

Specification for

Cast iron flanged pipes and flanged fittings

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Contents

	Page
Co-operating organizations	Inside front cover
Foreword	ii
Section 1. General	
1 Scope	1
2 Definitions	1
3 Lengths and dimensions	1
4 Marking	1
5 Quality of metal used in casting pipes and fittings	2
6 Quality control	2
7 Mode of casting	2
8 Removal from moulds	2
9 Freedom from defects	2
10 Test for straightness and uniformity	2
11 Length of standard pipes	2
12 Tolerances on lengths and dimensions of castings	3
13 Flanges	3
14 Hydrostatic test	4
15 Coating	4
16 Weighing and marking of weights	5
17 Permissible weight deviations	5
18 Inspection	5
19 Manufacturer's certificate	5
20 Testing facilities	5
Section 2. Specific Requirements	
Table 1 — Tolerances on lengths and dimensions	3
Table 2 — Flanges to BS 10 related to class of pipe or fitting	3
Table 3 — Hydrostatic test pressures	4
Table 4 — Standard nominal internal diameters, thicknesses and external diameters for straight pipes and fittings	6
Table 5 — Weight per foot of plain barrel and flange weights	7
Table 6 — Overall lengths of standard pipes	7
Table 7 — Weights of standard pipes	8
Table 8 — Dimensions of flanges	9
Table 9 — Dimensions of bends, equal crosses, flanged sockets and flanged spigots	10
Table 10 — Weights of bends, equal crosses, flanged sockets and flanged spigots	12
Table 11 — Weights of flanged sockets and flanged spigots having external diameters as previously specified for Class AB in BS 78:1938 (non-preferred)	14
Table 12 — Dimensions of tees, radial tees and tapers	15
Table 13 — Weights of tees, radial tees and tapers	22
Table 14 — Dimensions and weights of angle branches	26
Table 15 — Dimensions and weights of duckfoot bends	31
Table 16 — Dimensions and weights of blank flanges	32

Foreword

This standard makes reference to the following British Standards:

BS 10, *Flanges and bolting for pipes, valves and fittings*.

BS 18, *Methods for tensile testing of metals*.

BS 78, *Cast iron spigot and socket pipes (vertically cast) and spigot and socket fittings — Part 1: Pipes — Part 2: Fittings*.

BS 1452, *Grey iron castings*.

This revised British Standard, authorized by the Iron and Steel Industry Standards Committee, is a companion to BS 78, “*Cast iron spigot and socket pipes (vertically cast) and spigot and socket fittings*”.

This revision follows upon the revision of BS 10, “*Flanges and bolting for pipes, valves and fittings*”, and of BS 78, “*Cast iron spigot and socket pipes (vertically cast) and spigot and socket fittings*”.

The flange details therefore now conform to the requirements of the 1962 edition of BS 10, and to emphasize this the flanges are now classified by the appropriate table reference of that standard.

Only two classes of fittings, AB and CD, are specified as against four for pipes. The specified thicknesses and pressures conform to the last letter of the classification code, that is B and D respectively, though the AB fittings are intended for use with Class A or B pipes, and the CD fittings with Class C or D pipes.

NOTE 1 Metric equivalents of British units are not given in this standard. Some of the nominal dimensions of pipes manufactured in metric units and British units overlap and it would therefore be very confusing if metric equivalents were given when the equivalent of a British size was only slightly different from the actual metric size. However, to assist a reader more familiar with metric than British units, conversion factors are given in an appendix.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 34, an inside back cover and a back cover.

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

Section 1. General

1 Scope

This British Standard deals with cast iron flanged pipes and flanged fittings. It covers four classes of pipes and two classes of fittings tested to the pressures specified in Clause 14.

NOTE Standard pipes having overall lengths in accordance with Table 6, in sizes 2 in to 24 in inclusive, are no longer generally available with cast-on flanges. Pipes of substantial length are now generally manufactured from spun iron pipe barrels with flanges screwed-on; details of these pipes are available from manufacturers. Short straight flanged pipes, in sizes 2 in to 24 in inclusive, are still available with cast-on flanges; lengths may vary dependent on the source of supply but are generally not longer than 2 ft 6 in for sizes up to and including 10 in and 3 ft 3 in for larger sizes.

2 Definitions

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

2.1

straight pipe

a pipe of uniform bore, straight in the axis, with a flange at each end, of standard or non-standard length

2.2

standard pipe

a straight pipe of standard length

2.3

fitting

any casting other than a straight pipe

NOTE Under this definition are included all the fittings detailed in Table 4–Table 15 of this specification.

