

Circular flanges for pipes, valves and fittings (Class designated) —

**Part 3: Steel, cast iron and copper alloy
flanges —**

**Section 3.2 Specification for cast iron
flanges**

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Committees responsible for this British Standard

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British Chemical Engineering Contractors' Association
 British Compressed Gases Association
 British Fluid Power Association
 British Foundry Association
 British Gas plc
 British Malleable Tube Fittings Association
 British Maritime Technology
 British Non-ferrous Metals Federation
 British Pump Manufacturers' Association
 British Steel Industry
 British Valve and Actuator Manufacturers' Association Ltd.
 Combustion Engineering Association
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 Department of Trade and Industry (National Engineering Laboratory)
 Ductile Iron Producers' Association
 Electricity Supply Industry in England and Wales
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 Institution of Production Engineers
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Foreword

This Section of BS 1560 has been prepared under the direction of the Piping Systems Components Standards Policy Committee and constitutes a new Section of BS 1560 for Class designated cast iron flanges. For PN designated cast iron flanges, reference should be made to BS 4504-3.2.

This Section of BS 1560 is related to ISO 7005-2 published by the International Organization for Standardization (ISO) in respect of flanges having nominal pressures PN 20 and PN 50 covered by the international standard. The types of flanges are identical to those flanges given in ISO 7005-2 but differences exist for some dimensions, pressure/temperature ratings and the ranges of nominal sizes.

To align with the format of ISO 7005, BS 1560-3 is published in three Sections:

- *Section 3.1: Specification for steel flanges;*
- *Section 3.2: Specification for cast iron flanges;*
- *Section 3.3: Specification for copper alloy and composite flanges.*

British Standards for flanges once included details of Class 125 and Class 250 cast iron flanges which were used in the petroleum industry and which complied with BS 1575 and BS 1576. These standards have been with-drawn. Latterly, product standards have usually made reference to the applicable ANSI standards published by the American National Standards Institute, i.e. ANSI B16.1 or ANSI B16.42 from which this Section of BS 1560-3 has evolved via the ISO/TC 5/SC 10 work.

The flanges specified in this Section of BS 1560 have compatible mating dimensions with steel flanges complying with BS 1560-3.1. Until such time as all 3 parts of ISO 7005 are published and this Section of BS 1560 is revised, this Section of BS 1560 specifies flanges having inch bolt sizes and bolt holes as specified in BS 1560-3.1.

The principles adopted in the preparation of BS 1560-3.2 are in accordance with the following.

- a) Dimensions, other than mating dimensions, are based on ISO 7005-2 for PN 20 (Class 125 and Class 150) and PN 50 (Class 250 and Class 300) flanges.

The maximum size of flange specified in BS 1560-3.2 has been limited to 24 in (DN 600) whereas ISO 7005-2 covers flanges up to 36 in (DN 900). However, dimensions for flanges of sizes 1 in (DN 25) up to and including 24 in (DN 600) are in accordance with ISO 7005-2. In addition, ½ in and ¾ in sizes have been included in this Section of BS 1560 for Class 125 integral flanges in grey cast iron and Class 150 integral flanges in ductile cast iron, neither of which is included in ISO 7005-2.

The outside diameters of pipes for use with cast iron flanges are outside the scope of this Section of BS 1560 because diameters vary according to the method of production.

- b) Mating dimensions for bolt holes and bolt sizes are compatible with those given in BS 1560-3.1.
- c) With the exception of those for ductile cast iron flanges complying with grades 500-7 and 600-3 of BS 2789 and grade 420/5 of BS 4772 (see Table 10), pressure/temperature ratings are in accordance with ISO 7005-2.
- d) Surface finish and spot facing or back facing are in accordance with ISO 7005-2 but, in addition, cast surfaces are permitted for flange faces.
- e) Flanges have been additionally designated by code numbers to maintain harmonization with BS 4504-3.2 and BS 1560-3.1 which are based on the principles agreed internationally for designating flanges by type numbers.

Guidance notes and recommendations have been included in an inforatory appendix. Appendix B 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 7076-1 and BS 7076-3.

This standard specifies inch bolting only and the use of metric bolting is outside the scope. However, for information Appendix C gives the proposed metric bolt sizes to be used in lieu of the inch sizes specified. Users of metric bolting should note that bolt hole clearances will be reduced.

Assessed capability. Users of this Section of BS 1560 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.

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 16, 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.

1 Scope

This Section of BS 1560 specifies requirements for circular grey and malleable cast iron flanges having Class 125 and Class 250 designations and ductile cast iron¹⁾ flanges having Class 150 and Class 300 designations. The flanges are in the range of nominal sizes ½ in to 24 in and of the type given in Table 1.

Table 1 — Types of grey, malleable and ductile cast iron flanges

Code no. ^a	Description
205	Blank flange
212	Hubbed slip-on flange for welding
213	Hubbed threaded flange
215	Loose hubbed flange for lapped pipe end
221	Integral flange
NOTE 1 Figure 1 illustrates flanges according to description and code numbers.	
NOTE 2 Flanges may be designated by description or code numbers.	
^a Code numbers have been made non-consecutive to permit possible future additions.	

This Section of BS 1560 specifies the types of cast iron flanges and their facings, dimensions, bolt sizes, flange face surface finish, marking, materials for bolting and flange materials together with their 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 (code 212) and threaded flanges of grey and ductile cast iron (code 213) attached to ductile and grey cast iron pipes to BS 4772 and BS 4622 (see 7.1) and their routine inspection and pressure testing are outside the scope of this Section of BS 1560 but some guidance is given in Appendix B.

