

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

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

**Section 3.3 Specification for copper
alloy and composite 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
- Copper Development Association
- Department of Trade and Industry (National Engineering Laboratory)
- Ductile Iron Producers' Association
- Electricity Supply Industry in England and Wales
- Energy Industries Council
- Engineering Equipment and Materials Users' Association
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- High Pressure Pipework Consultative Committee
- Institution of Gas Engineers
- Institution of Mechanical Engineers
- Institution of Production Engineers
- Institution of Water and Environmental Management (IWEM)
- Water Authorities Association

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Foreword

This Section of BS 4504 has been prepared under the direction of the Piping Systems Components Standards Committee and constitutes the first revision of BS 4504-2:1974. BS 4504-2 will be withdrawn 12 months after the publication of this Section of BS 4504. For Class designated copper alloy and composite flanges, reference should be made to BS 1560-3.3.

To align with the format of the international standard, ISO 7005¹⁾, BS 4504-3 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 4504-3 is related to ISO 7005/3 published by the International Organisation for Standardization (ISO) in respect of flanges having nominal pressures PN 6, PN 10, PN 25 and PN 40 covered by the international standard. The types of flanges, their ranges of sizes and dimensions are identical to those flanges of the same nominal pressures given in ISO 7005/3.

The PN 20 and PN 50 flanges given in ISO 7005/3 are related to the Class designated flanges specified in BS 1560-3.3.

The flanges specified in this Section of BS 4504 are intended to be interchangeable with, but not necessarily identical in every detail to, flanges manufactured in accordance with BS 4504-2:1974.

The flanges specified, with the exception of integral (code 321) flanges, are for attachment to copper or copper alloy tubes in accordance with BS 2871.

This Section of BS 4504 differs from BS 4504-2:1974 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 standard now specifies eight types of flange as against six in BS 4504-2:1974. Types 23 and 26 in BS 4504-2:1974 have been deleted and codes 301, 302, 305 and 314 have been introduced.
- c) The material specifications are equivalent to those in ISO 7005/3.
- d) To avoid possible confusion in giving descriptive names to flange types and flange faces, all flanges are designated by code numbers based on internationally agreed type numbers.
- e) Flange dimensions are in accordance with ISO 7005/3.
- f) The pressure/temperature ratings of the flanges are in accordance with PN 6, PN 10, PN 16, PN 25 and PN 40 flanges in ISO 7005/3.
- g) Spot facing or back facing is also in accordance with ISO 7005/3.
- h) The marking of flanges is basically in accordance with ISO 7005/3 but limitations in the methods are included.
- i) The tolerances are more detailed and generally in accordance with ISO 7005/3.
- j) Guidance notes and recommendations contained in BS 4504-2:1974 and similar notes in ISO 7005/3 have been included in an information appendix (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 4865-1 to BS 4865-4.

For comparison purposes the code numbers used in this Section of BS 4504 are compared with the type numbers given in BS 4504-2:1974 in appendix C.

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

Assessed capability. Users of this British Standard 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 24, 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 4504 specifies requirements for PN designated circular copper alloy and composite flanges in the ranges of nominal pressure PN 6 to PN 40 and in nominal sizes up to DN 1 800 of the types given in Table 1.

Table 1 — Types of copper alloy and composite flanges

Code no.	Description
301	Plate flange in copper alloy for brazing or welding
302	Loose flange in steel with a plate collar in copper alloy for brazing or welding
304	Loose flange in steel with a weld-neck collar in copper alloy for welding
305	Blank flange in copper alloy or in steel clad with the jointing face in copper alloy
307	Loose flange in steel with slip-on collar in copper alloy for soft soldering, brazing or welding
312	Hubbed slip-on flange in copper alloy for soft soldering, brazing or welding
314	Hubbed slip-on flange in copper alloy for soft soldering, brazing or welding supplied with tube stops
321	Integral flange in copper alloy as part of some other equipment or component

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

NOTE 1 Details of tube stops used in conjunction with code 314 flanges are outside the scope of this standard.

NOTE 2 To assist purchasers appendix A lists information which should be supplied when ordering flanges.

NOTE 3 The routine inspection and pressure testing are outside the scope of this standard but some guidance is given in appendix B.

