may be fitted (see 8.10), shall be of a material at least equal to that of the body.

23 Cover bolting

Cover bolts shall comply with the requirements of BS 1506-621 grade A (BS 4882:1973, section 3, grade B7) and nuts shall comply with the requirements of BS 1506-162 (BS 4882:1973, section 3, grade 2H) unless other bolting material is specified in the order.

24 Nameplate

24.1 For valves of nominal size 150 mm and larger, the nameplate shall be of 18-8 Cr-Ni steel or nickel alloy and shall be attached to the valve by pins of similar material or by welding.

24.2 For smaller valves the nameplate material and attachment shall be of corrosion resistant material in accordance with manufacturer's standard. Brass and aluminium are acceptable.

25 Soft seal ring

Soft seals shall be of the manufacturer's standard material for the duties specified. Any retaining ring in the disk shall be of the same material as the disk, but any fixing screws shall be of 18-8 Cr-Ni steel.

26 Special fitments

26.1 Outside attachment. The following materials shall be used.

26.1.1 Stuffing box. Material shall be at least equal to that of the shell.

26.1.2 Packing for outside lever hinge pin. The packing shall be of braided asbestos containing a suitable corrosion inhibitor. Unless the purchase order specifies other packing or a higher packing design temperature, it shall be suitable for use with steam or petroleum fluid at a minimum packing design temperature of 400 °C.

26.2 Loading spring. This shall be of a material not inferior to that of the nominal trim.

27 Special applications

When valves are specified for highly corrosive services or environment or for low temperature service, the material specification for all parts shall be subject to agreement between the purchaser and the manufacturer.

Table 2 — Trim materials, hardness and acceptable specifications

Nominal trim symbol	Material type			Minimum Brinell hardness ^b	Acceptable material specification						
	Seat surfaces	Hinge pin and disk spindle and bushes	Upper temperature limitation ^a °C		Seat surfaces	Cast ^d		Forged		Bar	
						BS	ASTM	BS	ASTM	BS	ASTM
CR13	13Cr.	13Cr.	600	250 ^c	1504-713	A351-CA15	1503-410521	A182-F6	1506-713	A276-410	
18-8 Ti	18-8 Cr. Ni. Ti.	18-8 Cr.Ni. Ti.	800	Manufacturer's standard	1504-821 Ti	—	1503-321S40 1503-321S50	A182-F321	1506-821 Ti	A276-321	
18-8 Nb	18-8 Cr. Ni. Nb.	18-8 Cr. Ni. Nb.	800	Manufacturer's standard	1504-821 Nb	A351-CF8C	1503-347S40 1503-347S50	A182-F347	1506-821 Nb	A276-347	
18-10-2	18-10-2 Cr. Ni. Mo.	18-10-2 Cr. Ni. Mo.	800	Manufacturer's standard	1504-845B	A351-CF8M	1503-316S41	A182-F316	1506-845	A276-316	
18-12-3	18-12-3 Cr. Ni. Mo.	18-12-3 Cr. Ni. Mo	800	Manufacturer's standard	1504-846	—	1503-316S41	—	—	A276-317	
25-20	25-20 Cr. Ni.	25-20 Cr. Ni.	900	Manufacturer's standard	—	—	—	A182-F310	—	—	
HF	66-26-5 Co. Cr. W.	—	650	350	—	—	—	—	—	—	
		13 Cr.	600	—	1504-713	A351-CA15	1503-713	A182-F6	1506-713	A276-410	
CR13	13 Cr.	13 Cr.	600	250	1504-713	A351-CA15	1503-713	A182-F6	1506-713	A276-410	
Cu. Ni.	Cu. Ni.	—	370	175	Manufacturer's standard with 30 % nickel minimum						
CR13	13 Cr.	13 Cr.	600	300	1504-713	A351-CA15	1503-713	A182-F6	1506-713	A276-410	
HF	66-26-5 Co. Cr. W.	—	650	350	—	—	—	—	—	—	
Ni. Cu.	Ni. Cu. alloy	Ni. Cu. alloy	200	Manufacturer's standard	3071-NA1	—	—	—	3076-NA13	—	
AB	Aluminium bronze	Aluminium bronze	300	Manufacturer's standard	1400-AB1 AB2	B148-952A 935D	2872-CA103 CA104	B124-642 630	2874-CA103 CA104	B150-642 630	
B	Bronze	—	290	Manufacturer's standard	1400-G1 LG2	B584-905 836	—	—	—	—	
	—	Manganese bronze	230	Manufacturer's standard	1400 HT B1	B584-864 865	2872-CZ114	B138-675	2874-CZ114	B138-675	

^a These are conservative figures for general guidance only, but all the trim materials listed are suitable for service down to – 30 °C (see clause 5).

^b See BS 240-1.

^c In ball type valves the hardness of the ball shall be 320 HB min. and there shall be a difference of not less than 50 HB between the ball and the body seat surface.

^d Not acceptable for hinge pin material (see 20.5).

Section 4. Marking

28 Required markings

Every valve complying with the requirements of this standard shall be clearly marked in accordance with clauses 29 to 34 and shall have a nameplate securely fastened to it.

