

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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- British Fluid Power Association
- British Foundry Association
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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 informative 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:

- a) Class 125 (grey cast iron);
- b) Class 125 (malleable cast iron);
- c) 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.