



# **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
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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 BS 4504-2 will be withdrawn 12 months after the publication of this Section of BS 4504.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 7005<sup>1)</sup>, 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.

<sup>1)</sup> 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:

- parallel; or
- 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,<sup>2)</sup> 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.

<sup>2)</sup> 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

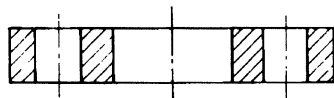
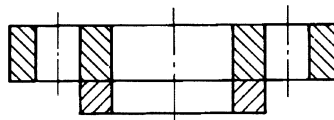


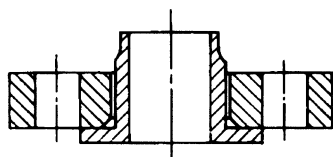
Plate flange in copper alloy  
(for brazing or welding)

Code 302



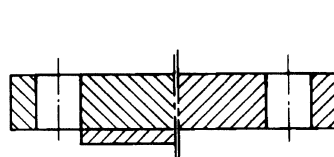
Loose flange in steel with plate  
collar in copper alloy (for brazing  
or welding)

Code 304



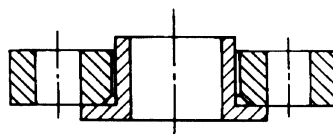
Loose flange in steel with a  
weld-neck collar in copper alloy  
(for welding)

Code 305



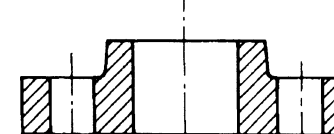
Blank flange in copper alloy or in  
steel clad with the jointing face in  
copper alloy

Code 307



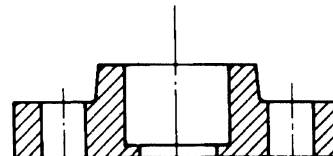
Loose flange in steel with slip-on  
collar in copper alloy (for soft  
soldering, brazing or welding)

Code 312



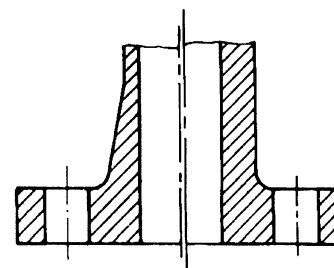
Hubbed slip-on flange in copper  
alloy (for soft soldering, brazing  
or welding)

Code 314



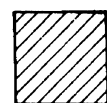
Hubbed slip-on flange in copper  
alloy supplied with tube stops  
(for soft soldering, brazing or welding)

Code 321

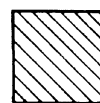


Integral flange in copper alloy

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.



Copper alloy  
component



Steel  
component

Figure 1 — Flanges codes

Table 2 — Synoptic table

[illegible]

Table 2 — Synoptic table

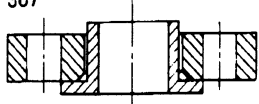
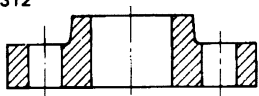
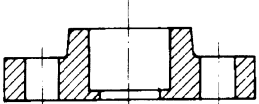
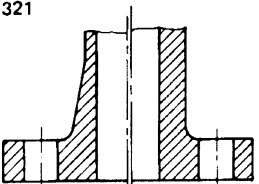
Flange and code no.	Table no.	PN	DN																					
			10	15	20	25	32	40	50	65	80	100	125	150	175	200	250	300	350	400	450	500	600	700
<b>307</b>  Loose flange in steel with slip-on collar in copper alloy	7	6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	8	10	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	9	16	x	x	x	x	x	x	x	x	x	x	x	x	x	x								
<b>312</b>  Hubbed slip-on flange in copper alloy	7	6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
	8	10	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
	9	16	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x							
	10	25	x	x	x	x	x	x	x	x	x	x	x	x	x	x								
<b>314</b>  Hubbed slip-on flange in copper alloy supplied with tube stops	7	6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	8	10	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
	9	16	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
	10	25	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
<b>321</b>  Integral flange in copper alloy	7	6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	8	10	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
	9	16	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
	10	25	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
	11	40	x	x	x	x	x	x	x	x	x	x												