29 Body and nameplate markings

Body and nameplate markings shall be as follows:

- a) nominal size designation, the numerals denoting the nominal size prefixed by the letters DN, e.g. DN 150 (see clause 6);
- b) class rating, the numerals denoting the class rating (see clause 4);
- c) body material identification, standard symbol from BS 560-2;
- d) manufacturer's name or trade mark;
- e) the number of this British Standard, i.e. BS 1868.

30 Cover marking

Cover markings shall be as follows:

- a) cover material identification, that being the standard symbol from BS 1560-2 or BS 1501;
- b) melt identification, required on all pressure-containing steel castings or forgings.

31 Body marking

31.1 Melt identification. Melt identification is required on all pressure-containing steel castings and forgings.

31.2 Ring joint number. Pipe end flanges and body/cover flanges grooved for ring joints and the rings to be used with them shall be marked with the corresponding ring number, e.g. R25. This identification shall be placed on the rim of both pipe end flanges, or the cover end flange of the body, as applicable, and on the outside periphery of the ring. In the case of non-standard ring joints the flange and ring shall be marked R SpL.

For ring numbers see Table 1.

32 Direction of flow

An arrow indicating the direction of flow shall be cast or embossed on the body of each valve.

33 Nameplate marking

33.1 Pressure/temperature restrictions. Any pressure or temperature restrictions within the appropriate ratings given in BS 1560-2 that may be imposed by the manufacturer due to limitations on materials or design shall be shown on the nameplate.

Such special limiting pressure /temperature ratings shall also comply with the appropriate rating tables in BS 1560-2.

33.2 Valve trim identification. Trim materials shall be indicated in the following order using the appropriate symbol from Table 2.

- a) Disk, piston or ball b) Seat
- as in the examples below:

<u>DISK</u> CR13		<u>CR13</u>
	or	<u>CR13</u> <u>CR13</u> or
<u>SEAT</u> CR13		<u>CR13</u>

33.3 Identification number. The manufacturer's figure or number identifying the valve in all respects shall be shown. The same figure or number shall therefore be used only for valves that are identical in design, detail, dimensions and material and that have interchangeable parts.

34 Additional markings

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 standard.

35 Omission of markings

35.1 If the size or shape of the valve body precludes the inclusion of all the required markings, they may be omitted from the body only as found necessary subject to the approval of the purchaser. The sequence of omission shall be

- a) nominal size;
- b) manufacturer's name or trademark;
- c) class rating.

35.2 The number of this British Standard may be omitted from the body or from the nameplate (but not from both) at the manufacturer's option.

| Section 5. Testing

36 Production pressure testing

All valves shall be pressure tested by the manufacturer before despatch in accordance with BS 6755-1, as follows:

- a) hydrostatic shell test;
- b) hydrostatic seat test;
- c) hydrostatic seat test at 25 % of the seat test pressure required for test b).

The test durations shall be as given in Table 2(a).

Seat test leakage rate C shall apply for metal seated valves and rate A for soft-seated valves.

NOTE If a lower seat test leakage rate is required for metal seated valves this should be specified by the purchaser in the enquiry or purchase order.

Table 2(a) — Test durations

Nominal valve size DN	Minimum test duration	
	Shell test	Seat test
	S	S
Up to and including DN 50	15	15
DN 65 up to and including DN 150	60	60
DN 200 up to and including DN 300	120	120
DN 350 and larger	300	120

Section 6. Shipping

37 Preliminary

After inspection and before preparation for despatch, all valves shall be thoroughly cleaned and dried. When swing pattern check valves are supplied with outside attachments, these parts shall normally be detached and packed separately.