NOTE 4 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 size (DN)

The ranges of nominal size (DN) from DN 10 to DN 1 800 applicable to each flange type and for each PN designation shall be as given in Table 2.

4 PN designations and pressure/temperature ratings

4.1 PN designation

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

4.2 Pressure/temperature ratings

The pressure/temperature ratings of flanges manufactured from the materials specified in Table 3 shall be as given in Table 13, and shall be the maximum allowable non-shock working gauge 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.

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.

5 Materials

Copper alloy components of flanges shall be manufactured from the materials given in Table 3 and steel components of flanges shall be manufactured from the materials given in Table 4.

NOTE 1 Where there is an appropriate application standard it is the responsibility of the purchaser to ensure that the requirements of that standard are met.

NOTE 2 If a protective coating such as zinc coating or painting on steel components is required, the purchaser should state the requirements on the enquiry and/or order (see appendix A).

6 Bolting

6.1 Bolting materials and their applicable temperature ranges shall be as given in Table 5.

6.2 Bolt sizes shall be as given in Table 7 to Table 11, as appropriate. The dimensions and finish of studbolts and hexagon headed bolts with hexagon nuts shall comply with the requirements of BS 3692, BS 4190, BS 4439 or BS 4882 (metric) as appropriate.

6.3 Studbolts shall be of the forms shown in BS 4882 except that the form shown in Figure 3(b) of BS 4882:1973 shall apply only to stud bolts of material other than alloy steel.

6.4 The mating surface of all bolt heads and nuts shall be full faced.

7 Dimensions

7.1 Flange dimensions

Dimensions of each type of flange for each PN shall be as given in Table 7 to Table 11 and clause 10, if appropriate.

NOTE 1 The bore sizes of integral (code 321) flanges are usually equal to the nominal size of the pipe, valve or fitting to which they form a part and the actual bore sizes are usually given in the appropriate standard(s) for the pipe, valve or fitting.

NOTE 2 A summary of the various types of flanges specified showing the nominal sizes (DN) applicable to each type and to each PN is given in Table 2.

7.2 Tube sizes

Dimensions of flanges shall be compatible with the tube sizes given in Table 7 to Table 11 as appropriate.

NOTE Alternative values (T_1 and T_2) are specified for flanges, in the nominal pressure range PN 6 to PN 25 which have tube outside diameters in the nominal size range DN 10 to DN 65 inclusive, and also DN 250, and it is therefore essential that the purchaser should specify the tube size for which the flange is required (see appendix A).

7.3 Hubs

The hubs of slip-on copper alloy flanges (code 312) and slip-on copper alloy flanges with tube stops (code 314) shall be either:

- a) parallel; or
- b) have a draft angle of not greater than 4° on the outside surface for forgings or castings.

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

8.1 Plate flanges (code 301), copper alloy (unclad) flanges (code 305), hubbed slip-on flanges (code 312), hubbed slip-on flanges supplied with tube stops (code 314) and integral flanges (code 321) shall be supplied with flat faces for use with full face gaskets.

8.2 When integral flanges (code 321) in Table 7 to Table 11, in sizes up to and including DN 100, are bolted to other flanges with raised faces the appropriate flange thicknesses (C_1^*) given in Table 11 shall apply.

NOTE 1 These flanges are permitted to have raised faces with diameters equal to those of the raised faces on the mating flanges and with raised face heights of not greater than 1.6 mm, if appropriate.

NOTE 2 When hubbed slip-on flanges (code 312) and integral flanges (code 321) in sizes other than those given in the notes to Table 7 to Table 11 are bolted to a steel or cast iron flange with a raised face, then it is essential that the raised face on that flange should be removed.

9 Facing finishes

9.1 All flange jointing faces shall be machine finished and when compared by visual or tactile means with reference specimens, shall be in accordance with the values given in Table 6.

NOTE 1 It is not intended that instrument measurements be taken on the faces themselves and the R_a and R_z values as defined in BS 1134 relate to the reference specimens.

NOTE 2 Requirements for special coatings or finishes should be stated in the enquiry and/or order so that an appropriate allowance may be incorporated in the machining of any relevant mating dimensions (see appendix A).

9.2 Composite flanges shall be machine finished on all locating diameters, with bores and abutment faces in accordance with Table 6.

