BS 5353:1989

Specification for

Steel plug valves

UDC 621.646.614:669.1:001.4:620.1

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Piping Systems Components Standards Committee (PSE/-) to Technical Committee PSE/7, upon which the following bodies were represented:

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 Shipbuilders
British Valve and Actuator Manufacturers' Association Ltd.
Chartered Institution of Building Services Engineers
Copper Development Association
Copper Tube Fittings Manufacturers' Association
Department of the Environment (Property Services Agency)
Electricity Supply Industry in England and Wales
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Engineering Equipment and Materials Users' Association
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Institution of Chemical Engineers
Institution of Gas Engineers
Institution of Mechanical Engineers
Institution of Water and Environmental Management (IWEM)
Society of British Gas Industries
Steel Casting Research and Trade Association
Water Authorities Association
Water Companies Association

The following body was also represented in the drafting of the standard, through subcommittees and panels:

Scottish Council Development and Industry

This British Standard, having been prepared under the direction of the Piping Systems Components Standards Committee, was published under the authority of the Board of BSI and comes into effect on 28 February 1989

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Contents

Foreword

This revision of this British Standard has been prepared under the direction of the Piping Systems Components Standards Committee and supersedes BS 5353:1980 which is withdrawn.

The opportunity has been taken in carrying out this revision to introduce internationally agreed pressure/temperature ratings, based on the definition of nominal pressure (PN) given in International Organization for Standardization (ISO) standard 7268, covering ratings previously given in German (DIN) and American (ANSI) standards. However, in this revision the use of PN has been limited to valves with flanges designated PN 10, PN 16, PN 25 and PN 40 in accordance with BS 4504-3.1. For valves with flanges complying with BS 1560-3.1, Class ratings have been retained.

The designation Class 800 for threaded and socket weld end valves has also been retained as there is no equivalent in the PN system.

This revision also takes account of the latest agreements in ISO/TC 153/SC 1, Valves — Design, construction, marking and testing, and ISO/TC 5/SC 10, Metallic flanges and their joints. On this basis the terminology and definitions in this standard are in accordance with those given in ISO standards and the minimum bore dimensions conform to those agreed in ISO/TC 153/SC 1. However at the time of publication of this British Standard no corresponding international standard exists.

The main differences between this British Standard and the 1980 edition are as follows.

a) Class 400 valves have been omitted.

b) The range of sizes for PN designated valves has been extended to nominal sizes up to and including DN 600.

c) Details of socket-weld end dimensions are included.

d) A greater choice of materials is available for the pressure containing shell and some additional requirements are given for trim component materials.

e) Details of anti-static testing are included and reference is made to BS 6755-1 for production pressure testing. Pressure test durations have changed.

f) Requirements for fire type-testing are included. In clause **12** reference is made to both BS 5146-1 and BS 6755-2 for fire testing. It is intended that BS 5146-1 will be withdrawn on 31 July 1990 and thereafter clause **12** will be amended to require fire testing in accordance with BS 6755-2 only.

The minimum pressure/temperature seat ratings given in this standard for soft seated valves are based on the use of PTFE without fillers, of virgin material completely free of reclaimed processed material for the valve seats, but attention is drawn to the use of alternative seat materials that could give higher pressure/temperature ratings.

Pressure/temperature ratings of the soft seated valve are dependent on both the body rating and the pressure capability of the seats. Seat pressure capability will be limited by the strength of the seat material, particularly by the loss of strength which may occur at elevated temperatures. The applicable valve pressure rating at any temperature will, therefore, be limited by either the body rating or the seat rating.

Throughout this British Standard those dimensions shown in parentheses are non-preferred. The non-preferred sizes are given for replacement of existing valves; they are not recommended for new pipework systems.

Attention is drawn to BS 5158, which specifies cast iron valves for less arduous duties than valves covered by this standard and to BS 6683 for guidance on the installation of valves.

Product certification. Users of this British Standard are advised to consider the desirability of third party certification of product conformity with this British Standard based on testing and continuing surveillance which may be coupled with assessment of a supplier's quality systems against the appropriate Part of BS 5750.

Enquiries as to the availability of third party certification schemes will be forwarded by BSI to the Association of Certification bodies. If a third party certification scheme does not already exist, users should consider approaching an appropriate body from the list of Association members.

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.

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Section 1. General

1 Scope

This British Standard specifies requirements for the valve seat and body pressure/temperature ratings and the design, including materials, dimensions, operation, performance, testing and marking of lubricated, and soft seated and lined plug valves having a steel shell with specified shell wall thickness. This standard also specifies anti-static requirements, an optional fire tested design and the option of a steel or cast iron plug.

It applies to short, regular or venturi pattern valves. The range of valves covered by this standard are given in Table 1 (see also clause **4**).

Pressure/temperature ratings of the linings of lined valves and flange attachment methods, other than those specified in **8.4**, are outside the scope of this standard.

NOTE 1 The information to be supplied by the purchaser at the time of the enquiry/order is given in Appendix A.
Appendix B shows typical weld-end preparations. Examples of typical plug valve constructions are contained in Appendix C.
NOTE 2 The titles of the publications referred to in this standard are listed on page 20.

2 Definitions

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

2.1
face-to-face dimension

for flanged valves, the distance between the extremities of the flange faces

2.2
end-to-end dimension

for butt-weld end valves, the distance between the extremities of the connecting ends

2.3
anti-static design

a feature that may be inherent or incorporated in the design of the valve that ensures electrical continuity between the plug, stem and the body of the valve

2.4
fire type-tested design

a design that is capable of complying with BS 6755-2

2.5
anti-blow-out stem

a design that ensures the valve stems cannot be blown out of the body in the event of the stem seal retainer, e.g. gland, being removed while the valve is under pressure

2.6
nominal size (DN)

a numerical designation of size which is common to all components in a piping system other than those components designated by outside diameter 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.
NOTE 2 This definition is identical with that given in ISO 6708.

2.7
nominal pipe size (NPS)

a designation of size in inches which is common to all components in a piping system other than those components designated by outside diameter. It is a convenient number for reference purposes and it is normally only loosely related to manufacturing dimensions

NOTE 1 Nominal pipe size is designated by the letters NPS followed by a number.
NOTE 2 NPS is used only in association with the "Class" rating system.

2.8
thread size (TS)

a fractional designation of size independent of any unitary system that is used to identify threaded (BS 21) connections in valves

2.9
nominal pressure (PN)

a numerical designation which is a convenient rounded number for reference purposes

all the 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 the appropriate standards.
NOTE 2 Nominal pressure is designated by the latters PN followed by the appropriate reference number.
NOTE 3 This definition is identical with that given in ISO 7268.

2.10
class

a numerical designation for reference purposes

NOTE 1 The maximum allowable working pressure depends on materials, design and design temperature and should be selected from the tables of pressure/temperature ratings given in the appropriate standards.
NOTE 2 Class is designated by the word Class followed by the appropriate reference number.

2.11
lubricated plug valve

a valve having the mating surfaces of the plug and body separated from each other by a pressurized, renewable film of lubricant/sealant (see Appendix C)

2.12
soft seated plug valve

a non-lubricated valve having soft seats of a low frictional material fitted between the body and the plug (see Appendix C)

2.13
lined plug valve

a valve having a fully moulded, bonded or keyed non-removable lining on all internal wetted surfaces that may be lubricated or non-lubricated

2.14
short plug valve

a valve having end-to-end dimensions corresponding with wedge gate valves (as specified in BS 2080)

2.15
regular plug valve

a valve generally having plug ports of greater area than short or venturi valves

2.16
venturi plug valve

a valve having reduced plug port area and a body throat approximating to a venturi

3 Valve patterns

Valves shall be short, regular or venturi pattern.

NOTE In Class 150, PN 10 and PN 16 the venturi and regular pattern are available only in the long series of end-to-end dimensions in accordance with BS 2080. In all other cases short, venturi and regular pattern valves have the same end-to-end dimensions.