Table 3 — Copper alloy materials

Material			Flange types and codes					
Form	Copper alloy standard	Alloy designation	Loose flanges or collars for composite flanges			Blank		Integral
			307, 312, 314	301, 302, 307, 312, 314	301, 302, 304, 307, 312, 314	305		321
			Methods of attachment			Without cladding	Cladding	
			Soft solder <sup>a</sup> (Slip-on)	Silver brazing <sup>b</sup> (Slip-on)	Fusion welding (Slip-on or butt-weld)			
Castings	BS 1400	LG 2	×	×		×		×
		LG 4	×	×		×		×
		AB 1			×			×
		AB 2			×			×
Forging	BS 2872	CA 104			×	×	×	
Plate	BS 2875	CZ 110		×	×	×	×	
		CN 102		×	×	×	×	
		CN 107		×	×	×	×	

<sup>a</sup> Applicable to attachment to copper tubes to BS 2871-1 and appropriate to sizes up to and including DN 50.

<sup>b</sup> For the purposes of this British Standard the term “silver brazing” is synonymous with brazing with silver alloy filler material. Reference should be made to BS 1723 for information on brazing techniques.

Table 4 — Steel materials for composite and clad blank flanges

Material	British Standard and grade	Alloy designation
Plate	BS 4360 Grade 40A	40A
	BS 4360 Grade 43A	43A
Forgings	BS 1503-221-430	430
	BS 1503-164-490	490

Table 5 — Bolting material application

Material						Temperature range				
Flange nominal pressure PN	Hexagon headed bolts	Studs	Nuts <sup>a</sup> for bolts or studs	Studbolts	Nuts for studbolts	– 10 °C to 260 °C	– 20 °C to 260 °C	– 20 °C to 120 °C	– 100 °C to – 20 °C	– 200 °C to – 100 °C
6, 10 and 16 (see note 1)	BS 3692 or BS 4190 Grade 4.6	BS 4439 Grade 4.8	BS 3692 or BS 4190 Grade 4	BS 4882 Carbon steel	BS 4882 Grade 2H/M	×		×		
	BS 2872 or BS 2874 Grades CA 104 and CA 105							×	×	×
				BS 4882 Grade L8/M	BS 4882 Grade 8F/M				×	×
6, 10, 16, 25 and 40	BS 3692 Grade 8.8	BS 4439 Grade 8.8	BS 3692 Grade 8	BS 4882 Grade B7/M	BS 4882 Grade 2H/M		×	×		
	BS 2872 or BS 2874 Grades CA 104 and CA 105							×	×	×
				BS 4882 Grade L8X/M	BS 4882 Grade 8FX/M				×	×
				BS 4882 Grade L7/M	BS 4882 Grade L4/M				×	
NOTE 1 The grades of bolting specified may also be used for flanges PN 25 and PN 40 provided the gaskets are contained within the bolts.										
NOTE 2 Free cutting steels are not permitted.										
NOTE 3 Although not covered by this standard, proprietary high strength cupro nickel bolting is available.										
<sup>a</sup> Nuts of a higher strength grade can be substituted.										

Table 6 — Surface finish of flange faces

Method of machining	$R_a^a$		$R_z^a$	
	min.	max.	min.	max.
Turning <sup>b</sup>	μm	μm	μm	μm
	3.2	12.5	12.5	50
Other than turning	3.2	6.3	12.5	25
<sup>a</sup> $R_a$ and $R_z$ are defined in BS 1134.				
<sup>b</sup> The term “turning” includes any method of machine operation producing either serrated concentric or serrated spiral grooves.				