NOTE 3 The titles of the publications referred to in this standard are listed on page 17.

2 Ranges of nominal sizes

The range of nominal sizes from ½ in to 24 in applicable to each flange code and for each Class designation shall be as given in Table 2 and Table 3.

3 Class designations and pressure/temperature ratings

3.1 Class designations

The range of Class designations of flanges shall be as follows:

- Class 125 (grey cast iron);
- Class 125 (malleable cast iron);
- Class 150 (ductile cast iron);

d) Class 250 (grey cast iron);

e) Class 300 (ductile cast iron).

NOTE Class 125 and Class 150 flanges have compatible mating dimensions as do Class 250 and Class 300 flanges. The Class designations used originate from related ANSI standards (see foreword).

3.2 Pressure/temperature ratings

The pressure/temperature ratings of flanges manufactured from the materials specified in Table 4 shall be as given in Table 9 for grey cast iron and malleable cast iron and Table 10 and Table 11 for ductile cast iron and shall be the maximum allowable non-shock working gauge pressure at the temperatures shown.

NOTE 1 Linear interpolation is permitted for immediate temperatures. The relevant pressures and temperatures are those of the fluid in the pipework system.

NOTE 2 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.

Bolting and temperature limitations on bolting shall be in accordance with Table 12.

3.3 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 flange ratings.

4 Materials

Flanges shall be manufactured from the materials given in Table 4.

5 Bolting

5.1 Materials for bolting shall be in accordance with BS 1768, BS 1769 or BS 4882 (inch) as appropriate (see Table 12 for grades and temperature limitations).

Free cutting steels for bolts, studbolts and nuts shall not be used.

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/mm² should be used. If higher strength bolting is used, it is recommended that the 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 Class 250 grey cast iron mating flanges have flat faces, they will not comply with this Section of BS 1560 in respect of the flange thickness.

5.2 Bolt sizes shall be as given in Table 7 and Table 8, as appropriate.

¹⁾ 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.

5.3 The dimensions and finish of hexagon-headed bolts with hexagon nuts shall comply with BS 1768, BS 1769 or BS 4882 (inch) as appropriate.

5.4 Studbolts with hexagon nuts shall comply with BS 4882 except that the form shown in Figure 3 b) of BS 4882:1973 shall apply only to studbolts of material other than alloy steel.

5.5 The mating surfaces of all bolt heads and nuts shall be full faced.

5.6 The dimensions of washers, when used, shall be in accordance with BS 3410.

6 Repairs

Repairs by welding to ductile cast iron flanges shall be permitted unless otherwise prohibited by the applicable material standard.

7 Dimensions

7.1 Flange dimensions

Flanges shall have the dimensions appropriate to their nominal sizes, types and Class designations as given in Table 6, Table 7 and Table 8 and as qualified by clause 10 and the notes to Table 7 and Table 8, if appropriate.

NOTE 1 Hub diameters (dimension N) are recommended minimum values within normal casting tolerances. Using larger N dimensions may require spot or back facing of flanges (see clause 10).

NOTE 2 Hub diameters (dimension N) and hub lengths (dimension H_1) given in Table 7 and Table 8 for code 213 threaded flanges do not apply to flanges for attaching to grey iron pipe barrels to BS 4622 or ductile iron pipe barrels to BS 4772.

NOTE 3 Details of attachment of code 213 grey iron and ductile iron threaded flanges to pipe barrels to BS 4622 and BS 4772 and of code 212 ductile iron hubbed slip-on flanges for welding to pipe barrels to BS 4772 are not given in this Section of BS 1560.

7.2 Threaded flanges

7.2.1 The threads of code 213 threaded flanges, except for flanges for attaching to grey iron pipe barrels to BS 4622 and ductile iron pipe barrels to BS 4772, shall be taper or parallel in accordance with BS 21 or shall taper in accordance with ANSI/ASME²⁾ B1.20.1.

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

7.2.2 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.

²⁾ American Society of Mechanical Engineers.

7.2.3 Gauging shall comply with BS 21 or ANSI/ASME B.1.20.1 as appropriate.

7.3 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

Class 125 grey cast iron flanges shall have flat faces (type A, see Figure 2). Class 250 grey cast iron flanges shall have raised faces (type B, see Figure 2) (but see note to 5.1 for flanges where bolting having a yield strength exceeding 240 N/mm² is used). Class 150 and Class 300 ductile cast iron flanges shall be manufactured with either raised or flat faces (see note). Class 125 malleable cast iron flanges shall have flat faces. Facing dimensions for raised face flanges shall be as given in Table 6.

NOTE Class 250 grey cast iron and Class 150 and Class 300 ductile cast iron flanges are usually manufactured with raised faces. However, for special applications they are sometimes used with flat faces and it is therefore essential that the purchaser specifies the requirement for flat faces in accordance with Appendix A.

For raised faces (flange facing type B, see Figure 2) the transition from the raised face diameter 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 5.

NOTE It is not intended that instrument measurements be taken on faces themselves 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 3410 for the inch bolt size being fitted.

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

11 Marking

11.1 Identification

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

- a) the number of this British Standard, i.e. BS 1560³⁾;
- b) flange code number, e.g. 205;
- c) Class designation, e.g. 125;
- d) nominal size (inch), e.g. 8;
- e) material designation using the grades given in Table 4;
- f) manufacturer's name or trade mark;
- g) thread identification for code 213 malleable cast iron flanges (see 11.2).