4 Nominal sizes

Valves shall be of nominal sizes (DN) or nominal pipe sizes (NPS) or threaded sizes (TS) according to type of end fitting as given in Table 1.

5 Pressure designation

Pressure designation of valves shall be as given in Table 1.

6 Pressure/temperature ratings

NOTE 1 The pressure/temperature ratings of the linings of lined valves are outside the scope of this standard.
NOTE 2 Since the maximum or minimum operating temperature may be limited by the grade of lubricant/sealant used in the valve, attention is drawn to **10.10**.

6.1 Soft seated valves

Minimum pressure/temperature seat ratings of soft seated valves shall be as given in Table 2. With the exception of the soft seats and primary seals, all valve components shall be capable of withstanding the pressure/temperature ratings as specified in BS 1560-3.1, BS 4504-3.1 or Table 3, as appropriate.

6.2 Metal seated valves

Pressure/temperature ratings of metal seated valves shall be as specified in BS 1560-3.1, BS 4504-3.1 or Table 3, as appropriate.

7 Dimensions

7.1 Flanged-end valves

7.1.1 Flange dimensions shall comply with BS 1560-3.1 for Class designated valves or BS 4504-3.1 for PN designated valves.

NOTE See Table 1 for PN/Class relationship.

7.1.2 Face-to-face dimensions shall be in accordance with BS 2080. Valves having flanges complying with BS 4504-3.1 and pressure ratings (PN) as given in Table 1 shall have the same face-to-face dimensions as the corresponding Class designated valves (see Table 1).

7.2 Butt-weld-end valves

End-to-end dimensions shall be in accordance with the following:

a) Table 4 for PN 10, PN 16, PN 25, PN 40, Class 150 and Class 300 valves;

b) BS 2080 for Class 600, Class 900, Class 1500 and Class 2500 valves.

NOTE The details for the weld preparation for butt-weld-end valves are not a requirement of this standard but attention is drawn to Appendix B which gives details of various weld-end preparations and it is incumbent upon the purchaser to specify a particular weld-end preparation, if required (see Figure 2 and Figure 3), and the schedule or diameter and wall thickness of the connecting pipe.

7.3 Socket-weld-end valves

Socket-weld-end dimensions shall be as given in Table 5. The minimum metal thickness at the socket-weld-end shall be as given in Table 6.

7.4 Soft seated extended-weld-end valves

The overall length of weld-end soft seated valves when fitted with extended ends shall be 400 ± 1 mm. Valves of nominal sizes DN 15 to DN 40 intended for butt-welding shall have ends square or bevelled for welding and valves intended for socket welding shall have the end prepared in accordance with **7.3**.

NOTE Valves of nominal size DN 50 should have bevelled ends in accordance with Appendix B which gives details of typical weld-end preparations and it is incumbent upon the purchaser to specify a particular weld-end preparation, if required (see Figure 2 and Figure 3).

Table 1 — Nominal size of valves and pressure designation

Nominal size of valve		Pressure designation						
DN	NPS or TS	Class 150 PN 10, PN 16	Class 300 PN 25, PN 40	Class 600	Class 800	Class 900	Class 1500	Class 2500
8	¼	—	—	—	C	—	— — —	—
10	⅜	—	—	—	C	—	— — —	—
15	½	B C D	B C D	B C D	C D	—	B C D	B C D
20	¾	B C D	B C D	B C D	C D	—	B C D	B C D
25	1	B C D	B C D	A C D	C D	—	A C D	A C D
(32)	(1¼)	B C D	B C D	B C D	C D	—	A C D	A C D
40	1½	B C D	B C D	A C D	C D	—	A C D	A C D
50	2	A C D	A C D	A C D	C D	—	A C D	A C D
(65)	(2½)	A	A	A	— —	—	A — —	A —
80	3	A	A	A	— —	A	A — —	A —
100	4	A	A	A	— —	A	A — —	A —
150	6	A	A	A	— —	A	A — —	A —
200	8	A	A	A	— —	A	A — —	A —
250	10	A	A	A	— —	A	A — —	A —
300	12	A	A	A	— —	A	A — —	A —
350	14	A	A	A	— —	—	A — —	— —
400	16	A	A	A	— —	—	A — —	— —
450	18	A	A	A	— —	—	— — —	— —
500	20	A	A	A	— —	—	— — —	— —
600	24	A	A	A	— —	—	— — —	— —

NOTE 1 A = flanged and butt-weld ends, B = flanged ends only, C = threaded ends and D = socket-weld ends.
NOTE 2 Non-preferred sizes are shown in parentheses (see foreword).

Table 2 — Minimum pressure/temperature soft seat ratings

Nominal size of valve DN	Minimum non-shock pressure rating at service temperature							
	40 °C	50 °C	75 °C	100 °C	125 °C	150 °C	175 °C	200 °C
	bar[a]	bar	bar	bar	bar	bar	bar	bar
8 to 150	48	47	43	39	36	32	29	25
200 to 300	35	34	31	28	25	23	20	17

NOTE 1 Pressure/temperature ratings given are for steady state conditions; where pressure and/or temperature cycling occurs the manufacturer should be consulted.
NOTE 2 The minimum pressure/temperature ratings and based on seats made from polytetrafluoroethylene (PTFE) without fillers, of virgin material completely free of reclaimed processed material (see **10.4**).
NOTE 3 See Table 1 for equivalent NPS and TS.

[a] 1 bar = 100 kN/m^2 = 100 kPa.

Table 3 — Class 800 body pressure/temperature ratings

Body material designation	Grade									
	Carbon steel	5 Cr ½ Mo	1¼ Cr½ Mo	2¼ Cr 1 Mo	18/8	18/8 Low C	18/10/2	18/10/2 Low C	18/8Ti	18/8 Nb
Bar stock bodies	Steel	B5	B11	B22	B304	B304L	B316	B316L	B321	B347
Forged bodies	Steel	F52	F11	F22	F304	F304L	F316	F316L	F321	F347
Service temperature	Maximum non-shock service pressure									
°C	bar	bar	bar	bar	bar	bar	bar	bar	bar	bar
– 30 to 38	138	138	138	138	118	98	138	98	138	138
50	137	137	137	137	115	98	137	98	137	137
75	135	135	135	135	110	98	135	98	135	135
100	133	133	133	133	103	98	133	98	133	133
125	132	132	132	132	98.5	97.5	132	97.5	132	132
150	130	130	130	130	94.5	95	130	91.5	130	130
175	129	129	129	129	90.5	89	129	84	129	129
200	128	128	128	128	86.5	82	128	77	128	128
225	125	125	125	125	83.5	76	125	77.5	125	125
250	122	122	122	122	80	70	122	71	122	122
275	116	116	116	116	77.5	66.5	116	68	116	116

Table 4 — End-to-end dimensions of butt-weld-end valves

Nominal size (DN)	End-to-end dimensions	
	PN 10, PN 16, Class 150 Short and regular pattern	PN 25, PN 40, Class 300 Short, regular and venturi pattern
	mm	mm
50	267	267[a]
(65)	305	305[a]
80	330	330[a]
100	356 ± 2	356[a] ± 2
150	457	457
200	521	521
250	559	559
300	635 ± 3	635
350	—	762
400	—	838 ± 3
450	—	914
500	—	991
600	—	1 143

NOTE 1 See Table 1 for equivalent NPS.
NOTE 2 Non-preferred size is shown in parentheses (see foreword).
[a] Short pattern only.

Table 5 — Socket-weld-end details

Nominal size (DN)	Minimum depth of socket	Bore of socket
	mm	mm
15	10	21.8
20	13	27.4
25	13	34.1 + 0.25
(32)	13	42.9 – 0
40	13	49.0
50	16	61.0

NOTE 1 See Table 1 for equivalent NPS.
NOTE 2 Non-preferred size is shown in parentheses (see foreword).