**Figure 2 — Dimensions of PN 6 flanges (see Table 7)**



Table 7 — Dimensions of PN 6 flanges (see Figure 2)

Nominal size	Tube outside diameter A		Mating dimensions					Flange thickness				Hub dia.	Neck dia.	Stub end diameter		Length through hub or collar			Collar thickness		Collar flange thickness		Cladding thickness	Collar or raised face dia.	Bore of flange or collar		Bore of flange		Chamfer
			Outside diameter	Diameter of bolt circle	Diameter of bolt hole	Bolting																							
	Number	Size				C2		C1		N3	N3			N1	N1	H1	H2	H2	S1 min.	S2	F	F			D1	B1	B2	E	
DN	T1	T2	D	K	L			304	305 307	301 312 314	321	312 314	321	304	307	312 314	304	307	304			304	307	305	304 305 307	301, 307, 312, 314	304	307	304 307
Codes affected	301, 304, 305, 307, 312, 314, 321																												
	mm	mm	mm	mm	mm			mm		mm		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
10	15	16.0	75	50	11	4	M10	10		6		21	16	18.0	21	10	35	16	1.0	2.0	5	5	33	15.07	16.07	19	23	—	
15	18	20.0	80	55	11	4	M10	10		6		26	21	22.0	26	10	35	16	1.0	2.0	5	5	38	18.07	20.08	24	28	2	
20	22	25.0	90	65	11	4	M10	10		6		31	28	27.0	31	10	40	16	1.5	2.5	5	5	48	22.08	25.08	28	33	3	
25	28	30.0	100	75	11	4	M10	12		8		36	35	32.0	36	12	40	18	1.5	2.5	5	5	58	28.08	30.08	33	38	3	
32	35	38.0	120	90	14	4	M12	12		8		45	42	40.0	45	12	40	18	1.5	2.5	5	5	69	35.09	38.08	41	47	3	
40	42	44.5	130	100	14	4	M12	12		9		51	52	46.5	51	13	45	19	1.5	2.5	5	5	78	42.09	44.60	48	53	3	
50	54	57.0	140	110	14	4	M12	12		11		67	64	59.0	67	15	45	19	1.5	2.5	6	5	88	54.09	57.23	62	69	3	
65	67	76.1	160	130	14	4	M12	12		13		87	79	78.0	87	17	45	19	2.0	3.5	6	5	108	66.78	76.33	81	89	3	
80	88.9		190	150	18	4	M16	14		13		104	94	91.0	104	17	50	21	2.5	4.0	6	5	124	89.18		94	106	3	
100	108.0		210	170	18	4	M16	14		16		123	116	110.0	123	20	50	21	2.5	4.0	6	5	144	108.38		113	125	3	
125	133.0		240	200	18	8	M16	14	18	20		148	155	135.0	148	22	50	21	2.5	4.0	6	5	174	133.63		138	151	4	
150	159.0		265	225	18	8	M16	14	18	20		175	180	161.0	175	24	50	21	2.5	4.0	8	5	199	159.63		164	178	4	
175	193.7		295	255	18	8	M16	18	20	22		210	209	196.0	210	26	50	23	3.0	4.5	8	5	229	194.63		200	213	5	
200	219.1		320	280	18	8	M16	18	20	22		235	234	221.0	235	28	50	23	3.0	4.5	8	5	254	220.03		225	238	5	
250	267.0		375	335	18	12	M16	20	22	24		285	286	269.0	285	30	50	27	3.0	4.5	8	5	309	268.13		278	288	5	
250	273.0		375	335	18	12	M16	20	22	24		285	286	275.0	291	30	50	27	3.0	4.5	8	5	309	274.13		284	296	7	
300	323.9		440	395	22	12	M20	24	22	24		342	336	326.0	342	30	50	30	4.0	5.5	10	5	363	325.03		330	345	7	
350	368.0		490	445	22	12	M20	26	22	26		386	390	370.0	386	30	50	32	4.0	5.5	10	5	413	369.13		374	369	7	
400	419.0		540	495	22	16	M20	30	22	28		439	442	421.0	439	30	50	36	4.0	5.5	10	5	463	420.13		426	442	7	
450	457.2		595	550	22	16	M20	32	24	30		477	492	459.0	477	32	50	38	4.0	5.5	10	5	518	458.33		465	480	7	
500	508.0		645	600	22	20	M20	32	24	30		530	546	510.0	530	33	50	47	4.5	6.0	10	5	568	509.13		516	533	9	
600	610.0		755	705	26	20	M24	36	—	30		—	646	612.0	637	—	60	50	5.0	6.5	14		5	667	612.00		619	639	9
700	711.0		860	810	26	24	M24	40	—	32		—	748	713.0	741	—	60	55	6.0	7.5	14	15	5	772	713.00		721	743	9
800	813.0		975	920	30	24	M27	44	—	34		—	852	815.0	844	—	60	60	6.0	7.5	14	16	5	878	815.00		824	846	9
900	914.0		1 075	1 020	30	24	M27	—	48	—	36	—	954	—	948	—	—	65	—	—	—	17	5	978	916.00		—	950	9
1 000	1 016.0		1 175	1 120	30	28	M27	—	52	—	36	—	1054	—	1 051	—	—	70	—	—	—	18	5	1 078	1 018.00		—	1 050	9
1 200	1 220.0		1 405	1 340	33	32	M30	—	60	—	40	—	1260	—	1 259	—	—	80	—	—	—	20	5	1 295	1 222.00		—	1 262	9
1 400	1 420.0		1 630	1 560	36	36	M33	—	66	—	44	—	1466	—	1 465	—	—	88	—	—	—	22	5	1 510	1 422.00		—	1 468	9
1 600	1 620.0		1 830	1 760	36	40	M33	—	74	—	48	—	1672	—	1 669	—	—	98	—	—	—	24	5	1 710	1 622.00		—	1 672	9
1 800	1 820.0		2 045	1 970	39	44	M36	—	84	—	50	—	1876	—	1 873	—	—	110	—	—	—	26	5	1 918	1 822.00		—	1 876	9
NOTE 1 For Code 321 flanges in sizes up to and including DN 100, codes 312 and 314 flanges up to and including DN 50 for bolting to flanges with raised faces the appropriate thickness C <sub>i</sub> in Table 11 (PN 40) apply.																													
NOTE 2 Codes 304, 305 and 307 flanges and code 321 flanges in the sizes DN 125 to DN 1800 may be used with inside bolt circle gaskets.																													
NOTE 3 See clause 8 for joint facings.																													