Example:

BS 1560/212 – 300 – 2½ – 420/12 – XYZ

NOTE Where a 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

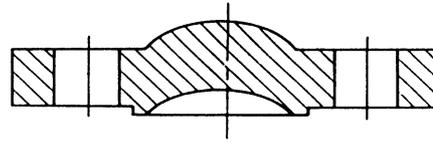
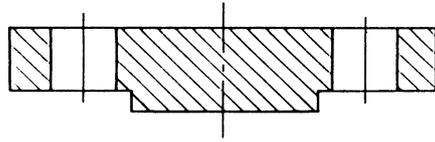
Threaded flanges (code 213), except for flanges for attachment to grey cast iron pipes in accordance with BS 4622 and ductile cast iron pipes in accordance with BS 4772, shall be marked to indicate the type of thread used.

Flanges with threads to BS 21 shall be marked Rc or Rp as appropriate followed by the nominal size of the thread, e.g. Rc ¾. Flanges with threads to ANSI/ASME B1.20.1 shall be marked with the nominal size of thread, number of threads per inch and the letters NPT, e.g. ¾ – 14NPT.

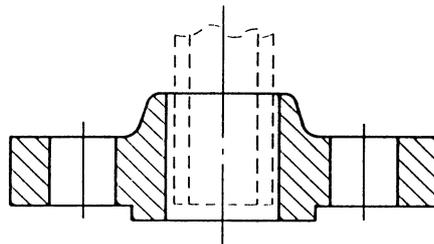
11.3 Stamping

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

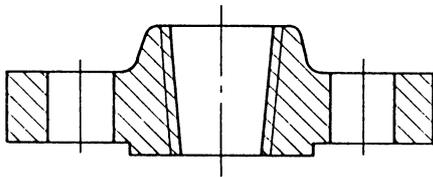
³⁾ Marking BS 1560, together with the flange code number, on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of this Section of BS 1560. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may be desirable.



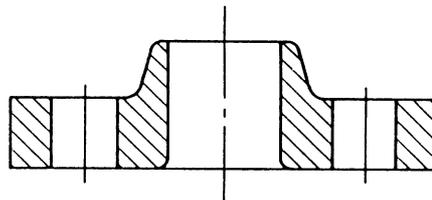
Code 205
Blank flange



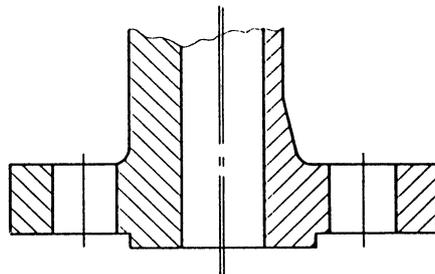
Code 212
Hubbed slip-on flange for welding



Code 213
Hubbed threaded flange



Code 215
Loose hubbed flange for lapped pipe end



Code 221
Integral flange

NOTE 1 Certain flanges made in certain materials have flat faces (see clause 8 and Figure 2).

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 Codes 212, 213 and 215 comprise flanges incorporating a hub.

NOTE 4 A code 221 flange is an integral part of some other equipment or component.

NOTE 5 Flanges may be designated by code numbers or by description.

Figure 1 — Flange codes

Table 2 — Synoptic table for grey cast iron and malleable cast iron flanges

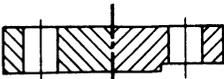
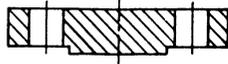
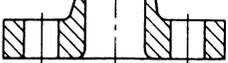
Flange	Code number	Class designation	Nominal in size																				
			½	¾	1	1¼	1½	2	2½	3	4	5	6	8	10	12	14	16	18	20	24		
 Blank	205																						
		125 grey			×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	
		250 grey			×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	
		125 malleable			×	×	×	×	×	×	×	×	×	×	×	×							
 Hubbed threaded	213																						
		125 grey			×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	
		250 grey			×	×	×	×	×	×	×	×	×	×	×	×	×	×					
		125 malleable			×	×	×	×	×	×	×	×	×										
 Integral	221																						
		125 grey	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	
		250 grey			×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
		125 malleable			×	×	×	×	×	×	×	×	×	×	×								

Table 3 — Synoptic table for ductile cast iron flanges

Flange	Code number	Class designation	Nominal in size																			
			½	¾	1	1¼	1½	2	2½	3	4	5	6	8	10	12	14	16	18	20	24	
 Blank	205																					
		150			×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
		300			×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
 Hubbed slip-on for welding	212																					
		150			×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
		300			×	×			×	×	×	×	×	×	×	×	×	×	×	×	×	×
 Hubbed threaded	213																					
		150			×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
		300			×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
 Loose hubbed for lapped pipe end	215																					
		150			×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
		300			×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
 Integral	221																					
		150	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
		300			×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×

NOTE These flanges may be manufactured with flat faces (see clause 8 and Figure 2).

Table 4 — Materials

Type	Standard	Grade
Grey cast iron (GI)	For flanges up to 12 in (DN 300) nominal size:	
	BS 1452	180
	BS 1452	220
	ASTM A126	A
	ASTM A126	B
	For flanges of 14 in (DN 350) and greater:	
Ductile cast iron ^a (DI)	BS 4772	420-5 ^b
	BS 2789	600-3
	BS 2789	500-7
	BS 2789	420-12
	BS 2789	400-18
	ASTM A395	414-18
Malleable cast iron (MI)	BS 6681	B30-06
	BS 6681	B32-10
	BS 6681	B35-12
	ASTM A47	32510
	ASTM A338	32510

^a Ductile cast irons are generally considered to be weldable but before welding these materials guidance should be sought from the manufacturer.