38 Preparation for despatch

38.1 Coatings. Coating of valves shall be as follows.

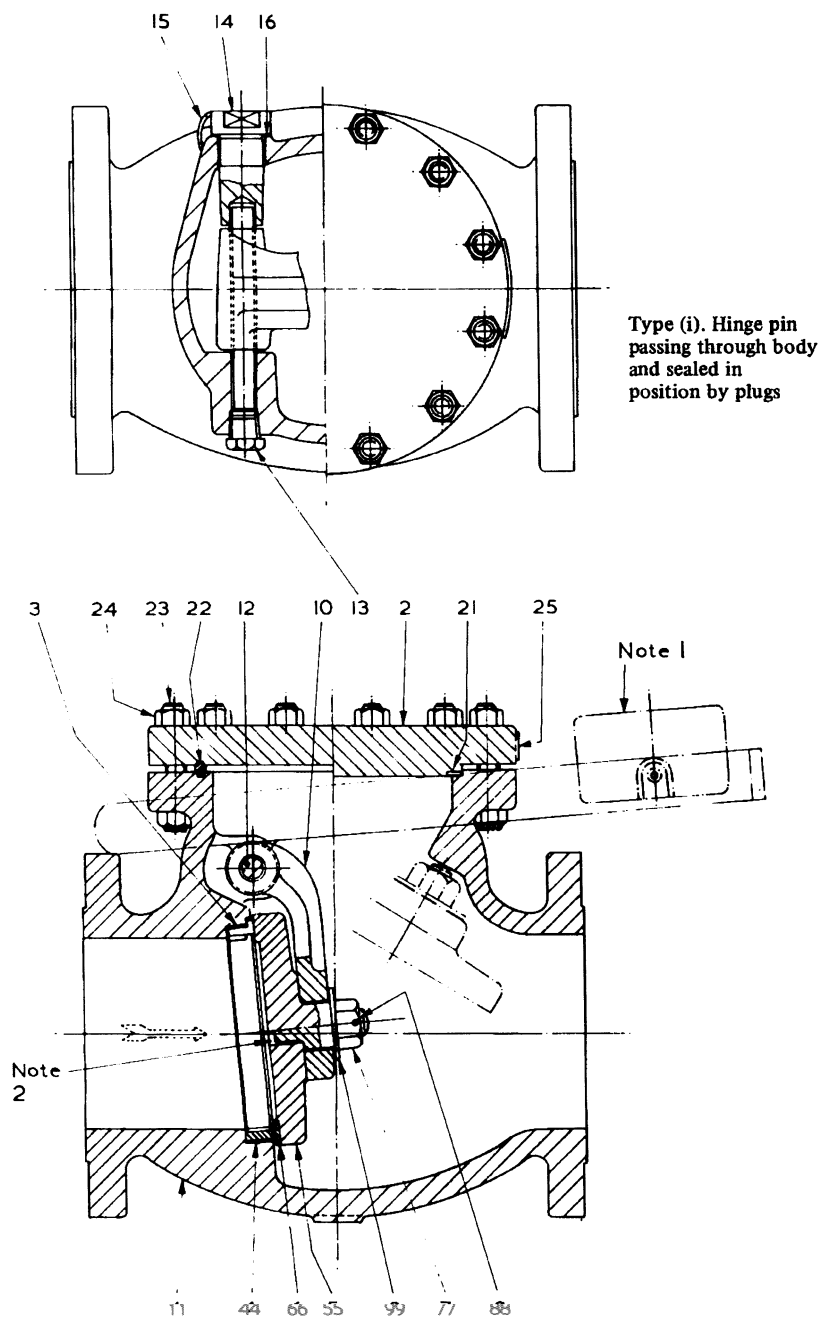
- a) Unmachined external surfaces of the valves shall be painted in aluminium finish paint except for austenitic steel valves, which shall not be painted.

- b) Machine or threaded surfaces, except for austenitic steel components, shall be coated with an easily removable rust preventative complying with the requirements of BS 1133-6.

38.2 End protection. After complying with the requirements of **38.1**, body end ports, flange faces and butt-welding ends shall be covered with suitable close-fitting protectors to protect the machined ends and prevent the ingress of dirt and moisture.

39 Packaging

Valves shall be so packaged as to minimize the possibility of damage during storage or transit. If special packaging is necessary, the purchaser shall specify his requirements.

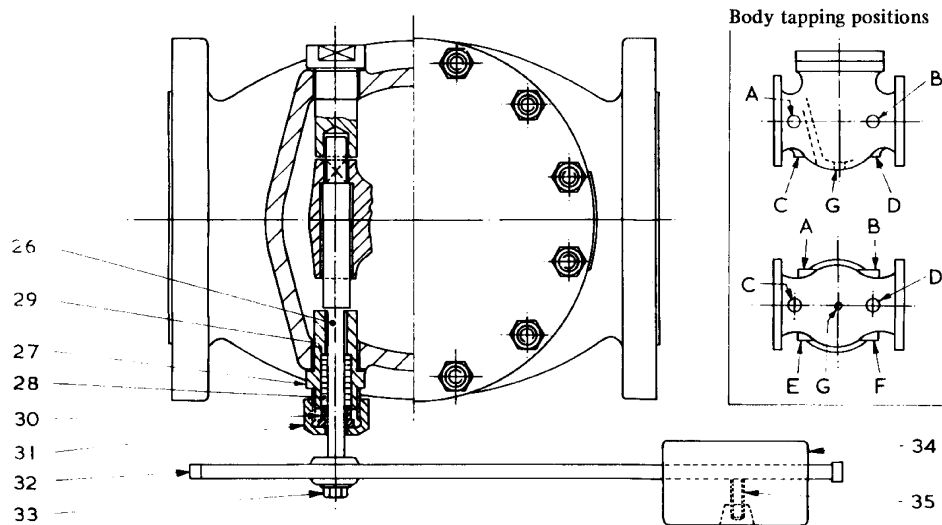


NOTE 1 Chain dotted lines show outside lever and weight to assist disk in closing.

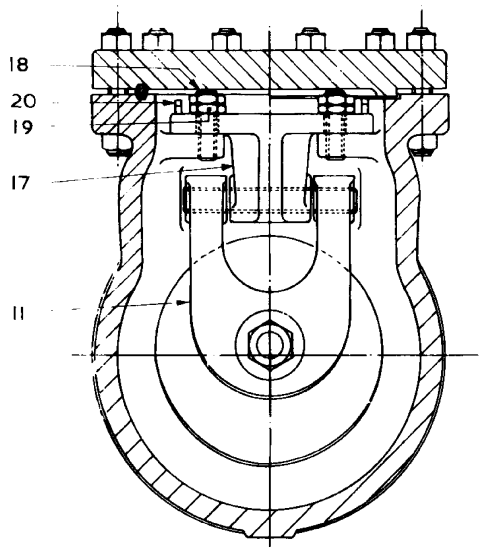
NOTE 2 Seal weld.