**Figure 3 — Dimensions of PN 10 flanges (see Table 8)**

Table 8 — Dimensions of PN 10 flanges (see Figure 3)

Nominal size	Tube outside diameter A		Mating dimensions					Flange thickness			Hub dia.	Neck dia.	Stub end diameter		Length through hub or collar			Collar thickness		Collar flange thickness		Cladding thickness	Collar or raised face dia.	Bore of flange or collar		Bore of flange		Chamfer	
			Outside diameter	Diameter of bolt circle	Diameter of bolt hole	Bolting																							
	T <sub>1</sub>	T <sub>2</sub>				D	K	L	Number	Size			C <sub>2</sub>	C <sub>1</sub>	N <sub>3</sub>	N <sub>3</sub>	N <sub>1</sub>	N <sub>1</sub>	H <sub>1</sub>	H <sub>2</sub>	H <sub>2</sub>			S <sub>1 min.</sub>	S <sub>2</sub>	F	F	D <sub>1</sub>	B1
DN	301, 304, 305, 307, 312, 314, 321							304 305	307	301 312 314	312 314	321	312 314	321	304	307	312 314	304	307	304		304	307	305	304 305 307	301, 307, 312, 314	304	307	304 307
Codes affected								304 305	307	301 312 314	312 314	321	312 314	321	304	307	312 314	304	307	304		304	307	305	304 305 307	301, 307, 312, 314	304	307	304 307
	mm	mm	mm	mm	mm			mm	mm		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	
10	15	16.0	90	60	14	4	M12	14	8	6	21	16	18.0	21	20	35	16	1.0	2.0	5	5	41	15.07	16.07	19	23	—		
15	18	20.0	95	65	14	4	M12	14	8	6	26	21	22.0	26	20	35	16	1.0	2.0	5	5	46	18.07	20.08	24	28	2		
20	22	25.0	105	75	14	4	M12	14	8	6	31	28	27.0	31	24	40	16	1.5	2.5	5	5	56	22.08	25.08	28	33	3		
25	28	30.0	115	85	14	4	M12	16	9	8	36	35	32.0	36	24	40	18	1.5	2.5	5	5	65	28.08	30.08	33	38	3		
32	35	38.0	140	100	18	4	M16	16	10	8	45	42	40.0	45	26	40	18	1.5	2.5	5	5	76	35.09	38.08	41	47	3		
40	42	44.5	150	110	18	4	M16	16	11	9	51	52	46.5	51	26	45	19	1.5	2.5	6	5	84	42.09	44.60	48	53	3		
50	54	57.0	165	125	18	4	M16	16	13	11	67	64	59.0	67	28	45	19	1.5	2.5	6	5	99	54.09	57.23	62	69	3		
65	67	76.1	185	145	18	4	M16	16	13	13	87	79	78.0	87	17	45	19	2.0	3.5	6	5	118	66.78	76.33	81	89	3		
80	88.9		200	160	18	8	M16	18	13	13	104	94	91.0	104	17	50	21	2.5	4.0	7	5	132	89.13		94	106	3		
100	108.0		220	180	18	8	M16	18	16	16	123	116	110.0	123	20	50	21	2.5	4.0	7	5	156	108.38		113	125	3		
125	133.0		250	210	18	8	M16	18	18	22	148	159	135.0	148	22	50	21	2.5	4.0	7	5	184	133.63		138	151	4		
150	159.0		285	240	22	8	M20	18	20	22	175	184	161.0	175	24	50	21	2.5	4.0	9	5	211	159.63		164	178	4		