7.5 Threaded-end valves

7.5.1 The minimum wall thickness at the threaded end shall not be less than that given in Table 6.

7.5.2 Valve ends shall have internal taper threads in accordance with ANSI/ASME B1.20.1 or BS 21.

7.6 Bolting

7.6.1 Bolting threads shall be in accordance with the following ISO metric or unified inch standards, as appropriate.

metric	inch
BS 3692	BS 1768 (below ½ in)
BS 4190	BS 1769
BS 4439	BS 2693-1
BS 4882	BS 4882

7.6.2 When used, valve body/cover bolting shall be of minimum size M10 (⅜).

Section 2. Design and materials

8 Design

8.1 General

Valves shall be of the tapered or parallel plug type.

NOTE Typical plug valve constructions are given in Appendix C.

8.2 Shell wall thickness

The minimum wall thickness of the pressure-containing shell, including covers or other closure members but excluding glands, shall be as given in Table 6. Drilling of, pinning to, or spot welding the wall of a pressure-containing part, e.g. for nameplate fixing, shall not be used where it would reduce the effective thickness below the value given in Table 6.

8.3 Body tappings

If body tappings are included, the design of valves DN 50 and larger shall be such that tappings of size given in Table 7 can be provided in the positions shown by arrows in Figure 1. Where the tapped hole needs reinforcement, a boss shall be provided.

Tappings shall have taper threads in accordance with ANSI/ASME B.1.20.1 or BS 21.

NOTE A requirement for a body tapping should be specified in the enquiry and/or order for the valve(s) (see Appendix A).

8.4 Flanged and extended weld ends

End flanges shall be cast or forged integral with the body or attached by butt welding. The welds of ends attached by butt welding or extended ends attached by socket welding shall comply with BS 2633 or BS 4677, as appropriate. Any heat treatment necessary to ensure that the material is suitable for the full range of service temperature shall be performed.

NOTE Other flange attachment welding methods are outside the scope of this standard.

Table 6 — Minimum shell wall thickness

Nominal size (DN)	Minimum shell wall thickness for pressure designation										
	PN 10	PN 16	Class 150	PN 25	PN 40	Class 300	Class 600	Class 800[a]	Class 900	Class 1500	Class 2500
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
8	—	—	—	—	—	—	—	3.3	—	—	—
10	—	—	—	—	—	—	—	3.5	—	—	—
15	4.0	4.0	4.0	4.0	4.0	4.0	5.0	4.0	—	6.0	8.0
20	4.0	4.0	4.0	4.0	4.0	4.0	5.0	4.3	—	7.0	9.0
25	5.0	5.0	5.0	5.0	5.0	6.0	6.0	5.0	—	8.0	11.0
(32)	6.0	6.0	6.0	6.0	6.0	7.0	7.0	5.6	—	10.0	14.0
40	6.0	6.0	6.0	6.0	6.0	7.0	7.0	5.6	—	12.0	16.0
50	6.5	6.5	7.0	7.5	8.0	8.0	8.0	6.1	—	14.0	20.0
(65)	6.5	7.0	7.0	7.5	8.0	8.0	9.0	—	—	16.0	23.0
80	6.5	7.0	7.0	7.5	8.0	9.0	10.0	—	13.0	20.0	26.0
100	7.5	7.5	8.0	8.0	9.0	10.0	12.0	—	16.0	23.0	32.0
150	8.0	9.0	9.0	9.0	11.0	12.0	16.0	—	22.0	32.0	44.0
200	9.0	10.0	10.0	11.0	13.0	14.0	20.0	—	26.0	40.0	56.0
250	9.5	11.0	11.0	12.0	14.0	16.0	23.0	—	31.0	48.0	70.0
300	11.0	12.0	12.0	13.0	16.0	18.0	27.0	—	36.0	55.0	81.0
350	11.0	12.5	13.0	14.0	17.5	20.0	29.0	—	—	60.0	—
400	12.0	14.0	14.0	16.0	19.0	22.0	32.0	—	—	68.0	—
450	13.0	15.0	15.0	18.0	—	—	—	—	—	—	—
500	14.0	16.0	16.0	20.0	—	—	—	—	—	—	—
600	15.0	18.0	18.0	22.0	—	—	—	—	—	—	—

NOTE 1 See Table 1 for equivalent nominal size (in).

NOTE 2 Non-preferred sizes are shown in parentheses (see foreword).

[a] Applies to forged or bar stock bodies only.

Table 7 — Body tappings

Nominal size of valve DN	Pipe tapping designation NPS/TS
50, 65, 80, 100	½
150, 200	¾
250 to 600	1

NOTE See Figure 1 for equivalent nominal size (in).

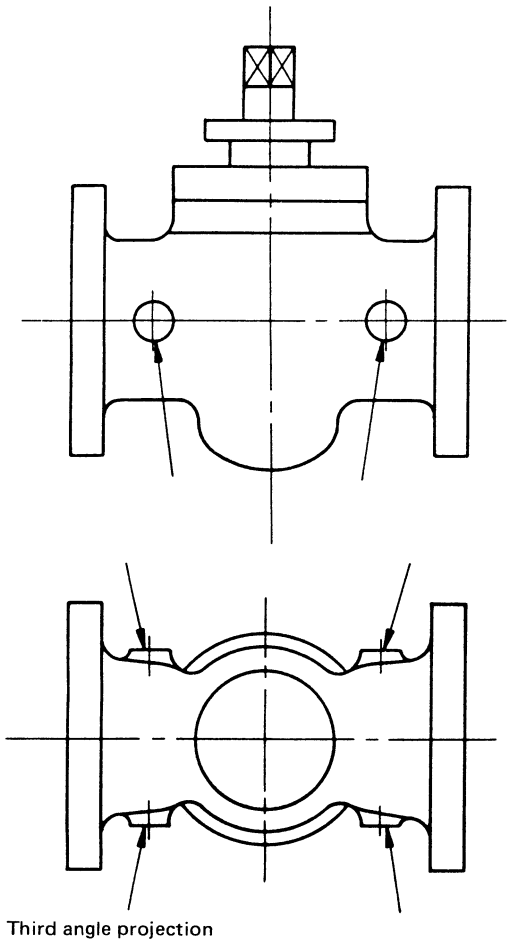


Figure 1 — Location of tappings

8.5 Stems, plug shanks, stem extensions

Permanent marking shall be provided on the end of stems, plug shanks (i.e. integral with the plug), stem extensions or other attachments to which an operating mechanism could be attached, to indicate the axis of the flow passage through the plug.

NOTE Attention is drawn to the fact that markings such as an engraved line on the end of the stem will only provide an approximate indication of the plug port position.

8.6 Stem retention

The valve design shall be such that the stem seal retaining fasteners, e.g. packing gland fasteners, alone do not retain the stem. The design shall ensure that the stem shall not be capable of ejection from the valve by the removal of the stem seal retainer, e.g. gland, alone while the valve is under pressure.

8.7 Cover

8.7.1 *Cover joint.* The joint between the cover and the body shall be able to withstand the appropriate pressure and temperature specified in clause **6**. The body/cover connection shall be one of the following:

a) male and female;

b) tongue and groove;

c) ring joint;

d) screwed (for valves up to and including DN 100);

e) flat faced (for PN 10, PN 16 or Class 150 valves).

NOTE Where possible, all body/cover connections and gaskets should have dimensions in accordance with BS 1560-3.1 or BS 4504-3.1.

8.7.2 *Cover bolting* (where used). For valve sizes up to and including DN 20 in pressure Classes PN 10 and PN 16 and Class 150 the minimum number of fasteners shall be two. For all other sizes and pressure Classes the minimum number of fasteners shall be four.

NOTE The requirements of a recognized design code, e.g. BS 5500, regarding size and number of cover fastenings, may take precedence.

8.8 Gland

For sizes larger than DN 150 the gland shall be bolted. For sizes DN 150 and smaller the gland shall be bolted or threaded. The bolted type shall be of one piece, one piece bushed or of two-piece self-aligning type. Vertically split glands shall not be used. Gland bolts shall pass through holes in the gland, open slots shall not be used.