NOTE 3 These sketches are composite for the purpose of showing some typical variations in individual details. A product utilizing any combination of these details (except when such combination may be specifically prohibited in the text) or similar construction will be acceptable provided that it complies with the requirements of this standard in all other respects.

Figure 1 — Swing type check valves

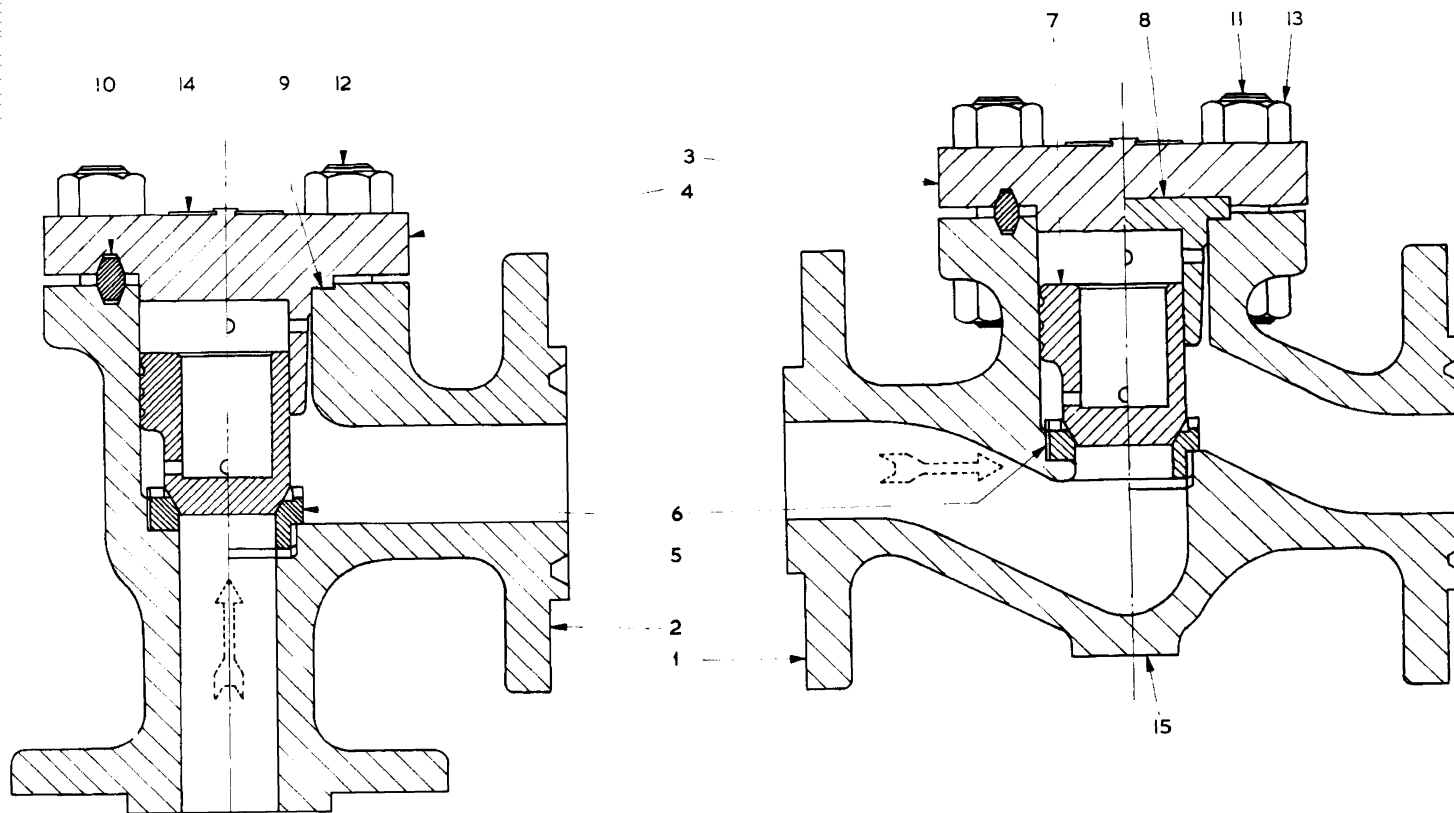


Typical design of outside lever and weight attachment



Type (ii). Hinge attached to internal body lugs

Ref.	Name of part	Material ref. clause	
1	Body	16	
2	Cover	16	
3	Shoulder seated ring	17	
4	Bottom seated ring	17	
5	Disk	19.1 & 20	
6	Disk facing ring	20	
7	Disk-retaining nut	19.2	
8	Pin for disk-retaining nut	19.2	
9	Disk washer	19.2	
10	Hinge (type (i))	21	
11	Hinge (type (ii))	21	
12	Hinge pin	20	
13	Pipe plug (taper threaded) for hinge pin (type (i) only)	22	
14	Hinge pin plug (parallel threaded) (type (i) only)	22	
15	Locking device for hinge pin	22	
16	Gasket for pipe plug (parallel threaded)	22	
17	Bearing bracket (type (ii) only)	21	
18	Stud for bracket (type (ii) only)	21	
19	Lock nuts for bracket (type (ii) only)	21	
20	Dowel pin for bracket (type (ii) only)	21	
21	Cover gasket	18	
22	Ring joint	18	
23	Stud bolts	23	
24	Nuts for stud bolts	21	
25	Nameplate	24	
26	Extended hinge pin	25	
27	Stuffing box	For outside attachment valves only	26.1.1
28	Packing		26.1.2
29	Packing washer		26
30	Gland		26
31	Gland nut		26
32	Lever		26.1
33	Lever retaining pin		26
34	Weight		26
35	Setscrew		26