175	193.7		315	270	22	8	M20	20	22	24	210	211	196.0	210	26	50	23	3.0	4.5	9	5	242	194.63		200	213	5		
200	219.1		340	295	22	8	M20	20	24	26	235	240	221.0	235	28	50	23	3.0	4.5	9	5	266	220.03		225	238	5		
250	267.0		395	350	22	12	M20	22	26	28	285	292	269.0	285	30	50	27	3.0	4.5	9	5	319	268.13		278	288	5		
250	273.0		395	350	22	12	M20	22	26	28	285	292	275.0	291	30	50	27	3.0	4.5	9	5	319	274.13		284	296	7		
300	323.9		445	400	22	12	M20	26	26	28	342	342	326.0	342	30	50	30	4.0	5.5	11	5	370	325.03		330	345	7		
350	368.0		505	460	22	16	M20	28	26	30	386	396	370.0	386	30	50	32	4.0	5.5	11	5	429	369.13		374	369	7		
400	419.0		565	515	26	16	M24	32	26	32	439	448	421.0	439	30	50	36	4.0	5.5	12	5	480	420.13		426	442	7		
450	457.2		615	565	26	20	M24	34	28	32	477	498	459.0	477	32	50	38	4.5	6.0	12	5	530	458.33		465	480	7		
500	508.0		670	620	26	20	M24	38	28	34	530	552	510.0	530	33	50	42	5.0	6.5	12	5	582	509.13		516	533	9		
600	610.0		780	725	30	20	M27	38	31	36	647	654	612.0	637	49	60	50	6.0	7.5	14	5	629	612.00		619	639	9		
700	711.0		895	840	30	24	M27	40	33	40	751	760	713.0	741	53	60	55	6.5	9.5	15	5	733	713.00		727	743	9		
800	813.0		1 015	950	33	24	M30	44	35	44	853	866	815.0	844	55	60	60	7.5	10.5	16	5	836	815.00		829	846	9		
900	914.0		1 115	1 050	33	28	M30	48	—	46	—	970	918.0	948	—	60	65	8.5	11.5	17	5	940	916.00		931	950	9		
1 000	1 016.0		1 230	1 160	36	28	M33	52	—	50	—	1 076	1 018.0	1 051	—	60	70	9.0	12.0	14	18	5	1 043	1 018.00		1 025	1 053	9	
1 200	1 220.0		1 455	1 380	39	32	M36	60	—	56	—	1 284	1 223.0	1 259	—	60	80	11.0	14.0	14	20	5	1 251	1 222.00		1 230	1 262	9	
1 400	1 420.0		1 675	1 590	42	36	M39	—	66	—	62	—	1 494	—	1 465	—	—	88	—	—	22	5	1 457	1 422.00		—	1 468	9	
1 600	1 620.0		1 915	1 820	48	40	M45	—	74	—	68	—	1 702	—	1 669	—	—	98	—	—	24	5	1 661	1 622.00		—	1 672	9	
1 800	1 820.0		2 115	2 020	48	44	M45	—	84	—	70	—	1 906	—	1 873	—	—	110	—	—	26	5	1 865	1 822.00		—	1 875	9	
NOTE 1	For Code 321 flanges in sizes up to and including DN 100, codes 312 and 314 flanges up to and including DN 50 for bolting to flanges with raised faces the appropriate thickness C <sub>1</sub> in Table 11 (PN 40) apply.																												
NOTE 2	Codes 304, 305 and 307 flanges, and code 321 flanges in the sizes DN 65 to DN 1 800 may be used with inside bolt circle gaskets.																												
NOTE 3	See clause 8 for joint facings.																												



