
British Standard

Circular flanges for pipes, valves and fittings (PN designated)

Part 3. Steel, cast iron and copper alloy flanges

Section 3.2 Specification for cast iron flanges

Brides circulaires pour tuyaux, robinets et raccords (désignées par le PN)

Partie 3. Brides en acier, en fonte et en alliage de cuivre

Section 3.2 Brides en fonte — Spécifications

Runde Flansche für Rohre, Armaturen und Formstücke (nach Nenndruckstufen)

Teil 3. Flansche aus Stahl, Gußeisen und Kupferlegierungen

Abschnitt 3.2 Flansche aus Gußeisen

Foreword

This Section of BS 4504 has been prepared under the direction of the Piping Systems Components Standards Policy Committee and constitutes the first revision of BS 4504 : Part 1 : 1969 in respect of the cast iron flanges contained in that standard which will be withdrawn 12 months after the publication of this standard and BS 4504 : Section 3.1 for steel flanges. For Class designated cast iron flanges, reference should be made to BS 1560 : Section 3.2.

To align with the format of the proposed ISO standard, ISO 7005* 'Metallic flanges', BS 4504 : Part 3 is published in three Sections:

Section 3.1 Steel flanges

Section 3.2 Cast iron flanges

Section 3.3 Copper alloy and composite flanges

This Section of BS 4504 is related to ISO 7005/2* in respect of flanges having nominal pressures PN 2.5, PN 6, PN 10, PN 25 and PN 40 covered by the international standard. The types of flanges and their dimensions are identical with those flanges of the same nominal sizes and pressures given in ISO 7005/2.

The PN 20 and PN 50 flanges given in ISO 7005/2 are related to Class designated flanges specified in BS 1560 : Section 3.2.

The flanges specified in this Section of BS 4504 are intended to be interchangeable with, but not necessarily identical in every detail to, cast iron flanges manufactured in accordance with BS 4504 : Part 1 : 1969.

This Section of BS 4504 differs from BS 4504 : Part 1 : 1969 for the content covering the cast iron requirements in the following respects.

(a) The definitions for nominal size and nominal pressure are in accordance with ISO 6708 and ISO 7268 respectively.

(b) The British Standard materials now specified are the equivalent of the ISO materials specified in ISO 7005. The range of materials has also been extended to include ASTM specifications approved for use by the UK National Committee. Additionally ductile cast iron specifications are now included.

(c) To avoid possible confusion in giving descriptive names to flange types and flange faces, all flanges are

designated by code numbers and flange facings by a letter. This system is based on international agreement but has been adapted for national use.

(d) The flange dimensions in BS 4504 : Part 1 : 1969 were based on DIN standards current at the time of publication but the essential mating dimensions in this Section of BS 4504 are in accordance with ISO 7005. The essential mating dimensions of ductile cast iron flanges given in BS 4772 are in accordance with this Section of BS 4504.

(e) The pressure/temperature ratings are in accordance with ISO 7005.

(f) Threads for threaded flanges are specified for malleable cast iron flanges only.

(g) Spot facing or back facing is in accordance with ISO 7005.

(h) The marking of flanges is basically in accordance with the principles of ISO 7005 but limitations in the methods are included.

(j) Guidance notes and non-mandatory requirements contained in the original BS 4504 : Part 1 : 1969 have been included in an information appendix (B). The appendix is not intended to be exhaustive.

The various gasket types, dimensions, design characteristics and materials are outside the scope of this standard. For dimensions of gaskets reference should be made to BS 4865 : Part 1 or Part 3, as appropriate.

The outside diameters of pipes for use with cast iron flanges are not specified in this Section of BS 4504 because diameters vary according to the method of production.

For comparison purposes the code numbers used in this Section of BS 4504 are compared with the type numbers given in BS 4504 : Part 1 : 1969 in appendix C.