Angle pattern

Horizontal pattern

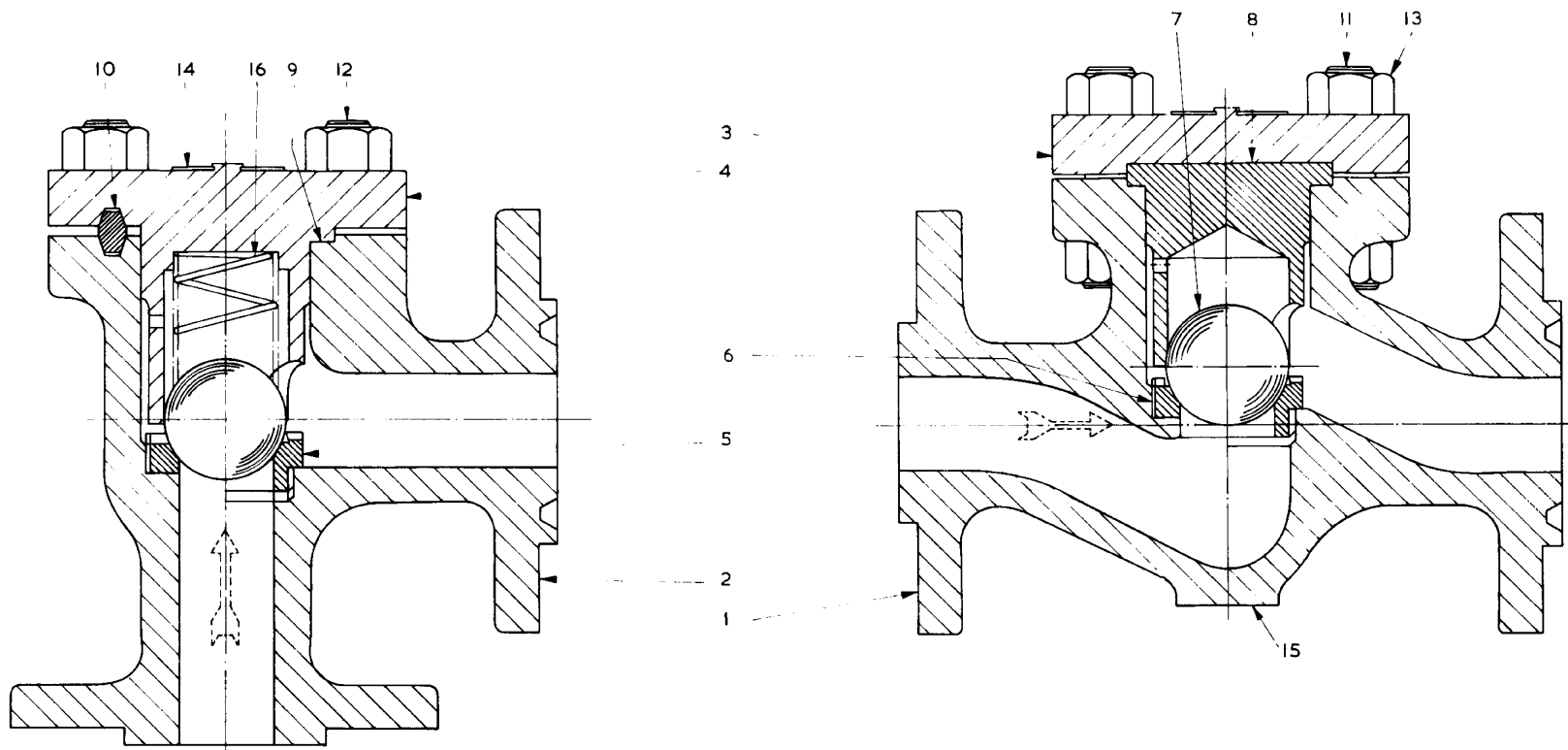
Ref.	Name of part	Material ref. clause
1	Body, horizontal pattern	16
2	Body, angle pattern	16
3	Cover	16
4	Cover with disk guide	16
5	Shoulder seated ring	17 & 20

Ref.	Name of part	Material ref. clause
6	Bottom seated ring	17 & 20
7	Disk	19.1 & 20
8	Disk guide	19.3
9	Cover gasket	18
10	Ring joint	18

Ref.	Name of part	Material ref. clause
11	Stud bolts	21
12	Driven-in studs	21
13	Nuts for stud bolts or driven-in studs	23
14	Nameplate	24
15	Body drain boss	16

NOTE These sketches are composite for the purpose of showing some typical variations in individual details. A product utilizing any combination of these details (except when such combination may be specifically prohibited in the text) or similar construction will be acceptable provided that it complies with the requirements of this standard in all other respects.