**Figure 4 — Dimensions of PN 16 flanges (see Table 9)**

Table 9 — Dimensions of PN 16 flanges (see Figure 4)

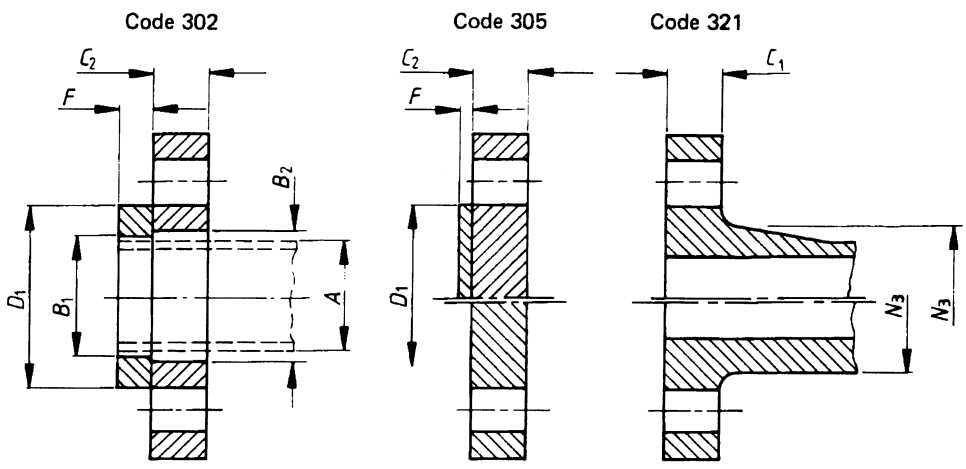
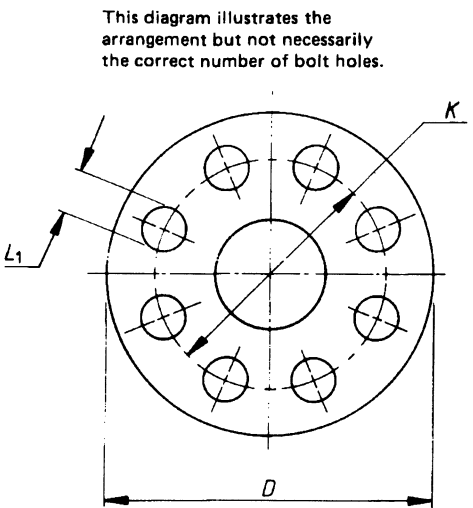
Nominal size	Tube outside diameter A		Mating dimensions					Flange thickness			Hub dia.	Neck dia.	Stub end diameter		Length through hub or collar			Collar thickness		Collar flange thickness		Cladding thickness	Collar or raised face dia.		Bore of flange or collar		Bore of flange		Chamfer
			Outside diameter	Diameter of bolt circle	Diameter of bolt hole	Bolting																							
	T <sub>1</sub>	T <sub>2</sub>				D	K	L	Number	Size			C <sub>2</sub>	C <sub>1</sub>	N <sub>3</sub>	N <sub>3</sub>	N <sub>1</sub>	N <sub>1</sub>	H <sub>1</sub>	H <sub>2</sub>	H <sub>2</sub>		S <sub>1</sub> min.	S <sub>1</sub>	F	F	D <sub>1</sub>	B <sub>1</sub>	
DN																													
Codes affected	301, 304, 305, 307, 312, 314, 321							304 305	307	301 312 314	321	312 314	321	304	307	312 314	304	307	304		304	307	305	304 305	307	301, 307, 312, 314	304	307	304 307
10	mm	mm	mm	mm	mm			mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
15	15	16.0	90	60	14	4	M12	14	8	6	21	16	18.0	21	20	35	16	1.0	2.5	5	5		41	15.07	16.07	19	23	—	
20	18	20.0	95	65	14	4	M12	14	8	6	26	21	22.0	26	20	35	16	1.0	2.5	5	5		46	18.07	20.08	24	28	2	
25	22	25.0	105	75	14	4	M12	14	8	6	31	28	27.0	31	24	40	16	1.5	2.5	5	5		56	22.08	25.08	28	33	3	
32	28	30.0	115	85	14	4	M12	16	9	8	36	35	32.0	36	24	40	18	1.5	2.5	5	5		65	28.08	30.08	33	38	3	
40	35	38.0	140	100	18	4	M16	16	10	8	45	42	40.0	45	26	40	18	1.5	2.5	5	5		76	35.09	38.08	41	47	3	
50	42	44.5	150	110	18	4	M16	16	11	9	51	52	46.5	51	26	45	19	1.5	2.5	6	5		84	42.09	44.60	48	53	3	
65	54	57.0	165	125	18	4	M16	16	13	11	67	64	59.0	67	28	45	19	1.5	2.5	6	5		99	54.09	57.23	62	69	3	