8.9 Lubricated valves

Lubricated valves shall be provided with a lubricant/sealant injection facility of one of the following:

a) a lubricant screw (for stick grade only);

b) a combination fitting (for stick and gun grade);

c) a nipple (for gun grade only).

In all cases a check valve shall be provided in the lubricant/ sealant system separate and independent of any check valve incorporated in a combination fitting or nipple (see Appendix A).

NOTE The option of stick or gun lubricant/sealant injection is not available for all valves, some valves being suitable for gun injection only.

8.10 Soft seated valves

Soft seats shall be secured or retained to prevent movement between the seat and plug/body or body lining within the specified operating range of the valve.

NOTE 1 Non-renewable soft seats will always be supplied unless the purchaser specifically requests renewable soft seats (see Appendix A).

It is permissible to provide a means to relieve body cavity pressure (see Appendix A).

NOTE 2 For plug valves designed to relieve pressures above normal working pressure that may build up in trapped cavities due to thermal expansion or evaporation of liquid, provision may be made for a pressure relief hole or passage or other means, e.g. pressure relieving seats, to relieve pressure in the bonnet and body cavities. The means adopted will be determined by the manufacturer unless the purchaser exercises his option in accordance with Appendix A.

8.11 Anti-static design

Soft seated and lined valves shall incorporate an anti-static feature that ensures electrical continuity between stem and body of valves DN 50 or smaller, or between plug, stem and body of larger valves. Compliance shall be checked by the test specified in clause **13**.

The use of a conductive stem seal is permitted provided that the seal is not the sole means of achieving the anti-static function.

NOTE Conductive packings may not be compatible with certain process fluids (see **10.4** and Appendix A).

8.12 Fire type tested design

Valves shall be either of fire type-tested design or non-fire type-tested design (see clause **12**).

NOTE If a fire type-tested design is required then it should be so specified in the purchaser's enquiry and/or order (see Appendix A.)

9 Operation

9.1 Mode

Valves shall be operated by a handwheel, wrench or actuator (see Appendix A).

NOTE For manually operated valves, clockwise closing will always be supplied unless the purchaser specifically requests anti-clockwise closing in accordance with Appendix A.

9.2 Wrench/handwheel sizing

The length of the wrench or diameter of the handwheel for direct or gear operated valves shall, after opening and closing a new valve at least three times, be such that a force not exceeding 350 N shall be required to operate the plug from either the open or closed position under the maximum differential pressure recommended by the manufacturer.

9.3 Direction of operation

Handwheels shall be marked to indicate the direction of closing.

9.4 Handwheel/wrench attachment

Handwheels and wrenches shall be fitted in such a way that, whilst held securely, they are capable of being removed and replaced where necessary.

9.5 Position indicator

All valves shall be provided with an indicator to show the position of the plug port and the design shall not permit incorrect assembly. When a wrench is the sole means of indicating port position, it shall be so arranged that the wrench lies parallel to the line of flow in the open position.

9.6 Travel stops

Stops shall be provided for both the fully open and fully closed positions of the valve and shall be so designed as to prevent mis-orientation.

9.7 Actuator attachment

The dimensions of actuator attachment flanges shall comply with BS 5840-1.

10 Materials

NOTE Lining materials are not a requirement of this standard and the purchaser should specify any particular requirements for lining materials in the enquiry and/or order (see Appendix A).

10.1 Pressure containing shell

10.1.1 The body and cover materials shall be selected from BS 1560-3.1 or BS 4504-3.1. However, for valves smaller than DN 50 and made from bar-stock, the range of materials shall be supplemented by the materials given in Table 8. For flat covers the range of materials shall be supplemented by plate complying with BS 1501-1, BS 1501-2 and BS 1501-3, as appropriate. Plate material shall have the same nominal composition and properties as the valve body material.

10.1.2 The carbon content of materials for all pressure-containing parts involved in welding operations shall be restricted as follows:

a) 0.25 % maximum for carbon or carbon molybdenum steels;

b) 0.15 % maximum for Cr Mo steels;

c) $C + \frac{Mn}{6}$ to be not greater than 0.41 %

where C and Mn are the carbon and manganese content, respectively, in percent.

Table 8 — Additional materials permitted for use in the manufacture of valves smaller than DN 50 from bar-stock

Material[a]	British Standard	Grade/symbol
Carbon steel	BS 970-1	070M20[b]
1¼ Cr ½ Mo	BS 1502	620-440
2¼ Cr 1 Mo	BS 1502	622
5 Cr ½ Mo	BS 1502	625
18/8	BS 970-1	304S31
18/8LC	BS 970-1	304S11
18/10/2	BS 970-1	316S31
18/10/2LC	BS 970-1	316S11
18/8/Ti	BS 970-1	321S31
18/8/Nb	BS 970-1	347S31

[a] The materials are in addition to those specified in BS 1560-3.1 or BS 4504-3.1.
[b] 070M20 in the normalized condition, or cold drawn from the hot rolled condition.

10.1.3 Any threaded body drain plug material shall have the same nominal composition and properties as that of the body material. Cast iron drain plugs shall not be used.

10.2 Plugs

Plugs shall have seating surfaces that are resistant to galling and shall be made of either:

a) steel (see Appendix A); or

b) cast iron (see Appendix A) of one of the following types:

1) grey (flake graphite);

2) spheroidal graphite;

3) austenitic.

When made of cast iron, plugs shall comply with the following.

i) For PN 10, PN 16 and Class 150 carbon steel valves, the cast iron shall have mechanical properties not less than those specified for grey cast iron complying with BS 1452, grade 180.

ii) For PN 25, PN 40 and all other Classes of carbon steel valves, the cast iron shall have mechanical properties not less than those specified for grey cast iron complying with BS 1452, grade 260.

10.3 Stems

When separate from the plug, stems shall be of steel with mechanical properties not less than those specified for the body material (see **10.1** and Appendix A).

10.4 Stem seals, body seals, gaskets and soft seal parts

Material for the stem seals, body seals or gaskets shall be suitable for use at the maximum temperature rating applying to the valve.

NOTE 1 The minimum corrosion resistance of any metallic part of a gasket should be equal to the corrosion resistance of the shell.
NOTE 2 Any special requirements for seal and gasket materials to ensure compatibility with process fluids should be stated on the enquiry and/or order (see Appendix A).
NOTE 3 Unless otherwise specified by the purchaser, the manufacturer will supply soft seat/seal parts of soft-seated valves made from unfilled virgin PTFE material completely free of reclaimed processed material. The purchaser should state on the enquiry if a material other than PTFE is required (see Appendix A).

10.5 Bolting

The material of bolting for pressure-containing and gland bolting purposes shall comply with BS 4882. The use of carbon steel bolting shall be restricted to:

a) a service temperature not exceeding 230 °C; or

b) PN 10, PN 16 and Class 150 valves when fitted with cast iron plugs.

10.6 Wrench and handwheel

The wrench or handwheel shall be of steel, malleable cast iron or nodular (spheroidal) graphite cast iron.

10.7 Wrench and handwheel nut

The wrench or handwheel nut material shall have a melting point above 955 °C. If of carbon steel, it shall be protected against atmospheric corrosion.

10.8 Gland

A one-piece gland or any gland flange shall be of steel. The bushing of a one-piece bushed gland or the gland proper of a two-piece gland shall be made of a material having a melting point above 955 °C.

10.9 Identification plates

The identification plate shall be of austenitic stainless steel or nickel alloy, and shall be attached to the valve by pins of similar material or by spot welding on carbon steel or austenitic stainless steel valves (see **8.2** and Appendix A).

10.10 Lubricant/sealants

Valves shall be supplied with lubricant and/or sealants, as appropriate.