Figure 2 — Piston type check valves



Angle pattern

Horizontal pattern

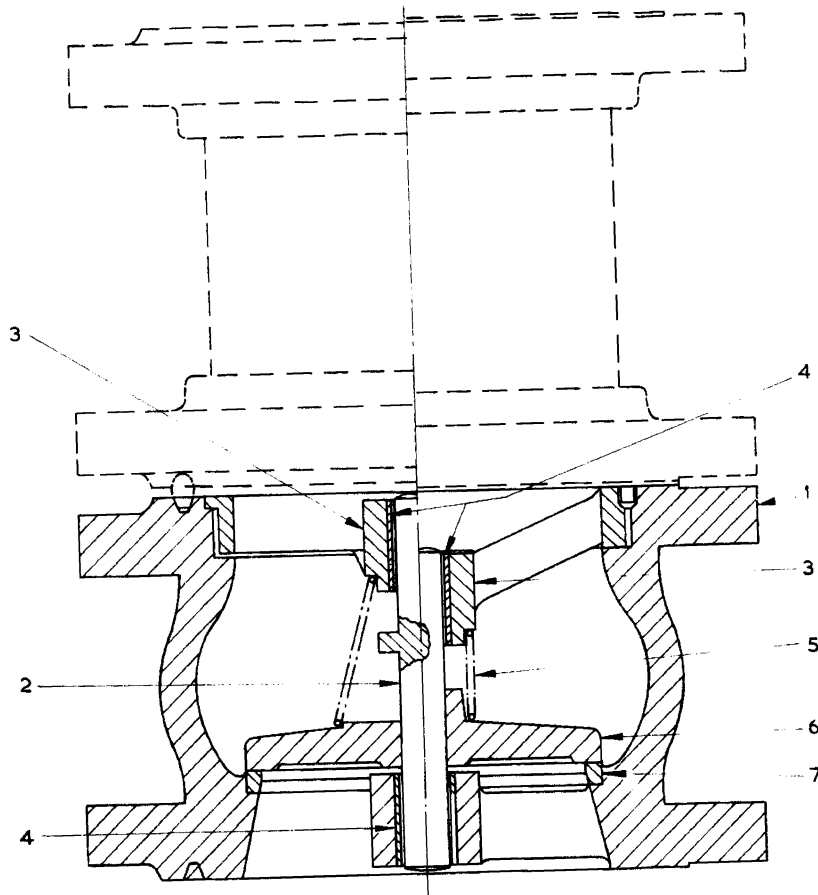
Ref.	Name of part	Material ref. clause
1	Body, horizontal pattern	16
2	Body, angle pattern	16
3	Cover	16
4	Cover with disk guide	16
5	Shoulder seated ring	17 & 20

Ref.	Name of part	Material ref. clause
6	Bottom seated ring	17 & 20
7	Ball	19.1 & 20
8	Ball guide	19.3
9	Cover gasket	18
10	Ring joint	18

Ref.	Name of part	Material ref. clause
11	Stud bolts	23
12	Driven-in studs	21
13	Nuts for stud bolts or driven-in studs	23
14	Nameplate	24
15	Body drain boss	16
16	Loading spring	25

NOTE These sketches are composite for the purpose of showing some typical variations in individual details. A product utilizing any combination of these (except when such combination may be specifically prohibited in the text) or similar construction will be acceptable provided that it complies with the requirements of this standard in all other respects.