Assessed capability. Users of this Section of BS 4504 are advised to consider the desirability of assessment and registration of a supplier's quality systems against the appropriate Part of BS 5750 by a third party certification body.

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

*ISO 7005/1 is in preparation, ISO 7005/2 and ISO 7005/3 are published.

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Specification

1 Scope

This Section of BS 4504 specifies requirements for PN designated, circular grey, malleable and ductile cast iron* flanges in the ranges of nominal pressure PN 2.5 to PN 40 and in nominal sizes up to DN 4000 of the types given in table 1.

Table 1. Types of cast iron flanges	
Code no.	Description
205	Blank flange
211	Weld-neck flange
212	Hubbed slip-on flange for welding
213	Hubbed threaded flange
214	Hubbed socket-weld flange
221	Integral flange
NOTE. Code numbers have been made non-consecutive to permit possible future additions.	

This Section of BS 4504 specifies the types of cast iron flanges and their facings, dimensions, tolerances, threading for malleable cast iron flanges, bolt sizes, flange face surface finish, marking, and materials for bolting and flange materials together with associated pressure/temperature ratings.

NOTE 1. To assist purchasers, appendix A lists information which should be supplied when ordering flanges.

NOTE 2. Dimensional details of attachment for welded flanges of ductile cast iron and threaded flanges of grey and ductile cast iron (see 7.1) and the routine inspection and pressure testing are outside the scope of this standard but some guidance is given in appendix B.

NOTE 3. The titles of the standards referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Section of BS 4504 the following definitions apply.

2.1 nominal size (DN). A numerical designation of size which is common to all components in a piping system other than components designated by outside diameters or by thread size. It is a convenient round number for reference purposes and is only loosely related to manufacturing dimensions.

NOTE 1. Nominal size is designated by the letters DN followed by the appropriate number.

NOTE 2. This definition is identical to that given in ISO 6708.

2.2 nominal pressure (PN). A numerical designation which is a convenient round number for reference purposes.

All equipment of the same nominal size (DN) designated by the same PN number shall have compatible mating dimensions.

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

NOTE 2. Nominal pressure is designated by the letters PN followed by the appropriate reference number.

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

3 Ranges of nominal sizes (DN)

The ranges of nominal sizes from DN 10 to DN 4000 applicable to each material, flange type and for each PN designation shall be as given in tables 2 to 4.

4 PN designations and pressure/temperature ratings

4.1 PN designations

The range of PN designations shall be PN 2.5, PN 6, PN 10, PN 16, PN 25 and PN 40.

4.2 Pressure/temperature ratings

The pressure/temperature ratings of the flanges manufactured from the materials specified in table 5 shall be as given in table 15 for grey iron, tables 16 and 17 for ductile iron and table 18 for malleable iron and shall be the maximum allowable non-shock working pressure at the temperatures shown.

NOTE 1. Linear interpolation is permitted for intermediate temperatures.

NOTE 2. The relevant pressures and temperatures are those of the fluid in the pipework system.

Bolting and temperature limitations on bolting shall be as given in table 19.

NOTE 3. The rating of flanges is not necessarily the rating of the whole pipework system. Gasket materials can also impose limitations on the pressure/temperature rating of a flanged joint and the gasket manufacturer should be consulted when selecting the material of the gasket.

4.3 Rating of flanged joints

If two flanges in a flanged joint do not have the same pressure/temperature rating, the maximum permissible working pressure of the joint at any temperature shall not exceed the lower of the two pressure ratings.

*The term 'iron' is generally used throughout industry instead of 'cast iron'. For the purposes of this British Standard the two terms are considered to be synonymous.

5 Materials

Flanges shall be manufactured from materials given in table 5.

NOTE. Where not otherwise prohibited by the applicable material standard or codes and regulations, repairs by welding are permitted for ductile iron flanges.