2.4

casting

the term “casting” is used in this specification to cover generally items defined in 2.1 to 2.3 above

3 Lengths and dimensions

The lengths and dimensions of the castings shall be in accordance with the appropriate tables in Section 2, except that the length of straight pipe, not of standard length, shall be specified by the purchaser.

4 Marking

Each casting shall have cast on it the class letter, manufacturer’s name or identification mark, the last two digits of the year of manufacture, and the number of this standard.

The marking shall be adjacent to the flange.

Pipes shall have cast on them, in addition, the nominal internal diameter in inches, and fittings shall have cast on them marks indicating the following:

Bends. The nominal internal diameter in inches, and the angle, in degrees, subtended by the bend. Bends having nominal internal diameters greater than 4 in shall also include in the marking the letter “S” or “M” to indicate short or medium bends, as appropriate.

Tees, crosses and angle branches. The nominal internal diameter in inches of the main body and of the branch.

Taper. The nominal internal diameter in inches at each end (see also the note to the drawings accompanying Table 12).

Blank flanges. The nominal internal diameter in inches of the corresponding pipe together with the letter representing the appropriate table of BS 10, i.e. A, D or E, with which the flange complies as regards thickness and drilling.

NOTE The mark “BS 2035” on or in relation to the product is a claim by the manufacturer that it complies with the requirements of the standard.

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5 Quality of metal used in casting pipes and fittings

The metal used for the manufacture of the castings shall be good quality grey cast iron, having a tensile strength of not less than 10 tonf/in² on a test piece of ½ in² cross-sectional area and machined from a 1.2 in diameter parallel bar as cast, to conform to the recommended dimensions for standard proportional round test pieces given in BS 18¹⁾.

The metal shall be prepared at the discretion of the manufacturer in a cupola, active mixer or other suitable furnace.

NOTE 1 The tensile strength of 10 tonf/in² is equivalent to cast iron conforming with Grade 10, BS 1452, “Grey iron castings”.

NOTE 2 The tensile strength obtained on the test bar represents the quality of the metal from which the pipes are cast and is not necessarily an indication of the tensile strength of the castings themselves.

6 Quality control

The manufacturer shall undertake to cast each day, as required for metallurgical control, tensile test bars from the same metal as that used for the castings.

The manufacturer shall keep records of the tensile tests made and these records shall be available for inspection by the purchaser or his representative.

7 Mode of casting

All castings shall be cast in sand moulds in such a manner as to ensure their soundness. Any head of metal shall afterwards be removed and the finished casting left to the dimensions and shape required.

8 Removal from moulds

The castings shall not be removed from their sand moulds until cooling has proceeded sufficiently to avoid casting strains, cracking or other injury.

9 Freedom from defects

The finished castings shall be sound, free from defects, smooth and readily machineable. All lumps or rough places shall be removed from the surfaces.

By agreement between the manufacturer and the purchaser or his representative, defects may be rectified.

10 Tests for straightness and uniformity

Each straight pipe shall be tested for straightness and for uniformity of thickness and diameter, by being rolled on a level gantry, and by the use of suitable straightedges, gauges and callipers, which, with the gantry, shall be provided and maintained in proper condition by the manufacturer.

11 Length of standard pipes

The overall lengths of standard pipes shall be as given in Table 6, in Section 2.

¹⁾ BS 18, “Methods for tensile testing of metals”.

12 Tolerances on lengths and dimensions of castings

The tolerances on the lengths and dimensions specified in Section 2 shall be in accordance with Table 1.

Table 1 — Tolerances on lengths and dimensions

Dimensions	Permissible tolerances
Length on straight pipes and tapers of length: 6 ft and less over 6 ft and up to 9 ft over 9 ft and up to 12 ft on fittings of nominal internal diameter: 2 in up to and including 12 in 15 in up to and including 24 in 27 in up to and including 48 in	$\pm \frac{1}{16}$ in $\pm \frac{3}{32}$ in $\pm \frac{1}{8}$ in $\pm \frac{1}{16}$ in $\pm \frac{3}{32}$ in $\pm \frac{5}{32}$ in
Thickness of wall of flange	– 12½ per cent of thickness given in the tables $\pm (0.05t^a + 0.03)$ in
External diameter of straight pipes	± 0.08 in
^a t = thickness of flange given in the tables.	

13 Flanges

The dimensions and drilling of the flanges, shall, unless otherwise specified by the purchaser, conform to the appropriate table of BS 10²⁾; these details are reproduced in Table 8 of this standard.