NOTE 1 These materials are compounded specifically for use in plug valves. The use of materials other than those recommended by the valve manufacturer can adversely affect the performance of the valves.
NOTE 2 The purchaser should state in the enquiry and/or order if the valve is required to be filled with lubricant/sealant to meet particular service conditions or a manufacturer's particular grade, otherwise the manufacturer will supply valves filled with the normal assembly grade (see Appendix A).

Section 3. Testing

11 Pressure testing

All valves shall be hydrostatically pressure tested in accordance with BS 6755-1 and for the durations given in Table 9, and additionally:

a) during the shell test there shall be no visually detectable leakage from the valve including the valve stem seals;

b) the seat test acceptance level for all valves shall be leakage rate A (i.e. no visually detectable leakage).

If a pressure test certificate is issued it shall contain a statement by the manufacturer confirming that the valves have been tested in accordance with this standard, and stating the actual pressures and medium used in the tests.

NOTE 1 Valves that have been hydrostatically seat tested may also be pneumatically seat tested at 6 bar if specified in the purchaser's enquiry and/or order (see Appendix A).

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

Table 9 — Pressure test durations

Nominal valve size (DN)		Minimum test durations: hydrostatic or pneumatic	
		Shell test	Seat test
	in	min	min
$\leqslant 100$	$\leqslant 4$	2	2
$150 \leqslant 250$	$6 \leqslant 10$	5	5
$300 \leqslant 450$	$12 \leqslant 18$	15	5
$450 \leqslant 600$	$20 \leqslant 24$	30	5

12 Fire testing

NOTE The text given in **12.1** applies to valves manufactured up to and including 31 July 1990. After that date BS 5146-1 will be withdrawn and the text given in **12.2** will apply. (See foreword.)

12.1 (Effective up to and including 31 July 1990). Valves designated as fire type-tested designs (see **8.12**) shall be type-tested to, and shall comply with, either:

a) BS 6755-2; or

b) Appendix A of BS 5146-1:1974.

12.2 (Effective from 1 August 1990). Valves designated as fire type-tested designs (see **8.12**) shall be type-tested to, and shall comply with BS 6755-2.

13 Anti-static testing

The anti-static type-test for soft seated and lined valves shall be carried out on a new, dry, "as built" valve of each type after pressure testing (see clause **11**). The test for electrical continuity shall be carried out after the test valve has been operated for at least five times. The discharge path as defined in **8.11** shall have electrical continuity with a resistance not exceeding 10 Ω from a power source not exceeding 12 V d.c.

14 Manufacturer's certificate

If required the manufacturer shall supply a certificate stating that the valve(s) comply in all respects with the requirements of this standard.

NOTE A requirement for a manufacturer's certificate of conformity should be specified on the enquiry and/or order (see Appendix A).

Section 4. Marking

15 General

15.1 Introduction

Valves shall be clearly marked in accordance with BS 5418, except as given in **15.2**, **15.3** and **15.4**.

15.2 Body marking

Body marking shall be either integral with the body or on a plate securely fixed to the body. The plate (if used) shall be separate and distinct from the identification plate referred to in **15.3** (but see **15.5**).

Body marking shall include the following.

a) Designation/size.

1) For PN designated valves the nominal size DN.

2) For Class designated valves the designation NPS followed by the appropriate size in inches or alternatively the size in inches alone.

3) For threaded end valves in addition to marking required by a) 1) or a) 2) the ends of the valve shall be marked in accordance with ANSI/ASME B1.20.1 or BS 21 as appropriate.

b) Nominal pressure, expressed as PN or Class as appropriate.

c) Body material symbol (see BS 1560-3.1, BS 4504-3.1 or Table 8).

d) Manufacturer's name or trade mark.

e) Cast number or melt identification.

f) Arrows to indicate direction of flow (unidirectional flow valves only).

Pipe flanges grooved for ring joints shall be marked with the ring number (e.g. R25, see BS 1560-3.1). This identification shall be marked on the rim of both flange edges.

Examples:

a) 1) DN 50 — PN 16-625-XYZ-1234.

a) 2) NPS 2 — 150-622-XYZ-2345.

15.3 Identification plate marking

Identification plates shall be marked with the following.

a) The number of this British Standard, i.e. BS 5353[1)].

b) The manufacturer's figure or number identifying the valve in all respects. The same figure or number shall therefore, only be used for valves that are identical in design, detail, dimensions and material.

NOTE This identification may be used to determine the precise pressure/temperature rating of the valve from the manufacturer's technical data.

c) Seat material designation, if different from that of the body.

d) Plug material designation, if different from that of the body. (See Table 10 for typical material symbols.)

e) Any pressure or temperature restrictions imposed by the manufacturer due to the limitations on materials or design of the closure components. This shall include the pressure differential across the plug at the 20 °C rating if it is lower than that of the body (see clause **6**) and the maximum permissible temperature and its corresponding allowable pressure.

15.4 Additional markings

Paints or inks used for additional markings on stainless steel valves shall comply with BS 5383.

NOTE Other additional markings may be used at the option of the manufacturer or at the request of the purchaser, provided that they do not conflict with any of the markings specified in this standard.

15.5 Omission of markings

On valves smaller than DN 50, it is permissible to omit the following body markings in the order given, provided that they are shown on the identification plate:

a) nominal size;

b) manufacturer's name or trade mark;

c) materials symbol;

d) nominal pressure rating.

Table 10 — Typical material symbols

Material	Symbol for plug/seat materials
Carbon steel	CS or steel
13 % chromium steel	CR 13
Austenitic stainless steel	304
	316
	321
Nickel copper alloy	Ni Cu
NOTE For other materials, the manufacturer's designation should be used.	

[1)] Marking BS 5353 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 5. Preparation for storage and transportation

NOTE See also BS 6683.

16 General

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

Valves shall have the plug in the open position.

NOTE Painting is not a requirement of this standard but if the valves are required to be painted this should be specified by the purchaser in accordance with Appendix A.

17 Body ends

All valves shall have the machined surfaces of body ends coated with a removable rust preventative and sealed to exclude foreign matter during transit and storage.

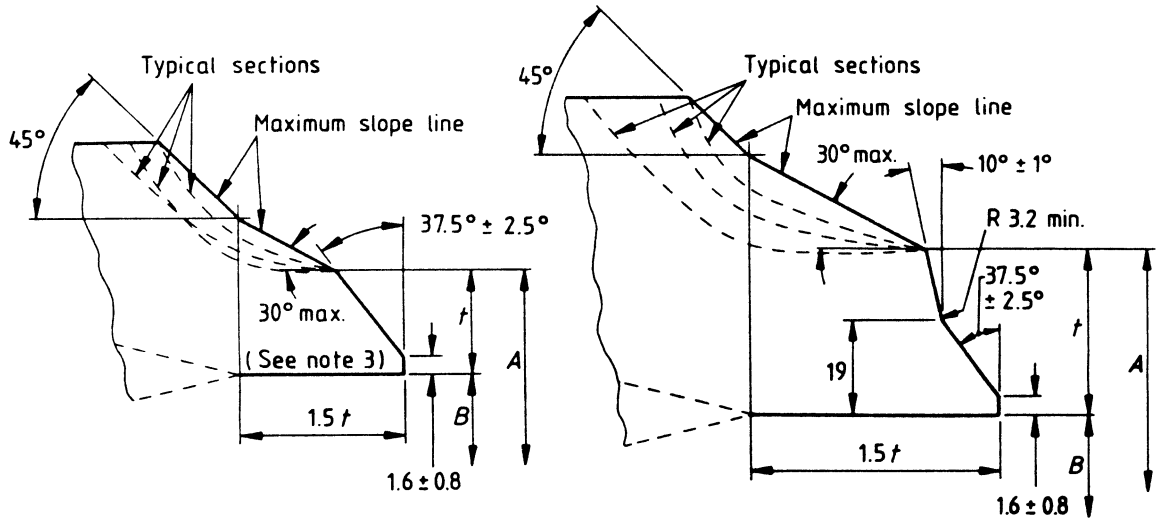
Appendix A Information to be supplied by purchaser