6 Bolting

6.1 Materials for bolting shall comply with BS 3692, BS 4190 or BS 4882 (metric), see table 19.

Free cutting steels for bolts, studbolts and nuts shall be restricted to the temperature range -10°C to 100°C and for flanges up to and including PN 16.

NOTE. For joints comprising grey cast iron flanges with raised faces, and where grey cast iron flanges are bolted to flanges of other materials and either or both of the flanges have a raised face, it is recommended that bolting having a yield strength not exceeding 240 N/mm^2 should be used. If higher strength bolting is used, it is recommended that mating flanges should have flat faces and that full face gaskets, which extend to the outside diameter of the flanges should be used. However, if grey cast iron mating flanges have flat faces, they will not comply with this Section of BS 4504 in respect of the flange thickness.

6.2 The dimensions and finish of studbolts and hexagon headed bolts with hexagon nuts shall comply with BS 4190, BS 3692, or BS 4882 as appropriate.

6.3 The dimensions and finish of studbolts with hexagon nuts shall comply with BS 4882.

6.4 Studbolts shall be of the forms shown in BS 4882 except that the form shown in figure 3(b) of BS 4882 : 1973 shall only apply to studbolts of other than alloy steel.

6.5 The dimensions of washers, when used, shall be as given in table 3 of BS 4320 : 1968.

NOTE. Black normal diameter series washers complying with BS 4320 may be used for the temperature range 0°C to 260°C . Outside these temperature limits the use of washers is not recommended.

7 Dimensions

7.1 Flange dimensions

Dimensions of each type of flange for each PN shall be as given in tables 7 to 13, and as qualified by clause 10 and the notes to tables 8 to 13, if appropriate.

NOTE 1. Neck diameters (dimension N) and corner radii (dimension R) are recommended minimum values within normal casting tolerances. The neck diameter dimensions do not apply to flanges for use with pipes and fittings to BS 4772 (see notes to tables 8 to 13 following table 13). Using larger N and R dimensions could mean spot facing or back facing of flange, see clause 10).

NOTE 2. Details of attachment for welded and threaded flanges of grey or ductile cast iron are not specified in this standard.

7.2 Tolerances

The tolerance on flange thickness (dimension C_1) for grey cast iron flanges shall be as given in table 14.

The tolerance on dimension b for ductile cast iron flanges having thickness dimension C_2 shall be:

$$\pm (1 + 0.05b)$$

$$\text{where } b = (C - f_1)$$

The tolerance on flange thickness for ductile cast iron flanges having thickness dimension C_1 shall be as given in table 14.

(see table 7 for dimension f_1 and tables 8 to 13 as appropriate for dimensions C_1 and C_2).

Tolerances on flange thickness for malleable cast iron flanges are not specified and the values of flange thickness (C_3 , C_4 and C_5 , as appropriate) given in tables 9 to 13 shall be minimum thicknesses.

The bearing surfaces for the bolting shall be parallel to the flange face within 2° maximum for grey, ductile and malleable cast iron flanges.

7.3 Threaded malleable cast iron flanges

7.3.1 The threads of threaded (code 213) malleable flanges shall be taper or parallel in accordance with BS 21 or taper in accordance with ANSI/ASME B1.20.1.

NOTE. BS 21 parallel threads will be supplied unless the purchaser specifies otherwise (see appendix A).

7.3.2 The axis of the screw thread shall be at 90° to the front face of the flange within a tolerance of $\pm 0.3^{\circ}$. Flanges shall be manufactured without a counterbore. The threads shall be chamfered to the major diameter of the thread at the back of the flange at an angle between 40° and 50° with the axis of the thread. The chamfer shall be concentric with the thread and shall be included in the measurement of the thread length provided that the chamfer does not exceed one pitch in length.

7.3.3 Gauging shall be in accordance with BS 21 or ANSI/ASME B1.20.1 as appropriate.

7.4 Bolt holes

Bolt holes shall be equally spaced on the pitch circle diameter and in the case of integral flanges, shall be positioned off-centre.