The appropriate flange table for each class of pipe or fitting shall be in accordance with Table 2.

Table 2 — Flanges to BS 10 related to class of pipe or fitting

Class of pipe or fitting	Flange table to BS 10
Class A pipe	Table A
^a Class AB fitting for use with Class A pipe	Table A
Class B pipe	Table D
^a Class AB fitting for use with Class B pipe	Table D
Class C and D pipe	Table E
Class CD fitting	Table E
^a Purchasers of Class AB fittings should specify the flange table required.	

Flanges of straight pipes shall be at right angles and concentric with the axis of the bore. The faces of the flanges shall be parallel.

The faces of the flanges of fittings shall be at right angles to the directional axes.

The faces of the flanges of flat tapers shall be at right angles to the line of the wall of shortest length.

Flanges shall be plain faced and shall be machined to a tool mark finish with a pitch of between $\frac{1}{32}$ in and $\frac{1}{20}$ in. Serrations shall be spiral or concentric.

At the junction of the back of the flange with the barrel of the casting a fillet shall be formed which shall have as large a radius as possible without encroaching upon the bearing surface of the bolt heads or that of the washers, where used, under the nuts.

All bolt holes shall be drilled unless the purchaser agrees that they be cored. The diameter of all bolt holes shall be at least $\frac{1}{16}$ in, but not more than $\frac{1}{8}$ in larger than the diameter of the bolt specified.

²⁾ BS 10, "Flanges and bolting for pipes, valves and fittings".

The bolt hole circle shall be concentric with the bore and, in fittings, the holes shall be located symmetrically off the centre-lines. In straight pipes the holes in one flange shall be located in line with those in the other.

The manufacturer shall provide metal templates corresponding in diameter, and drilled accurately with holes of the number and diameter and on the pitch circle of the diameter given in Table 7 for the appropriate class of flange. The templates shall have clearly stamped on them the letter of the appropriate BS 10 flange table, together with the number of that standard, e.g. BS 10E.

When the template is placed flat on the machined face of the flange and concentric with the bore, the holes in the template and in the flange shall coincide.

14 Hydrostatic test

Before being coated, each casting shall be hydrostatically tested by approved means at the foundry to the satisfaction of the purchaser or his representative.

a) *Test procedure.* The hydrostatic pressure shall be steadily applied and maintained sufficiently long for adequate inspection but in no case less than 15 seconds. The internal pressure imposed on the casting shall be measured by an accurate pressure gauge and means shall be provided for attaching the gauge of the purchaser or his representative.

While under the test pressure, each casting shall be smartly struck over the full length with a suitable hand hammer weighing approximately $1\frac{1}{2}$ lb. All testing shall be carried out under cover wherever possible.

b) *Test requirements.* The castings shall withstand the specified hydrostatic test pressures without showing any leakage, sweating or other defects.

c) *Hydrostatic test pressures.* The test pressures applied at works, or after installation, shall be as specified in Table 3 except that, unless the castings are being tested at works between fixed test ends, the pressures shall not exceed those specified in BS 10 for the relevant flange, i.e. Table A 100 lbf/in², Table D 200 lbf/in² and Table E 400 lbf/in².

Table 3 — Hydrostatic test pressures

Class		Hydrostatic test pressure at works		Maximum hydrostatic test pressure after installation	
Pipes	Fittings				
		ft head	lbf/in ²	ft head	lbf/in ²
A	—	300	130	200	87
B	AB	500	217	400	173
C	—	700	303	600	260
D	CD	900	390	800	347

15 Coating

Except when otherwise agreed between the purchaser and the manufacturer, all pipes and fittings shall be coated externally and internally.

Coating shall not be applied to any casting unless its surfaces are clean, dry and free from rust.

In the case of castings (wholly or partially coated) which are imperfectly coated or where the coating does not set or conform to the quality specified, the coating shall be removed, and the castings recoated.

The coating material shall set rapidly with good adherence and shall not scale off.

In all instances where the coating material has a tar or similar base, it shall be smooth and tenacious and hard enough not to flow when exposed to a temperature of 62 °C (145 °F) but not so brittle at a temperature of 0 °C (32 °F) as to chip off when scribed lightly with a penknife. For fittings for use in, or transport through, a tropical country, a temperature of 77 °C (170 °F) shall apply, instead of 62 °C (145 °F).

The inside coating shall not contain any constituent soluble in water or any ingredient which could impart any taste or odour whatsoever to potable water after sterilization and suitable washing out of the mains, unless it is specifically stated that the pipes are not to be used for conveying potable water.