^b The term "Grade 420-5" for convenience is used in this Section of BS 1560. "Grade 420-5" refers to material having a minimum tensile strength of 420 N/mm² and a minimum elongation of 5 % and is the same as that specified in Table 7 of BS 4772:1988.

Table 5 — Surface finish of flange faces

Manufacturing process	R_a^a	R_z^a
	μm	μm
Turning ^b	3.2 to 12.5	12.5 to 50
Other machining processes	3.2 to 6.3	12.5 to 25
Cast surface ^c	3.2 to 25	

NOTE When selecting gaskets for flanged joints reference should be made to the recommendations in BS 7076-1 or BS 7076-3, as appropriate, that account be taken of operating conditions, the properties of gasket materials, flange bolt loading and surface finish of flange faces.

^a R_a and R_z are defined in BS 1134.

^b "Turning" covers any method of machine operation producing either serrated concentric or serrated spiral grooves.

^c "Cast surface" covers surfaces produced by moulding processes where the resultant castings may or may not be subjected to shot or grit blast cleaning operations. Such surfaces are assessed using roughness comparison specimens complying with BS 2634-3. Cast surfaces may have serrated concentric grooves to enhance gasket sealing efficiency. Cast surfaces are normally used for applications where joints incorporate gaskets of readily deformable material, e.g. rubber (see note).

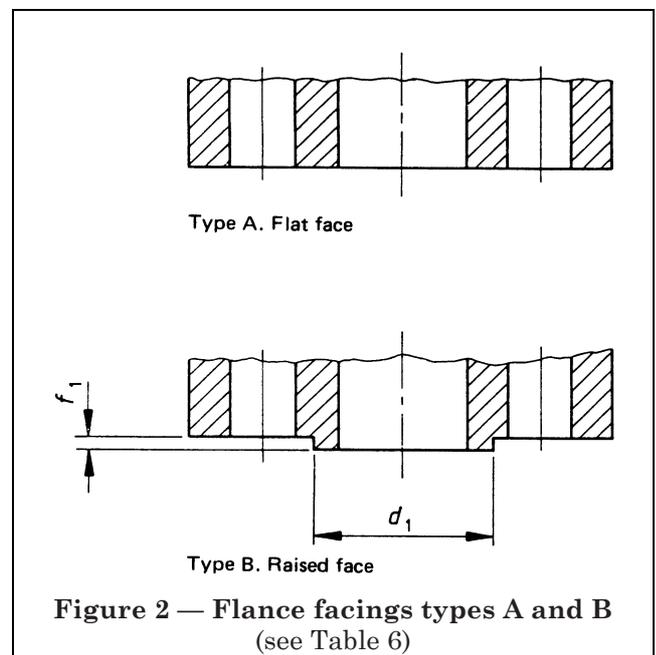
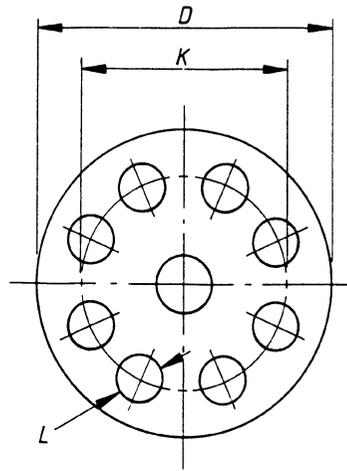
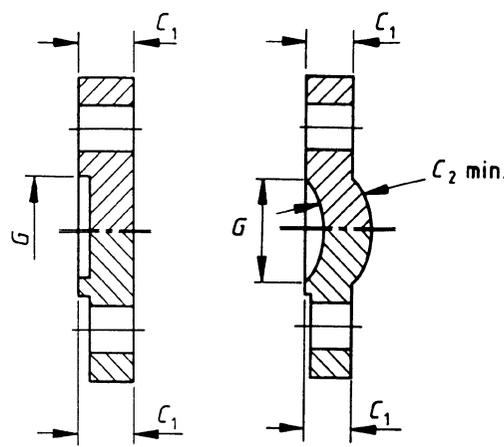


Table 6 — Facing dimensions (see Figure 2)

Nominal size		Class 150 Class 300		Class 250	
in	DN	d_1	f_1	d_1	f_1
½	15	35	2	—	—
¾	20	43	2	—	—
1	25	51	2	68	2
1¼	32	64	2	77	2
1½	40	73	2	90	2
2	50	92	2	106	2
2½	65	105	2	125	2
3	80	127	2	145	2
4	100	157	2	176	2
5	125	186	2	211	2
6	150	216	2	246	2
8	200	270	2	303	2
10	250	324	2	357	2
12	300	381	2	418	2
14	350	413	2	481	2
16	400	470	2	535	2
18	450	533	2	592	2
20	500	584	2	649	2
24	600	692	2	770	2