The following information should be supplied by the purchaser in an enquiry or order:

a) valve pattern (see clause **3**);
b) nominal size DN, NPS or TS (see clause **4**);
c) pressure designation (see clause **5**);
d) details of pressure and/or temperature cycling expected (see **6.1**);
e) body ends (see clause **7**);
f) flanged, including facing type (see **7.1**);
g) butt-weld-end preparation (see **7.2**);
h) socket-weld-ends (see **7.3**);
i) extended weld ends (see **7.4**);
j) threaded ends (see **7.5**) whether BS 21 (Taper) or ANSI/ASME B1.20.1;
k) body tapping and location if required (see **8.3**) and whether to BS 21 (Taper) or ANSI/ASME B1.20.1;
l) if gun lubrication is required (see **8.9**);
m) if renewable seats are required (see **8.10**);
n) if cavity relief is required (see **8.10**);
o) if fire type-tested design is required (see **8.12**);
p) operation (see **9.1**) if other than wrench or handwheel;
q) operation (see **9.1**) if anti-clockwise close is required;
r) materials (see clause **10**) lining, where particular material is required;
s) materials (see **10.1**) pressure containing shell (specify);
t) materials (see **10.2**) plug where particular material is required;
u) materials (see **10.3**) stem, where particular material is required;
v) materials (see **10.4**) soft seats, if other than virgin PTFE is required;
w) materials (see **10.4**) any special requirements for stem seals, body seals and gaskets to ensure compatibility with process fluid;
x) identification plates (see **10.9**) if fixing by spot welding is not permitted;
y) materials (see **10.10**) service conditions, or grade of lubricant/sealant required;
z) if additional pneumatic seat test is required (see clause **11**);
aa) if pressure test certificate is required (see clause **11**);
bb) if certificate of conformity is required (see clause **14**);
cc) if valves are to be painted (see clause **16**).

Appendix B Weld-end preparations

Typical weld-end preparations are shown in Figure 2 and Figure 3.



All dimensions are in millimetres.

a) Welding end for connection to pipe of wall thickness t of 22 mm or less

NOTE 1 A is the nominal outside diameter of welding end (see table below); B is the nominal inside diameter of pipe (for tolerance on B, see table below); t is the nominal wall thickness of pipe.

NOTE 2 Dotted lines denote maximum envelope for transitions from welding groove.

NOTE 3 The inside and outside surfaces of valve welding ends should be machine finished overall. Contour within the envelope is at the manufacturer's option unless otherwise specifically ordered.

b) Welding end for connection to pipe of wall thickness t greater than 22 mm

NOTE 4 Intersections should be slightly rounded.

NOTE 5 Valves having nominal wall thickness of 3 mm or less at the weld preparation may have ends cut square or slightly chamfered ends.

NOTE 6 For nominal outside diameters and wall thicknesses of steel pipes, see ANSI B36.10 or BS 1600-2.

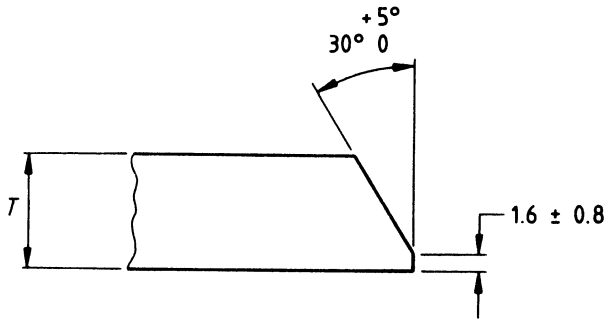
NOTE 7 Regardless of tolerances specified for dimensions A and B, the thickness of the weld-end should never be less than 87.5 % of the nominal thickness of the pipe.

Valve nominal size ***A***	DN	25	(32)	40	50	(65)	80	100	150	200	250	300	350	400	450	500	600
	mm	35	44	50	62	75[a]	91	117	172	223	278	329	362	413	464	516	619
Tolerance on *A*	mm	+ 2.5 − 1							+ 4 − 1								
Tolerance on *B*	mm	+ 1										+ 2					

NOTE Figures in parentheses are non-preferred sizes.

[a] A is 78 mm when used with pipe complying with BS 3600.

Figure 2 — Weld-end preparation



Dimension is in millimetres.

Figure 3 — Typical bevel for shell wall thicknesses (*t*) 22 mm or less for pipeline applications

Appendix C Typical plug valve constructions

Typical constructions of plug valves are shown in Figure 4, Figure 5, Figure 6 and Figure 7 which are composite sketches for the purpose of showing some typical variations in individual details. A product utilizing any combination of the details shown in each particular figure, except when such combination may be specifically prohibited in the text, or similar construction will be acceptable provided it complies with this standard in all other respects.