9.3 It is permitted to machine or leave unmachined the flange rims.

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. The bearing surfaces for the bolting shall be parallel to the flange face within the limits given in Table 12.

11 Tolerances

Flanges shall comply with the tolerances given in Table 12.

12 Marking

All flanges other than integral shall be marked as follows.

- a) Number of this British Standard,²⁾ i.e. BS 4504.
- b) Flange code number, e.g. 305.
- c) Nominal pressure (PN), e.g. PN 10.

d) Nominal size (DN), e.g. DN 100. Where a flange can be made to suit more than one tube size, the tube size T_1 or T_2 shall be marked as appropriate (see Table 7 to Table 10).

e) Material designation. The alloy designation symbols given in Table 3 and Table 4 shall be used, as appropriate.

f) Manufacturer's name or trade-mark.

Examples:

a) Copper alloy components:

1) BS 4504/312 – PN 16 – DN 300 – CZ 110 – XYZ

2) BS 4504/302 – PN 16 – DN 50 T_1 – LG 2 – XYZ

b) Steel components:

1) BS 4504/302 – PN 16 – DN 300 – 43A – XYZ

2) BS 4504/304 – PN 16 – DN 100 – 490 – XYZ

Copper alloy flanges shall be clearly and permanently marked by a method other than stamping with steel stamps.

NOTE 1 The manufacturer's name or trade-mark together with other relevant marking may be produced during casting or forging for both copper alloy and steel components.

NOTE 2 Steel flanges may be marked round the rim of the flange with round nosed steel stamps.

²⁾ 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 301

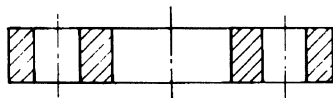
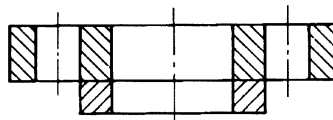


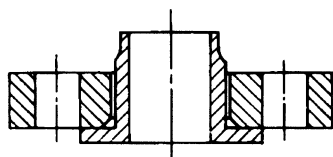
Plate flange in copper alloy
(for brazing or welding)

Code 302



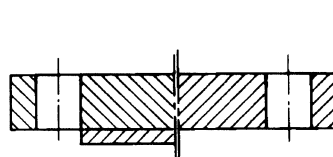
Loose flange in steel with plate
collar in copper alloy (for brazing
or welding)

Code 304



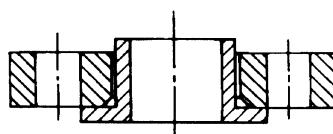
Loose flange in steel with a
weld-neck collar in copper alloy
(for welding)

Code 305



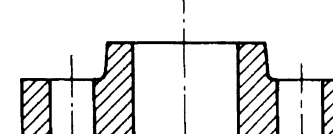
Blank flange in copper alloy or in
steel clad with the jointing face in
copper alloy

Code 307



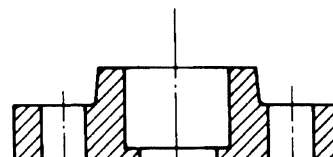
Loose flange in steel with slip-on
collar in copper alloy (for soft
soldering, brazing or welding)

Code 312



Hubbed slip-on flange in copper
alloy (for soft soldering, brazing
or welding)

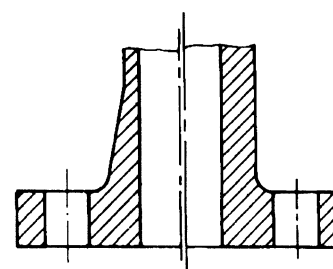
Code 314



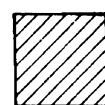
Hubbed slip-on flange in copper
alloy supplied with tube stops
(for soft soldering, brazing or welding)

NOTE. Code 301, 312, 314 and 321 comprise
flanges made of copper alloy.
Code 302, 304 and 307 comprise composite
flanges where the backing flange is made of steel.
Code 305 flange comprises either all copper alloy
or copper alloy clad steel.

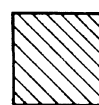
Code 321



Integral flange in copper alloy



Copper alloy
component



Steel
component

Figure 1 — Flanges codes