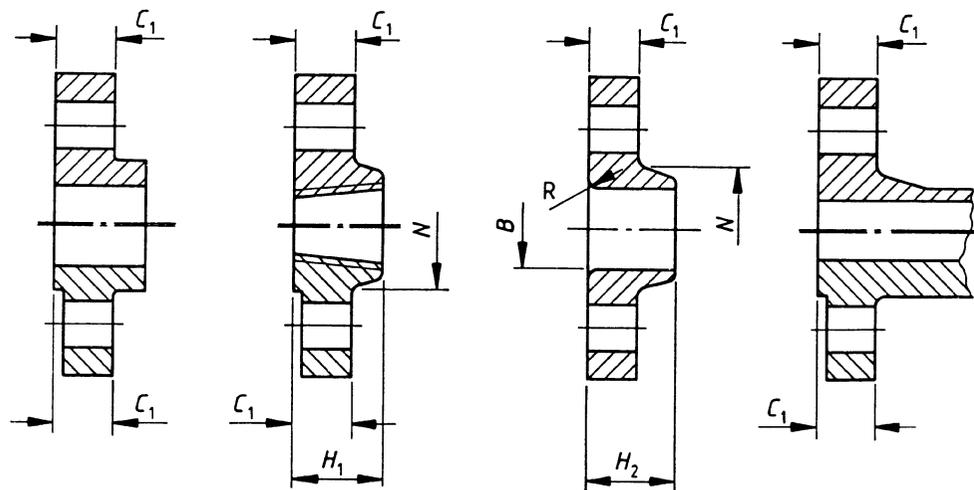


This diagram illustrates the arrangement but not necessarily the correct number of bolt holes.



Code 205
Blank flange

Grey and malleable iron blank flanges are supplied flat up to DN 250 and dished or domed for DN 300 and greater. Ductile iron blank flanges are supplied flat up to DN 250 and optionally flat, dished or domed for DN 300 and greater. The raised face is permitted to be either on the concave or convex side of dished blank flanges.



Code 212
Hubbed slip-on
flange for welding

Code 213
Hubbed threaded
flange

Code 215
Loose hubbed
flange for lapped
pipe end

Code 221
Integral flange

NOTE 1. For facing dimensions, see table 6.

NOTE 2. Dimension *N* is measured at the intersection of the projections of the hub draft angle and the back face of the flange.

Figure 3 — Dimensions of Class 125 and Class 150 flanges (see Table 7)

Table 7 — Dimensions of Class 125 grey cast iron (GI) and malleable cast iron (MI) flanges and Class 150 ductile cast iron (DI) flanges (see Figure 3)

Nominal size	Outside diameter of flanges		Mating dimensions				Flange thickness (minimum)					Hub diameter ^a		Length of hub (minimum)		Bore (minimum)	Corner radius	Diameter of port Radius of dish	Thickness of dish (minimum)				
			Diameter of bolt circle	Diameter of bolt holes ^b	Number of bolts	Nominal diameter of bolts	C_1					N		H_1	H_2					B	R	G	C_2
							GI	DI	MI	MI	MI	MI, GI, DI	D1										
Codes affected		All codes				All codes	All codes	Code 205	Code 213	Code 221	Code 213 ^c	Code 215	Code 213 ^c	Code 215	Code 215	Code 215	Code 215	Code 205	Code 205				
in	DN ^d	mm	mm	in (mm)		in	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm				
½ ^e	15	89	60.3	¾ (15.9)	4	½	11.0	14.0															
¾ ^e	20	98	69.8	¾ (15.9)	4	½	11.0	14.0															
1	25	108	79.4	¾ (15.9)	4	½	11.0	14.0	11.0	9.0	8.0	50	50	18	18	35	4	25					
1¼	32	117	88.9	¾ (15.9)	4	½	13.0	15.5	13.0	10.0	8.0	60	60	21	21	44	5	32					
1½	40	127	98.4	¾ (15.9)	4	½	14.5	17.5	14.5	11.0	9.0	65	65	22	22	50	6	38					
2	50	152	120.6	¾ (19.0)	4	¾	16.0	19.0	16.0	13.0	11.0	80	80	25	25	63	8	51					
2½	65	178	139.7	¾ (19.0)	4	¾	17.5	22.5	17.0	17.0	13.0	90	90	28	28	76	8	64					
3	80	190	152.4	¾ (19.0)	4	¾	19.0	24.0	17.0	17.0	13.0	110	110	30	30	92	10	76					
4	100	229	190.5	¾ (19.0)	8	¾	24.0	24.0	19.0	19.0	16.0	135	135	33	33	117	11	102					
5	125	254	215.9	¾ (22.2)	8	¾	24.0	24.0	19.0	19.0	19.0	165	165	37	37	145	11	127					
6	150	279	241.3	¾ (22.2)	8	¾	25.5	25.5	21.0	21.0	21.0	190	190	40	40	172	13	152					
8	200	343	298.4	¾ (22.2)	8	¾	28.5	28.5	21.0		21.0	245	245	44	44	223	13	203					
10	250	406	362.0	1 (25.4)	12	¾	30.0	30.0	23.0		23.0	305	305	49	49	278	13	254					
12	300	483	431.8	1 (25.4)	12	¾	32.0	32.0	25.0		25.0	355	355	56	56	329	13	305	20.5				
14	350	533	476.2	1½ (28.6)	12	1	35.0	35.0				390	390	57	79	360	13	356	22.3				
16	400	597	539.8	1½ (28.6)	16	1	36.5	36.5				445	445	64	87	412	13	406	25.4				
18	450	635	577.8	1¼ (31.8)	16	1½	39.5	39.5				500	500	68	97	463	13	457	26.9				
20	500	698	635.0	1¼ (31.8)	20	1½	43.0	43.0				555	555	73	103	515	13	508	28.4				
24	600	813	749.3	1¾ (34.9)	20	1¾	48.0	48.0				660	660	83	111	616	13	610	31.7				

NOTE 1 The external diameter and thickness of the pipe to be joined to the flange should be specified by the purchaser where these dimensions affect the bore of the flange (see Appendix A).

NOTE 2 For information relating to the bore of code 221 integral flanges reference should be made to the relevant product standard.