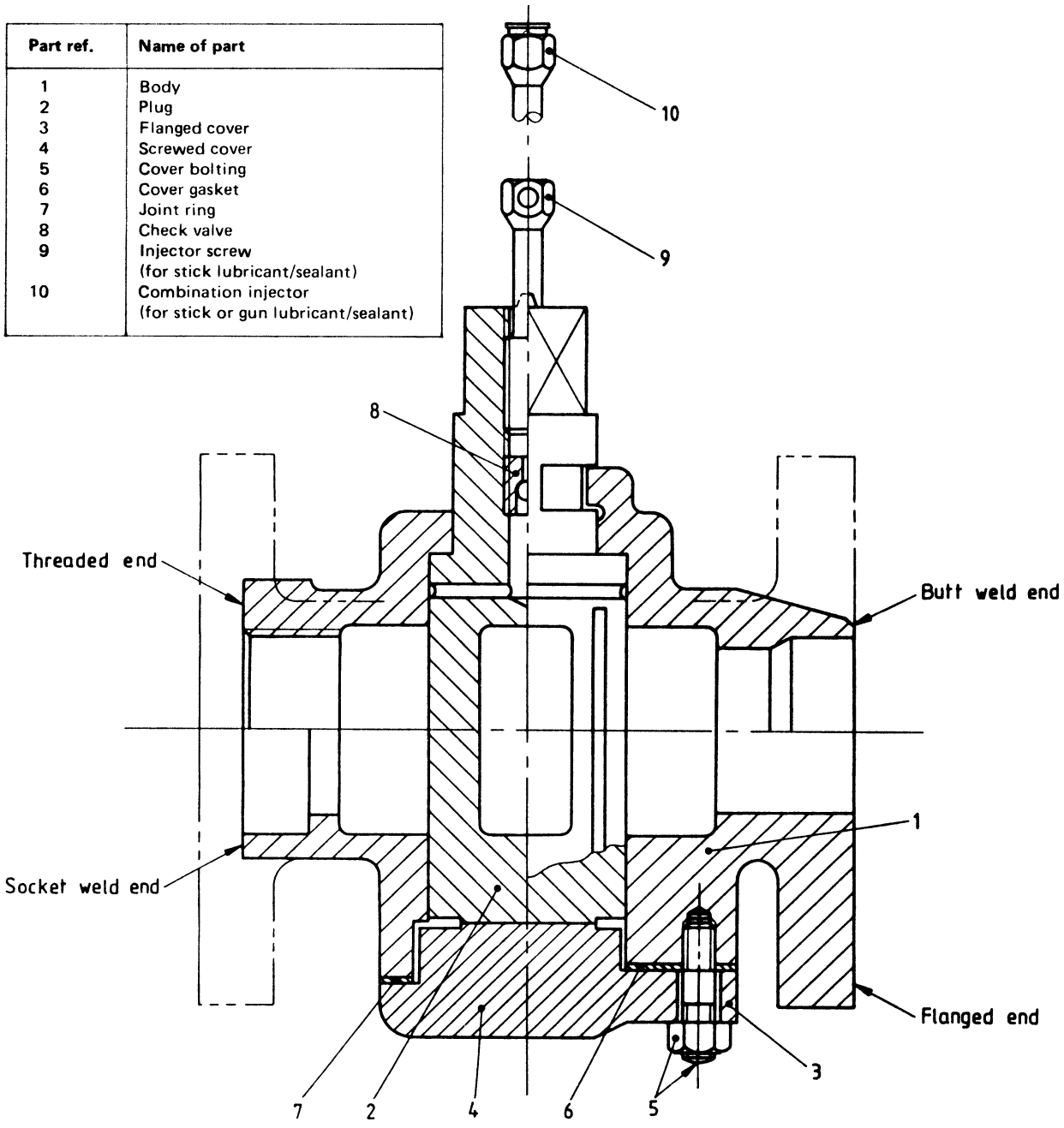
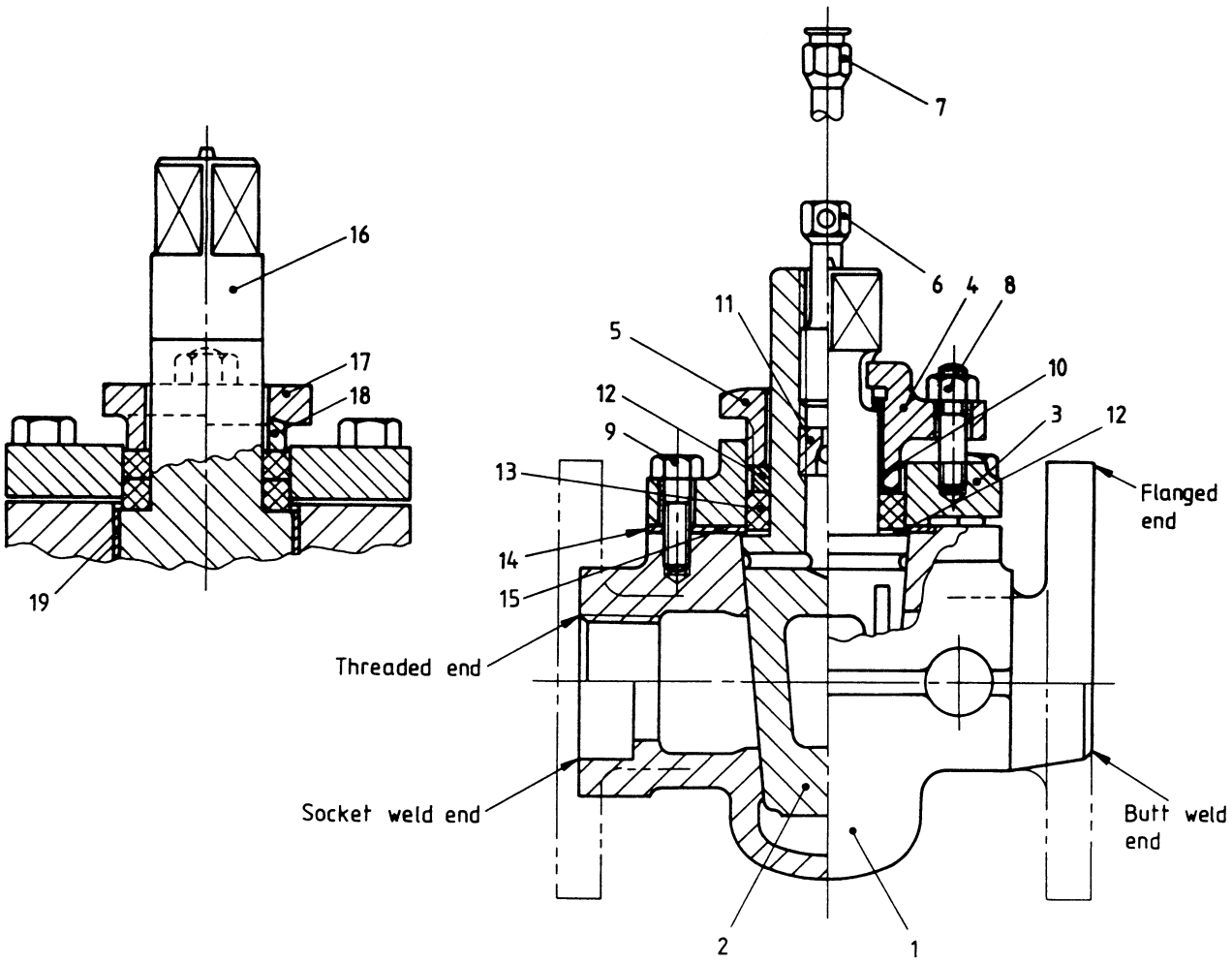
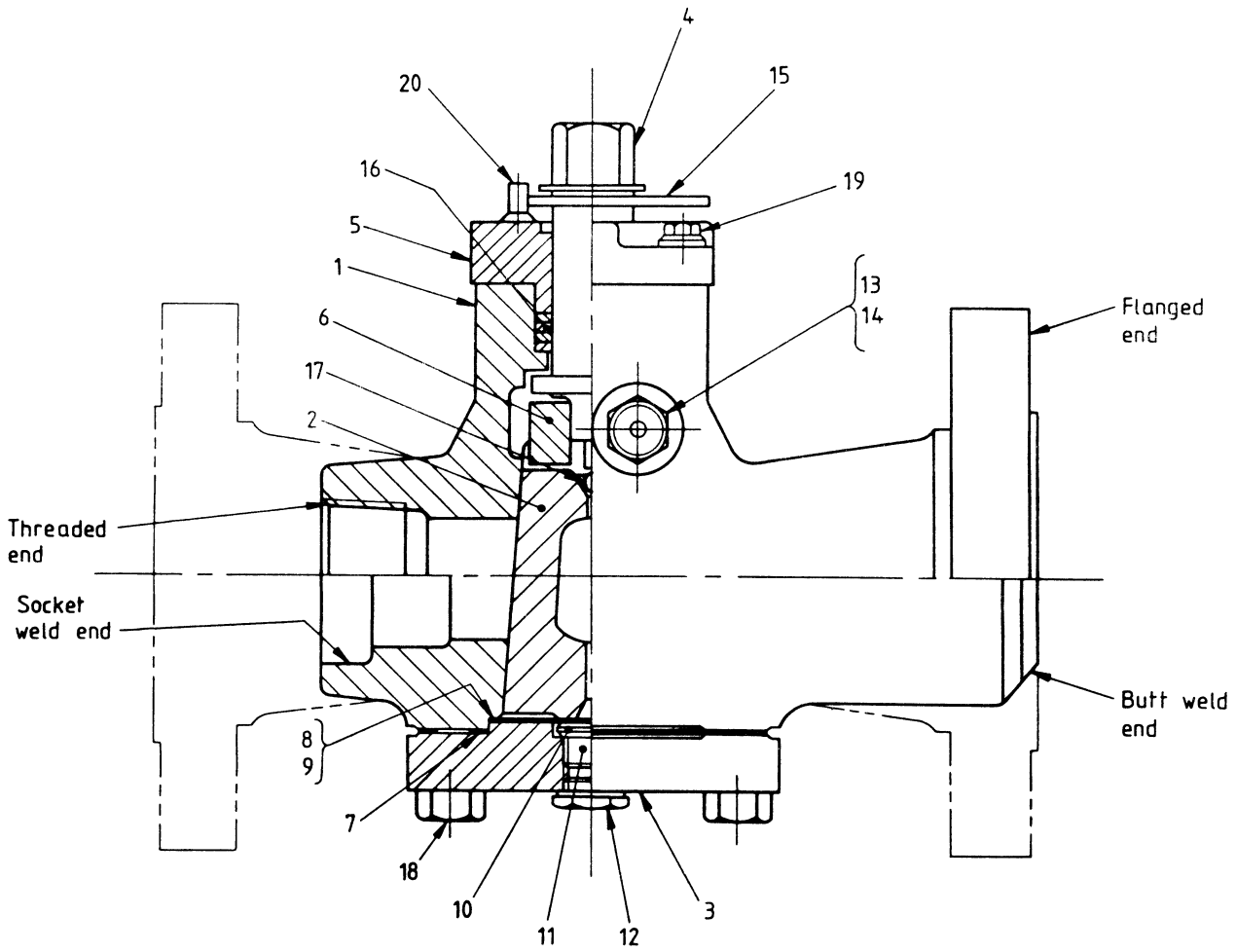