All machined faces shall be thoroughly cleaned of any coating and before they have become affected by rust shall be treated with an approved protective composition.

16 Weighing and marking of weights

Each casting of 6 in nominal internal diameter and over shall be weighed, and its weight shall be stamped and distinctly marked on the body in durable paint, but castings under 6 in nominal internal diameter may, unless otherwise specified, be weighed in batches of approximately 1 680 lb.

17 Permissible weight deviations

- a) *Standard pipes*. The permissible deviations from the standard weights specified in Table 7 are minus 4 per cent or plus 6 per cent.
- b) *Straight pipes, not of standard length, and fittings*. The permissible deviations from the calculated weights of straight pipes, not of standard length, and from the weights of fittings specified in the appropriate tables are:
 - i) Flanged spigots, flanged sockets and straight pipes not of standard length ± 8 per cent
 - ii) Bends, duckfoot bends, tees, angle branches, crosses, radial tees, and blank flanges ± 10 per cent

Where castings have flanges differing from those specified at the head of the appropriate weight tables, the difference in the weights of the flanges shall be taken into account.

18 Inspection

The purchaser or his representative shall have access at all reasonable times to those parts of the works engaged on the manufacture and testing of the castings which he has ordered.

19 Manufacturer's certificate

The manufacturer shall, on request, supply to the purchaser a signed certificate stating, at the purchaser's option,

- either a) that the castings comply in all respects with the provisions of this specification,
- or b) the results of all the specified tests.

20 Testing facilities

The manufacturer shall supply, furnish and prepare the necessary test pieces, and supply the labour and appliances for such testing as may be carried out on his premises in accordance with this British Standard. If there are no facilities at his own works for making the prescribed tests the manufacturer shall arrange for the tests to be carried out elsewhere.

Section 2. Specific requirements

Table 4 — Standard nominal internal diameters, thicknesses and external diameters for straight pipes and fittings

Straight pipes and fittings

Nominal internal diameter	Class A pipes		Class B pipes Class AB fittings		Class C pipes		Class D pipes Class CD fittings		Nominal internal diameter
	Thickness	External dia.	Thickness	^a External dia.	Thickness	External dia.	Thickness	External dia.	
in	in	in	in	in	in	in	in	in	in
2	0.36	2.72	0.36	2.72	0.36	2.72	0.36	2.72	2
3	0.38	3.76	0.38	3.76	0.38	3.76	0.40	3.76	3
4	0.39	4.80	0.39	4.80	0.40	4.80	0.46	4.80	4
5	0.41	5.90	0.41	5.90	0.45	5.90	0.52	5.90	5
6	0.43	6.98	0.43	6.98	0.49	6.98	0.57	6.98	6
8	0.47	9.14	0.47	9.14	0.57	9.14	0.65	9.14	8
10	0.52	11.26	0.52	11.26	0.63	11.26	0.73	11.26	10
12	0.55	13.14	0.57	13.14	0.69	13.60	0.80	13.60	12
15	0.59	16.26	0.63	16.26	0.77	16.78	0.89	16.78	15
18	0.63	19.38	0.69	19.38	0.85	19.96	0.98	19.96	18
21	0.67	22.50	0.75	22.50	0.92	23.12	1.06	23.12	21
24	0.71	25.60	0.80	25.60	0.98	26.26	1.13	26.26	24
27	0.75	28.70	0.85	28.70	1.04	29.40	1.20	29.40	27
30	0.79	31.78	0.89	31.78	1.09	32.52	1.26	32.52	30
33	0.83	34.88	0.94	34.88	1.15	35.66	1.33	35.66	33
36	0.87	37.96	0.98	37.96	1.20	38.76	1.38	38.76	36
42	0.95	44.12	1.06	44.12	1.30	45.00	1.50	45.00	42
48	1.03	50.26	1.13	50.26	1.38	51.20	1.60	51.20	48

^a Refer to Table 9, Note 2.