80	67	76.1	185	145	18	4	M16	16	20	13	103	79	78.0	87	32	45	19	2.0	3.5	6	5		118	66.78	76.33	81	89	3	
100	88.9		200	160	18	8	M16	18	20	13	114	94	91.0	104	34	50	21	2.5	4.0	7	5		132	89.13		94	106	3	
125	108.0		220	180	18	8	M16	18	20	16	134	116	110.0	123	40	50	21	2.5	4.0	7	5		156	108.38		113	125	3	
150	133.0		250	210	18	8	M16	18	22		164	159	135.5	148	44	50	21	2.5	4.0	7	5		184	133.63		138	151	4	
175	159.0		285	240	22	8	M20	18	22		188	184	161.5	175	44	50	21	2.5	4.0	9	5		211	159.63		164	178	4	
200	193.7		315	270	22	8	M20	22	24		213	211	197.0	210	44	50	23	3.0	4.5	9	5		242	194.63		200	213	5	
250	219.1		340	295	22	12	M20	22	26		238	236	222.0	235	46	50	23	4.0	4.5	9	5		266	220.03		225	238	5	
250	267.0		405	355	26	12	M24	24	28		287	290	269.0	285	48	50	27	4.0	4.5	9	5		319	268.13		278	288	5	
250	273.0		405	355	26	12	M24	24	28		287	290	275.0	291	48	50	27	4.0	4.5	9	5		319	274.13		284	296	7	
300	323.9		460	410	26	12	M24	28	—	28	—	342	327.0	—	—	50	—	5.0	6.5	11	5		370	—	325.03	—	330	—	7
350	368.0		520	470	26	16	M24	32	—	30	—	396	371.0	—	—	50	—	6.0	7.5	11	5		429	—	369.13	—	374	—	7
400	419.0		580	525	30	16	M27	36	—	32	—	448	422.0	—	—	50	—	7.5	9.0	12	5		480	—	420.13	—	426	—	7
500	508.0		715	650	33	20	M30	—	—	34	—	552	—	—	—	—	—	—	—	—	—		—	—	—	—	—	—	
NOTE 1 For code 321 flanges in sizes up to and including DN 100, codes 312 and 314 flanges up to and including DN 50 for bolting to flanges with raised faces the appropriate thickness C <sub>1</sub> in Table 11 (PN 40) apply.																													
NOTE 2 Codes 304,305 and 307 flanges, codes 312 and 314 in sizes DN 65 to DN 250 and code 321 in sizes DN 125 to DN 250 may be used with inside bolt circle gaskets.																													
NOTE 3 See clause 8 for joint facings.																													