NOTE 3 For facing dimensions see Table 6.

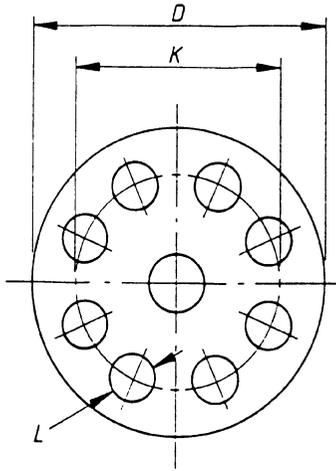
^a Hub diameters are recommended minimum values, within normal casting tolerances.

^b Metric dimensions in brackets.

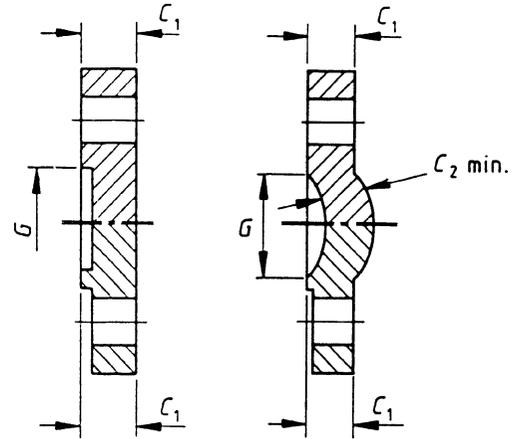
^c Not applicable to flanges for attachment to pipes to BS 4622 and BS 4772.

^d Nominal size (DN) is given for information only.

^e Applies to code 221 flanges only.

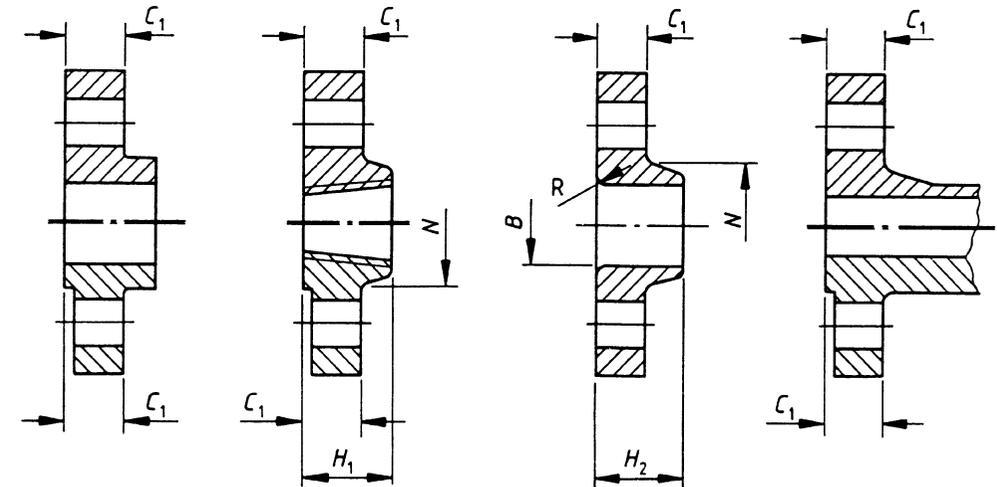


This diagram illustrates the arrangement but not necessarily the correct number of bolt holes.



Code 205
Blank flange

Grey iron blank flanges are supplied flat up to DN 200 and dished or domed for DN 250 and greater. Ductile iron blank flanges are supplied flat up to DN 200 and optionally flat, dished or domed for DN 250 and greater. The face is permitted to be either on the concave or convex side of dished blank flanges.



Code 212
Hubbed slip-on
flange for welding

Code 213
Hubbed threaded
flange

Code 215
Loose hubbed
flange for lapped
pipe end

Code 221
Integral flange

NOTE 1. For facing dimensions, see table 6.

NOTE 2. Dimension *N* is measured at the intersection of the projections of the hub draft angle and the back face of the flange.

Figure 4 — Dimensions of Class 250 and Class 300 flanges (see Table 8)

Table 8 — Dimensions of Class 250 grey cast iron (GI) flanges and Class 300 ductile cast iron (DI) flanges (see Figure 4)