Table 5 — Weight per foot of plain barrel and flange weights

(Based on a density of 0.255 lb/in³)

Nominal internal diameter	Class A pipes		Class B pipes Class AB fittings		Class C pipes		Class D pipes Class CD fittings		Nominal internal diameter
	BS 10 Table A flanges		BS 10 Table D flanges		BS Table E flanges		BS 10 Table E flanges		
	Weight per ft of barrel	Weight of flange	Weight per ft of barrel	Weight of flange	Weight per ft of barrel	Weight of flange	Weight per ft of barrel	Weight of flange	
in	lb	lb	lb	lb	lb	lb	lb	lb	in
2	8.17	3.3	8.17	3.6	8.17	4.0	8.17	4.0	2
3	12.35	5.0	12.35	5.4	12.35	5.4	12.92	5.4	3
4	16.54	7.1	16.54	7.1	16.92	7.8	19.19	7.8	4
5	21.64	9.5	21.64	9.9	23.58	10.6	26.89	10.6	5
6	27.08	11.4	27.08	11.0	30.57	11.6	35.13	11.6	6
8	39.17	15.5	39.17	15.3	46.96	17.2	53.05	17.2	8
10	53.69	23.1	53.69	24.7	64.38	24.0	73.90	24.0	10
12	66.57	27.3	68.88	28.5	85.63	28.6	98.44	28.6	12
15	88.88	41.2	94.66	44.3	118.51	44.9	135.95	44.9	15
18	113.56	53.2	123.97	62.6	156.15	61.5	178.81	61.5	18
21	140.61	72.7	156.82	87.8	196.34	86.0	224.79	86.0	21
24	169.89	91.7	190.73	104.8	238.16	111.2	272.99	111.2	24
27	201.52	82.4	227.57	128.9	283.54	154.1	325.31	134.1	27
30	235.35	88.0	264.29	162.5	329.34	167.2	378.64	167.2	30
33	271.69	99.7	306.70	193.5	381.52	216.1	438.93	216.1	33
36	310.20	115.9	348.39	228.8	433.29	236.9	495.90	236.9	36
42	394.26	128.9	438.79	284.2	546.13	301.2	627.27	301.2	42
48	487.46	164.2	533.70	346.5	660.93	360.6	762.91	360.6	48

NOTE 1 External diameters and weights per foot of barrel are not applicable to preferred Class AB flanged sockets and flanged spigots, of 30 in to 48 in nominal internal diameter inclusive. Refer to note appended to Table 9.

NOTE 2 Thicknesses of angle branches are as detailed in Table 14; where the thicknesses differ from those in Table 4 the weights per foot of barrel detailed in Table 5 are not applicable to such castings.

NOTE 3 The weight of an integrally cast flange is based on the volume of flange outside the mean external diameter of the pipe barrel, the volume of the bolt holes having been deducted.

NOTE 4 For reducing or unequal fittings the wall thickness for each outlet is related to its nominal internal diameter.

Table 6 — Overall lengths of standard pipes

Nominal internal diameter	Length of pipe
in	ft
2	6
3	9
4 to 12 inclusive	9 and 12
15 to 48 inclusive	12

Table 7 — Weights of standard pipes

(Based on a density of 0.255 lb/in³)

Nominal internal diameter	Class A		Class B		Class C		Class D		Nominal internal diameter
	BS 10 Table A flanges		BS 10 Table D flanges		BS 10 Table E flanges		BS 10 Table E flanges		
	Overall length		Overall length		Overall length		Overall length		
	9 feet	12 feet	9 feet	12 feet	9 feet	12 feet	9 feet	12 feet	
in	lb	lb	lb	lb	lb	lb	lb	lb	in
2	^a 121	^a —	^a 122	^a —	^a 122	^a —	^a 127	^a —	2
3	163	213	163	213	168	219	181	246	3
4	214	279	215	280	234	305	264	344	4
5	267	348	266	347	298	390	339	445	5
6	383	501	383	501	457	598	512	671	6
8	529	691	533	694	628	821	714	935	8
10	654	853	677	884	828	1 085	944	1 239	10
12	—	1 149	—	1 225	—	1 512	—	1 721	12
15	—	1 469	—	1 613	—	1 997	—	2 269	15
18	—	1 833	—	2 057	—	2 528	—	2 869	18
21	—	2 222	—	2 498	—	3 080	—	3 498	21
24	—	2 583	—	2 989	—	3 671	—	4 172	24
27	—	3 000	—	3 496	—	4 286	—	4 878	27
30	—	3 460	—	4 067	—	5 011	—	5 699	30
33	—	3 954	—	4 638	—	5 673	—	6 425	33
36	—	4 989	—	5 834	—	7 156	—	8 130	36
42	—	6 178	—	7 098	—	8 652	—	9 876	42
48	—	—	—	—	—	—	—	—	48

^a Weights of 2 in nominal internal diameter standard pipes 6 ft long:

	Class A	Class B	Class C	Class D	
	BS 10 Table A flange	BS 10 Table D flange	BS 10 Table E flange	BS 10 Table E flange	
	lb	lb	lb	lb	
56		56	57	57	