Figure 3 — Ball type check valves



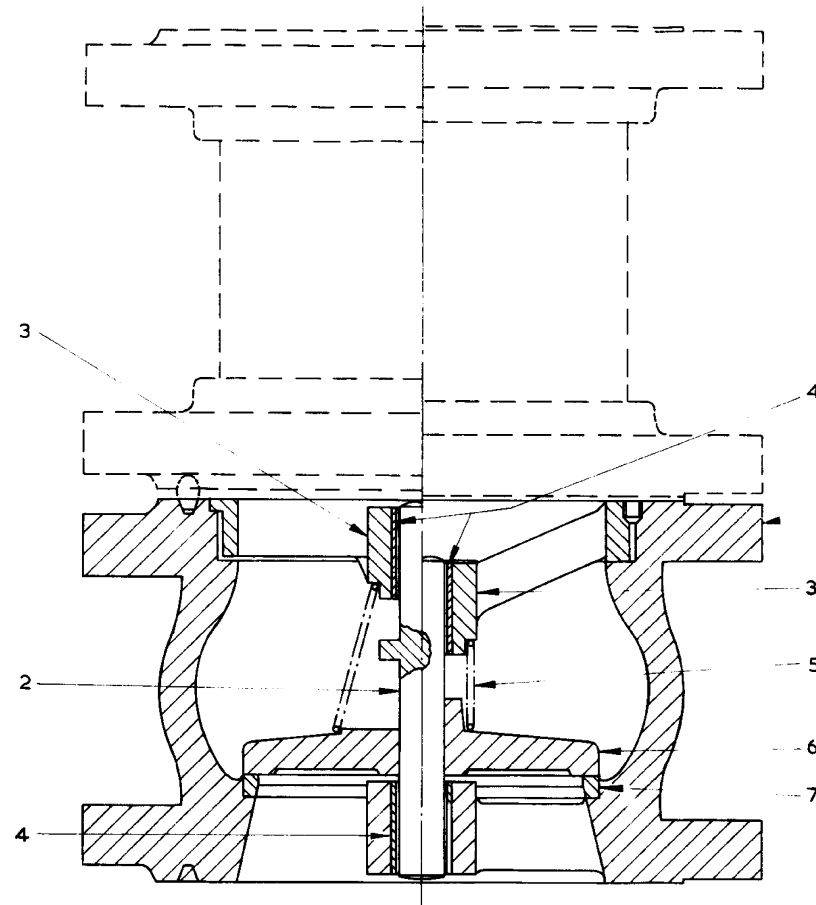
Vertical pattern

Ref.	Name of part	Material ref. clause
1	Body	16
2	Disk spindle	20
3	Spindle support cage	21
4	Spindle guide bush	20
5	Loading spring	25.2
6	Disk	19 & 20
7	Seat ring	17

NOTE This sketch is composite for the purpose of showing some typical variations in individual details. A product utilizing any combination of these details (except when such combination may be specifically prohibited in the text) or similar construction will be acceptable provided it complies with the requirements of this standard in all other respects.

Figure 4 — Ball type check valve

Ref.	Name of part	Material ref. clause
1	Body	16
2	Disk spindle	20
3	Spindle support cage	21
4	Spindle guide bush	20
5	Loading spring	25.2
6	Disk	19 & 20
7	Seat ring	17

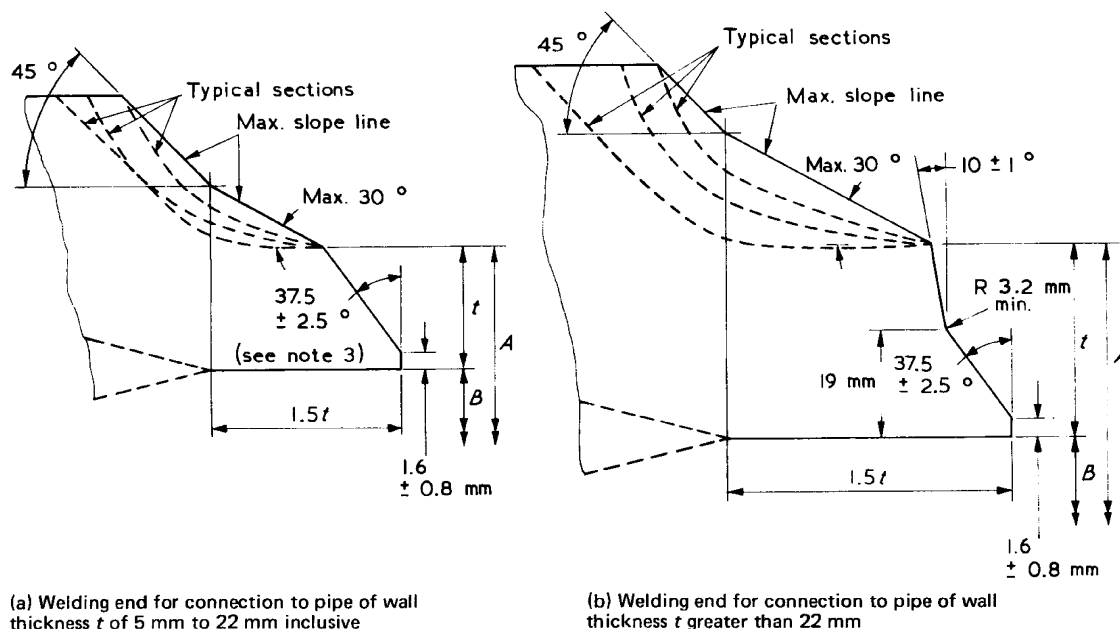


Vertical pattern

NOTE The face-to-face dimensions of disk check valves are considerably less than those given in BS 2080 for lift type check valves. When the standard dimension required, then these valves should be fitted with a spool piece as indicated.

These sketches are composite for the purpose of showing some typical variations in individual details and part names. A product utilizing any combination of these details (except when such combination may be specifically prohibited in the text) or similar construction will be acceptable provided that it complies with the requirements of this standard in all other respects.

Figure 5 — Disk type check valves



A = nominal outside diameter of welding end (see table below)

B = nominal inside diameter of pipe (for tolerance on B , see table below)

t = nominal wall thickness of pipe

NOTE 1 The inside and outside surfaces of valve welding ends shall be machine finished overall. Welding-end bores shall be machined parallel for a distance of $1.5t$ and then run out as shown in figures without abrupt change of section. The outsides of welding ends may be run out in any manner indicated in the figures, provided that sharp angles and abrupt changes of slopes are avoided.

NOTE 2 For outside diameters and wall thicknesses of standard steel pipes see BS 1600-2.

NOTE 3 For valves required to connect with pipe of less than 4.8 mm wall thickness, the angle $37.5 \pm 2.5^\circ$ shall not apply and welding ends shall be finished to a slight chamfer or be square, at the option of the manufacturer.

NOTE 4 Regardless of tolerances specified for dimensions A and B , the thickness of the welding end shall never be less than 87.5 % of the nominal thickness of the pipe.

NOTE 5 For end-to-end dimensions of butt-welding end valves see BS 2080.