Nominal size		Outside diameter of flange <i>D</i>	Mating dimensions				Flange thickness (minimum) <i>C</i> ₁	Hub diameter ^a		Length of hub (minimum)			Bore (minimum) <i>B</i>	Corner radius <i>R</i>	Diameter of port Radius of dish <i>G</i>	Thickness of dish (minimum) <i>C</i> ₂
			Diameter of bolt circle <i>K</i>	Diameter of bolt holes ^b <i>L</i>	Number of bolts	Nominal diameter of bolts		<i>N</i>		<i>H</i> ₁	<i>H</i> ₁	<i>H</i> ₂				
								GI, DI	GI	DI		DI				
Codes affected		All codes					All codes	Code 213 ^c	Codes 213 ^c & 215	Code 213 ^c	Code 213 ^c	Code 215	Code 215	Code 215	Code 205	Code 205
in	DN ^d	mm	mm	in (mm)		in	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
1	25	124	88.9	¾ (19.0)	4	¾	17.5	55	55	22	27	27	35	5	25	
1¼	32	133	98.4	¾ (19.0)	4	¾	19.0	65	65	25	27	27	44	5	32	
1½	40	156	114.3	¾ (22.2)	4	¾	20.5	70	70	28	30	30	50	6	38	
2	50	165	127.0	¾ (19.0)	8	¾	22.5	85	85	32	33	33	63	8	51	
2½	65	190	149.2	¾ (22.2)	8	¾	25.5	100	100	36	38	38	76	8	64	
3	80	210	168.3	¾ (22.2)	8	¾	28.5	120	120	40	43	43	92	10	76	
4	100	254	200.0	¾ (22.2)	8	¾	32.0	145	145	44	48	48	117	11	102	
5	125	279	235.0	¾ (22.2)	8	¾	35.0	180	180	48	51	51	145	11	127	
6	150	318	269.9	¾ (22.2)	12	¾	36.5	205	205	49	52	52	172	13	152	
8	200	381	330.2	1 (25.4)	12	¾	41.0	260	260	56	62	62	223	13	203	
10	250	444	387.4	1½ (28.6)	16	1	48.0	320	320	60	67	95	278	13	254	23.8
12	300	521	450.8	1¼ (31.8)	16	1½	51.0	375	375	65	73	102	329	13	305	25.4
14	350	584	514.4	1¼ (31.8)	20	1½	54.0	415	415	68	76	111	360	13	337	28.4
16	400	648	571.5	1½ (34.9)	20	1½	57.0	470	485	73	83	121	412	13	387	31.8
18	450	711	628.6	1½ (34.9)	24	1½	60.5		535		89	130	463	13	432	35.1
20	500	775	685.8	1½ (34.9)	24	1½	63.5		590		95	140	515	13	483	38.1
24	600	914	812.8	1½ (41.3)	24	1½	70.0		705		106	152	616	13	584	41.1

NOTE 1 The external diameter and thickness of the pipe to be joined to the flange should be specified by the purchaser where these dimensions affect the bore of the flange (see Appendix A).

NOTE 2 For information relating to the bore of code 221 integral flanges reference should be made to the relevant product standard.

NOTE 3 For facing dimensions see Table 6.

^a Hub diameters are recommended minimum value, within normal casting tolerances.

^b Metric dimensions in brackets.

^c Not applicable to flanges for attachment to pipes complying with BS 4622 and BS 4772.

^d Nominal size (DN) is given for information only.

Table 9 — Pressure/temperature ratings for grey cast iron and malleable cast iron flanges

Class	Standard	Grade	Size range	Temperature °C					
				-10 to 65	120	150	180	200	230
				Maximum non-shock gauge pressure					
125	BS 1452	180	≤ DN 300	bar ^a	bar	bar	bar	bar	bar
	ASTM A126	A		12.1	10.3	9.6	8.6		
	BS 6681	B30-06	≤ DN 300	13.8	12.1	11.4	10.3	9.8	8.6
	BS 6681	B32-10							
	BS 6681	B35-12							
	ASTM A47	32510							
	ASTM A338	32510							
	BS 1452	220							
	ASTM A126	B							
	BS 1452	220							
ASTM A126	B								
250	BS 1452	180	≤ DN 300	27.6	23.4	21.4	18.3	17.7	
	ASTM A126	A							
	BS 1452	220	≤ DN 300	34.5	28.6	25.9	23.1	20.8	17.2
	ASTM A126	B							
	BS 1452	220	300 < DN ≤ 600	20.7	17.9	16.6	15.2	14.1	
	ASTM A126	B							

^a 1 bar = 10⁵ N/m² = 10⁵ Pa.

Table 10 — Pressure/temperature ratings for ductile cast iron flanges complying with grades 500-7 and 600-3 of BS 2789 and grade 420/5 of BS 4772

Class	Temperature °C (see note)						
	-10 to 40	120	150	200	250	300	350
Maximum non-shock gauge pressure							
	bar	bar	bar	bar	bar	bar	bar
150	17.5	15.5	14.5	13.6	11.1	8.9	6.8
300	44	40.2	38.2	35.2	32.2	28.9	24.4

NOTE Ductile cast iron grade 600-3 is limited to applications up to temperatures of 120 °C.

Table 11— Pressure/temperating ratings for ductile cast iron flanges complying with grades 400-18 and 420-12 of BS 2789 and grade 414-18 of ASTM A395

Class	Temperature °C						
	-10 to 40	120	150	200	250	300	350
Maximum non-shock gauge pressure							
	bar	bar	bar	bar	bar	bar	bar
150	17.5	15.5	14.8	13.9	12.1	10.2	8.6
300	44.0	40.2	39.0	36.0	35.0	33.0	31.0

Table 12 — Bolting materials and temperature limitations

Materials		Temperature °C
British Standard	Grade/product	
BS 1768	A and B bolts O Nuts	For use at temperatures not exceeding 300 °C
BS 1769	Bolts and nuts	
BS 4882	B7M studbolts 2HM nuts	For use at temperatures up to and above 300 °C

NOTE 1 For bolting see also clause 5.
NOTE 2 Nuts of a higher strength grade than the bolts can be substituted.

Appendix A Information to be supplied by the purchaser

The following information should be supplied by the purchaser when making an enquiry or placing an order for flanges complying with this Section of BS 1560.

- a) Number and Section of this British Standard.
- b) Nominal size (in, see clause 2 and Table 2 and Table 3).
- c) Class designation (see clause 3).
- d) Flange type, by description or code number (see clause 1 and Figure 1).
- e) Facing type (see clause 8 and Figure 2).
- f) Material (see clause 4 and Table 4).
- g) External diameter and thickness of pipe (see Table 7 and Table 8).
- h) Thread required for hubbed threaded (code 213) flanges (see 7.2.1).