8 Flange facings

Grey cast iron flanges shall have raised faces (type B) (but see note to 6.1 for flanges where bolting having a yield strength exceeding 240 N/mm^2 is used). Ductile cast iron flanges shall have raised faces (type B) and malleable cast iron flanges shall have flat faces (type A). Facing dimensions shall be as given in table 7.

The transition from the edge of the raised face to the flange face shall be by either:

- (a) radius; or
- (b) chamfer.

9 Facing finishes

When compared by visual or tactile means with reference specimens all flange jointing faces shall be within the ranges given in table 6.

NOTE. It is not intended that instrument measurements be taken on the flange faces and the R_a and R_z values as defined in BS 1134 relate to the reference specimens.

10 Spot facing or back facing of flanges

Any spot facing or back facing shall not reduce the flange thickness to less than the thickness specified. When spot facing is used the diameter shall be large enough to accommodate the outside diameter of the equivalent normal series of washers complying with BS 4320 for the metric bolt size being fitted.

NOTE. When a flange is back faced the fillet radius at the hub may be reduced but it should not be eliminated entirely.

11 Marking

11.1 Identification

For blank flanges and where loose flanges are supplied and they do not form an integral part of a component, they shall be marked as follows.

- (a) Number of this British Standard, i.e. BS 4504*.

- (b) Flange code number, e.g. 205.
- (c) Nominal pressure (PN), e.g. PN 16.
- (d) Nominal size (DN), e.g. DN 100.
- (e) Material designation, in accordance with the grade given in table 5, e.g. 180.
- (f) Manufacturer's name or trade mark.
- (g) Thread identification for code 213 malleable cast iron flanges (see 11.2).

Example: BS 4504/212 - PN 16 - DN 300 - 420/12-XYZ

NOTE. Where a loose flange is subsequently used to form an integral part of a component and the component has a lower pressure rating than that of the flange, the lower rating should be clearly marked on the component.

11.2 Internal thread identification

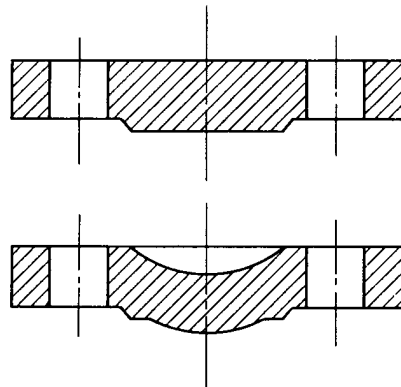
Threaded flanges (code 213) made using malleable cast iron shall be marked to indicate the type of thread used.

Threads to BS 21 shall be designated by the letter Rc or Rp as appropriate, followed by the nominal size, e.g. Rc 3/4. Threads to ANSI/ASME B1.20.1 shall be designated by the nominal size, number of threads per inch and the letters NPT, e.g. 3/4-14NPT.

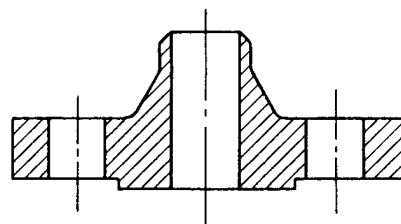
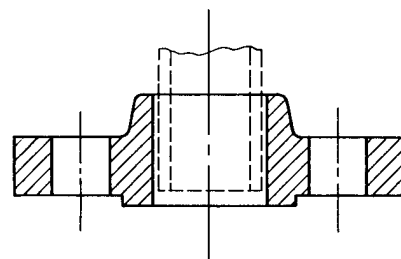
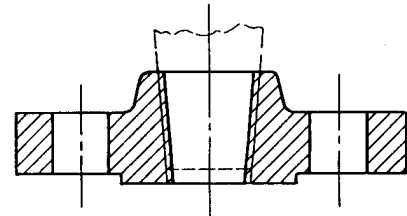
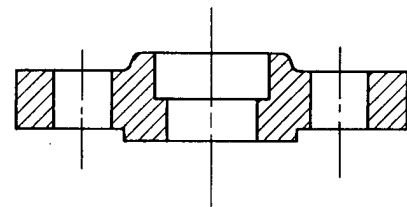
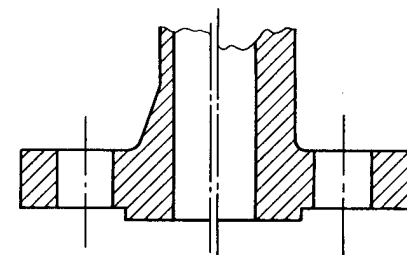
11.3 Stamping