Valve nominal size	mm	15	20	25	32	40	50	65	80	100	150	200	250	300	350	400	450	500	600
	(in)	(½)	(¾)	(1)	(1¼)	(1½)	(2)	(2½)	(3)	(4)	(6)	(8)	(10)	(12)	(14)	(16)	(18)	(20)	(24)
A (mm)		23	28	35	44	50	62	75 ^a	91	117	172	223	278	329	362	413	464	516	619
Tolerance on A (mm)		+ 0 - 0.8																	
Tolerance on B (mm)		± 0.8													± 1.6		+ 3.2 - 1.6		

^a A shall be 78 mm when used with BS 3600 steel pipe.

Figure 6 — Butt-welding ends

Appendix A Application to piping systems with BS 4504-1 flanges

A.1 General. Valves complying with the requirements of BS 1868 may be supplied for use in piping systems with BS 4504-1 flanges when specified by the purchaser. When this is the case all the requirements of BS 1868 apply with the following qualifications.

A.2 Pressure/temperature ratings. The pressure/temperature ratings of valves with BS 4504-1 flanges shall be in accordance with BS 4504-1, Table 3. Pressure/temperature ratings for valves in materials other than those listed in BS 4504-1, Table 3, shall be as agreed between the purchaser and the manufacturer.

A.3 Nominal pressure and class ratings and nominal size range. Valves complying with the requirements of this appendix, with flanges of the nominal pressure ratings given in column 1 of Table 3, shall have the same face-to-face dimensions as valves with BS 1560-2 flanges of the corresponding class ratings in column 2. Column 3 gives the applicable nominal size range.

Table 3 — Nominal pressure and class ratings and nominal size range

Rating		Nominal size range	
PN	Class		
		mm	in
10	150	50 to 600	(2 to 24)
16	150	50 to 600	(2 to 24)
25	300	25 to 600	(1 to 24)
40	300	25 to 600	(1 to 24)
64	600	25 to 600	(1 to 24)
100	600	25 to 600	(1 to 24)
160	900	25 to 300	(1 to 12)
250	1 500	25 to 300	(1 to 12)
320	2 500	25 to 250	(1 to 10)
400	2 500	25 to 200	(1 to 8)

A.4 Body end flanges

A.4.1 Dimensions. Body end flange dimensions shall comply with the requirements of BS 4504-1 except that flange thicknesses may be the appropriate values from BS 1560-2. Flange thicknesses shall be not less than those specified in BS 4504-1. When flange thicknesses comply with the requirements of BS 4504-1, the neck dimensions shall also comply with the requirements of BS 4504-1.

A.4.2 Spot facing or back facing. The requirements of BS 1560-2 for spot facing or back facing shall be complied with.

A.4.3 Finish of joint surface. The joint surface finish shall comply with the requirements of BS 4504-1.

A.5 Inspection and testing. Text deleted.

Table 4 deleted.

A.6 Marking. When supplied for use in piping systems with BS 4504-1 flanges, valves shall be permanently marked with the appropriate nominal pressure rating (i.e. PN). This marking may replace or supplement the requirements of 29 b) of BS 1868. The supplementary marking shall appear on the rims of both body end flanges.

A.7 Information to be supplied by the purchaser. This shall be as listed in clause 7 of BS 1868 except that a) shall be replaced by the following:

- a) Type class and nominal size
 - 1) valves are to comply with the requirements of Appendix A of this standard;
 - 2) nominal pressure rating and nominal size.

Publications referred to

This standard makes reference to the following British Standards:

BS 1133, *Packaging code.*

BS 1133-6, *Temporary protection of metal surfaces against corrosion (during transport and storage).*

BS 1400, *Copper alloy ingots and copper and copper alloy castings.*

BS 1501-6, *Steels for use in the chemical, petroleum and allied industries.*

BS 1503, *Steels for fired and unfired pressure vessels. Forgings.*

BS 1560, *Steel pipe flanges and flanged fittings (nominal sizes ½ in to 24 in) for the petroleum industry.*

BS 1560-2, *Metric dimensions.*

BS 1600, *Dimensions of steel pipe for the petroleum industry.*

BS 1600-2, *Metric units.*

BS 1832, *Oil resistant compressed asbestos fibre jointing.*

BS 2080, *Specification for face-to-face, centre-to-centre, end-to-end and centre-to-end dimensions of flanged and butt-welding end steel valves for the petroleum, petrochemical and allied industries.*

BS 2872, *Copper and copper alloys. Forging stock and forgings.*

BS 2874, *Copper and copper alloys. Rods and sections (other than forging stock).*

BS 3071, *Nickel-copper alloy castings.*

BS 3076, *Nickel and nickel alloys. Rods.*

BS 3351, *Piping systems for petroleum refineries and petrochemical plants.*

BS 4504, *Flanges and bolting for pipes, valves and fittings. Metric series.*

BS 4504-1, *Ferrous.*

BS 4882, *Bolting for flanges and pressure containing purposes.*

BS 6755, *Testing of valves.*

BS 6755-1, *Specification for production pressure testing requirements.*

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

If permission is granted, the terms may include royalty payments or a licensing agreement. Details and advice can be obtained from the Copyright Manager. Tel: 020 8996 7070.

BSI
389 Chiswick High Road
London
W4 4AL