Appendix B Application and installation

NOTE The information in this appendix is advisory only and it is not intended to be exhaustive.

B.1 The pressure/temperature ratings specified (see clause 3 and Table 9, Table 10 and Table 11) are shown as “maximum non-shock gauge”. When a system may be subject to any shock loading the purchaser should make a suitable allowance when stating the design pressure. Some codes allow equipment to be used in installations subject to moderate shock such as may occur in well designed and efficiently operated boiler feed mains and in such cases the manufacturer should be consulted.

B.2 Materials for bolting should be selected by the user according to pressure, flange material and the selected gasket so that the flanged joint remains tight under the expected operating conditions.

B.3 Flanges may be required to be tested after attachment of a pipe or other equipment or when forming an integral part of such equipment. The test pressure is then dependent on the requirements of the appropriate standard or code of practice in accordance with which the equipment has been manufactured or fabricated. In the absence of appropriate standards or codes of practice, test pressures should not exceed 1.5 times the allowable pressure at 20 °C rounded off to the next higher 1 bar increment.

Appendix C Use of metric bolting in lieu of inch bolting

C.1 Introduction

If users prefer or require to use metric bolting in lieu of the inch bolting specified in this Section of BS 1560-3, C.3 gives the comparable metric bolt sizes that have been agreed in ISO/TC 5/SC 10 in the preparation of ISO 7005.

C.2 Gaskets

WARNING. Users should note that the centring of an inside bolt circle gasket in an assembled flange joint will be affected when using metric bolting. It is **essential** therefore that great care be taken to ensure that gaskets are centred properly.

However, with care, and dependent on the tolerances which have been used it should be possible to fit the normal inch dimensioned gasket when using metric bolting in existing inch drilled holes.

C.3 Comparable sizes

If metric bolting is to be used the comparable inch and metric sizes are as given in Table 13.

Table 13 — Nominal bolt diameter

Inch	Metric
½	M14
⅝	M16
¾	M20
⅞	M24
1	M27
1⅛	M30
1¼	M33
1½	M39

C.4 Inch/metric bolt comparisons

To enable users to ascertain precisely the differences in the two systems, Table 14 is given for reference.

Table 14 — Inch/metric bolt comparisons

Bolt diameter				Bolt hole diameter		Clearances
Inch bolting		Metric	Difference	Inch hole		Metric bolt in an inch hole
in	mm	mm	mm	in	mm	mm
½	12.70	M14	+ 1.30	⅝	15.88	1.88
⅝	15.88	M16	+ 0.12	¾	19.05	3.05
¾	19.05	M20	+ 0.95	⅞	22.23	2.23
⅞	22.23	M24	+ 1.77	1	25.40	1.40
1	25.40	M27	+ 1.60	1⅛	28.58	1.58
1⅛	28.58	M30	+ 1.42	1¼	31.75	1.75
1¼	31.75	M33	+ 1.25	1⅜	34.93	1.93
1½	38.10	M39	+ 0.90	1⅝	41.28	2.28

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 1134, *Assessment of surface texture.*
- BS 1452, *Specification for grey iron castings.*
- 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 flanges⁴⁾.*
- BS 1560-3.3, *Specification for copper alloy and composite flanges¹⁾.*
- BS 1768, *Specification for unified precision hexagon bolts, screws and nuts (UNC and UNF threads). Normal series.*
- BS 1769, *Specification for unified black hexagon bolts, screws and nuts (UNC and UNF threads). Heavy series.*
- BS 2634, *Specification for roughness comparison specimens.*
- BS 2634-3, *Cast surfaces.*
- BS 2789, *Specification for spheroidal graphite or nodular graphite cast iron.*
- BS 3410, *Specification for metal washers for general engineering purposes.*
- BS 4504, *Circular steel flanges for pipes, valves and fittings (PN designated).*
- BS 4504-3, *Steel, cast iron and copper alloy flanges.*
- BS 4504-3.1, *Specification for steel flanges¹⁾.*
- BS 4504-3.2, *Specification for cast iron flanges¹⁾.*
- BS 4504-3.3, *Specification for copper alloy and composite flanges¹⁾.*
- BS 4622, *Specification for grey iron pipes and fittings.*
- BS 4772, *Specification for ductile iron pipes and fittings.*
- BS 4882, *Specification for bolting for flanges and pressure containing purposes.*
- BS 5750, *Quality systems¹⁾.*
- BS 6681, *Specification for malleable cast iron.*
- BS 7076, *Dimensions of gaskets for flanges to BS 1560.*
- BS 7076-1, *Specification for non-metallic flat gaskets.*
- BS 7076-3, *Specification for non-metallic envelope gaskets.*
- ANSI B16.1, *Cast iron pipe flanges and flanged fittings — Class 25, 125, 250 and 800¹⁾.*
- ANSI B16.42, *Ductile iron pipe flanges and flanged fittings — Class 150 and 300¹⁾.*
- ANSI/ASME B1.20.1, *Pipe threads, general purpose.*
- ASTM A47, *Ferritic malleable iron castings.*
- ASTM A126, *Specification for grey iron castings for valves, flanges and pipe fittings.*
- ASTM A338, *Malleable iron flanges, pipe fittings, and valve parts for railroad, marine and other heavy duty service at temperatures up to 650 °C (345 °C).*
- ASTM A395, *Specification for ferritic ductile iron pressure-retaining castings for use at elevated temperatures.*
- ISO 7005, *Metallic flanges.*
- ISO 7005-2, *Cast iron flanges¹⁾.*

⁴⁾ Referred to in the foreword only.

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