Where steel stamps are used, the marking shall be positioned on the rim of the flange. Low stress round nosed stamps shall be used.

*Marking BS 4504, together with the flange code number, 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 this section of BS 4504. 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.



Code 205 Blank flanges

Code 211
Weld-neck flangeCode 212
Hubbed slip-on flange for weldingCode 213
Hubbed threaded flangeCode 214
Hubbed socket-weld flangeCode 221
Integral flange

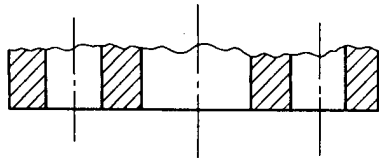
NOTE 1. Malleable cast iron flanges (codes 205, 213 and 221) have type A flat faces.

NOTE 2. The transition from the edge of the raised face to the flange face is either by radius or chamfer (see clause 8).

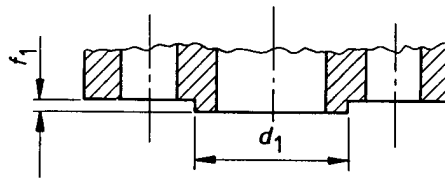
NOTE 3. Code 221 flange is an integral part of some other equipment or component.

NOTE 4. Flanges may be designated by code number or by description.

Figure 1. Flange codes



Type A
Flat face



Type B
Raised face

NOTE 1. Types A and B illustrate the types of facings which can be used in conjunction with the flanges shown in figure 1.

NOTE 2. Facings may be designated by type letter or by description.

Figure 2. Flange facings types A and B

Table 2. Synoptic table for grey iron

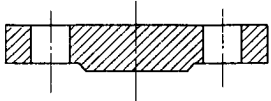
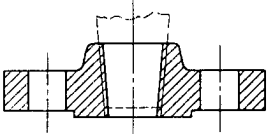
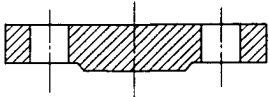
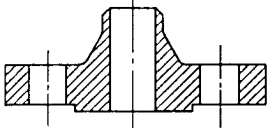
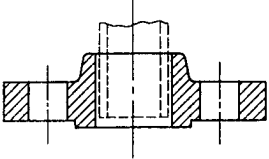
Flange and code no.	Table	DN PN	10	15	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500	600	700	800	900	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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Table 3. Synoptic table for ductile iron

Flange and code no.	Table	DN		10	15	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500	600	700	800	900	1000	1100	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200	3400	3600						
		PN																																													
Blank 																																															
	10	10							← Use PN 16 →							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X													
	11	16							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X											
	12	25							← Use PN 40 →							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X												
	13	40							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																							
Weld-neck 																																															
	10	10							← Use PN 16 →							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X													
	11	16									X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X												
	12	25									Use PN 40					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X													
	13	40									X	X	X	X	X	X	X	X	X	X	X	X	X	X																							
Hubbed slip-on 																																															
	10	10							← Use PN 16 →							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X													
	11	16									X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X												
	12	25									Use PN 40					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X													
	13	40									X	X	X	X	X	X	X	X	X	X	X	X	X	X																							