Figure 4 — Lubricated plug valve. Parallel plug



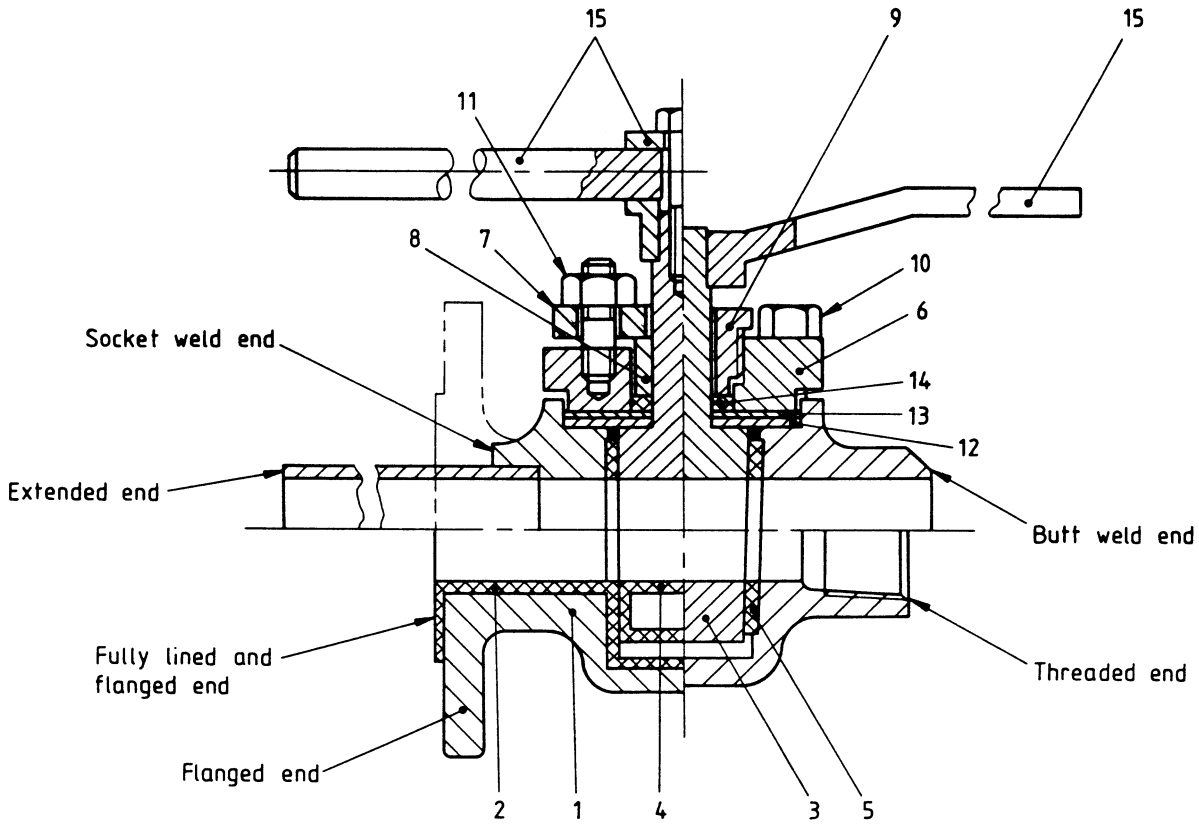
Part ref.	Name of part
1	Body
2	Plug
3	Cover
4	Gland (one piece)
5	Gland (screwed type)
6	Injector screw (for stick lubricant/sealant)
7	Combination injector (for stick gun lubricant/sealant)
8	Gland bolting
9	Cover bolting
10	Gland bush
11	Check valve
12	Packing ring
13	Packing
14	Gasket or joint ring
15	Shim
16	Stem
17	Gland flange
18	Gland
19	Plug facing

Figure 5 — Lubricated plug valve. Taper plug



Part ref.	Name of part	Part ref.	Name of part
1	Body	11	Adjusting screw
2	Plug	12	Adj. screw cover
3	Cover	13	Sealant screw
4	Stem	14	Check valve
5	Gland	15	Stop collar
6	Equaliser	16	Packing
7	Gasket	17	Balance system
8	Diaphragm	18	Cover cap screw
9	Diaphragm	19	Gland cap screw
10	Thrust button	20	Stop pin

Figure 6 — Lubricated plug, taper plug, pressure balanced



Part ref.	Name of part	Part ref.	Name of part
1	Body	9	Gland nut
2	Body lining	10	Cover bolting
3	Plug	11	Gland bolting
4	Plug lining	12	Seal
5	Body sleeve (body seat)	13	Diaphragm
6	Cover	14	Gland packing
7	Gland flange	15	Wrench
8	Gland		

Figure 7 — Soft seated plug valve

blank

Publications referred to

BS 21, *Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions).*

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 1452, *Specification for grey iron castings.*

BS 1501, *Steels for unfired and fired pressure vessels: plates.*

BS 1501-1, *Specification for carbon and carbon manganese steels.*

BS 1501-2, *Specification for alloy steels.*

BS 1501-3, *Corrosion and heat resisting steels. Imperial units.*

BS 1502, *Specification for steels for fired and unfired pressure vessels: sections and bars.*

BS 1560, *Circular flanges for pipes, valves and fittings (Class designated).*

BS 1560-3, *Steel, cast iron and copper alloy flanges.*

BS 1560-3.1, *Specification for steel flanges.*

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

BS 1600-2, *Metric units.*

BS 1768, *Specification for Unified precision hexagon bolts, screws and nuts (UNC & UNF threads). Normal series.*

BS 1769, *Specification for Unified black hexagon bolts, screws and nuts (UNC & UNF threads). Heavy series.*

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.*

BS 2633, *Specification for Class I arc welding of ferritic steel pipework for carrying fluids.*

BS 2693, *Specification for screwed studs.*

BS 2693-1, *General purpose studs.*

BS 3600, *Specification for dimensions and masses per unit length of welded and seamless steel pipes and tubes for pressure purposes.*

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.*

BS 4439, *Specification for screwed studs for general purposes. Metric series.*

BS 4504, *Circular flanges for pipe, valves and fittings (PN designated).*

BS 4504-3, *Steel, cast iron and copper alloy flanges.*

BS 4504-3.1, *Specification for steel flanges.*

BS 4677, *Specification for arc welding of austenitic stainless steel pipework for carrying fluids.*

BS 4882, *Specification for bolting for flanges and pressure containing purposes.*

BS 5146, *Inspection and test of valves.*

BS 5146-1, *Specification for steel valves for the petroleum, petrochemical and allied industries.*

BS 5158, *Specification for cast iron and carbon steel plugs for general purposes*[2)].

BS 5383, *Specification for material identification of steel, nickel alloy and titanium alloy tubes by continuous character marking and colour coding of steel tubes.*

BS 5418, *Specification for marking of general purpose industrial valves.*

BS 5500, *Specification for unfired fusion welded pressure vessels.*

BS 5750, *Quality systems*[2)].

BS 5840, *Valve mating details for actuator operation.*

BS 5840-1, *Specification for flange dimensions and characteristics.*

BS 6683, *Guide to installation and use of valves.*

[2)] Referred to in the foreword only.

BS 6755, *Testing of valves.*
BS 6755-1, *Specification for production pressure testing requirements.*
BS 6755-2, *Specification for fire-type-testing requirements.*
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).*
ANSI/ASME B36.10M, *Welded and seamless wrought steel pipe.*

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