**Figure 5 — Dimensions of PN 25 flanges** (see Table 10)

Table 10 — Dimensions of PN 25 flanges (see Figure 5)

Nominal size	Tube outside diameter <i>A</i>		Mating dimensions					Flange thickness		Hub dia.	Neck dia.	Stub end diameter	Length through hub or collar		Collar thickness		Collar flange thickness		Cladding thickness	Collar or face diameter	Bore of flange or collar		Bore of flange	Chamfer
			Outside diameter	Diameter of bolt circle	Diameter of bolt hole	Bolting																		
	Number	Size				<i>C</i> <sub>2</sub>	<i>C</i> <sub>1</sub>	<i>N</i> <sub>3</sub>	<i>N</i> <sub>3</sub>															
DN	<i>T</i> <sub>1</sub>	<i>T</i> <sub>2</sub>	<i>D</i>	<i>K</i>	<i>L</i>			<i>C</i> <sub>2</sub>	<i>C</i> <sub>1</sub>	<i>N</i> <sub>3</sub>	<i>N</i> <sub>3</sub>	<i>N</i> <sub>1</sub>	<i>H</i> <sub>1</sub>	<i>H</i> <sub>2</sub>	<i>S</i> <sub>1</sub> min.	<i>S</i> <sub>2</sub>	<i>F</i>	<i>F</i>	<i>D</i> <sub>1</sub>	<i>B</i> <sub>1</sub>	<i>B</i> <sub>2</sub>	<i>E</i>		
Codes affected	302, 304, 305, 312, 314, 321							302 304 305	312 314	312 314	321	304	312 314	304	304	304	304	302 304	305	302 304 305	302, 312, 314	302 304	304	
	mm	mm	mm	mm	mm			mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	
10	15	16.0	90	60	14	4	M12	16	8	21	16	18.0	20	35	1.5	2.5	12	5	5	40	15.07	16.07	18	—
15	18	20.0	95	65	14	4	M12	16	8	26	21	22.0	20	35	1.5	2.5	12	5	5	45	18.07	20.08	22	2
20	22	25.0	105	75	14	4	M12	16	8	31	28	27.0	24	40	1.5	2.5	14	5	5	58	22.08	25.08	28	3
25	28	30.0	115	85	14	4	M12	18	9	36	35	32.0	24	40	1.5	2.5	14	5	5	68	28.08	30.08	33	3
32	35	38.0	140	100	18	4	M16	18	10 9	45	42	40.0	26	40	1.5	2.5	14	5	5	78	35.09	38.08	42	3
40	42	44.5	150	110	18	4	M16	18	11	51	52	46.5	26	45	1.5	2.5	14	6	5	88	42.09	44.60	50	3
50	54	57.0	165	125	18	4	M16	20	13 11	67	64	59.0	28	45	2.0	3.0	16	6	5	102	54.09	57.23	62	3
65	67	76.1	185	145	18	8	M16	20	22 13	103	79	78.0	32	45	2.5	4.0	16	6	5	122	66.78	76.33	81	3
80	88.9		200	160	18	8	M16	22	24 14	114	94	91.0	34	50	3.5	4.5	18	7	5	138	89.18		94	3
100	108.0		235	190	22	8	M20	22	26 17	137	116	110.0	40	50	4.0	5.0	20	7	5	162	108.38		113	3
125	133.0		270	220	26	8	M24	24	26	160	165	135.5	44	50	5.0	6.3	22	7	5	188	133.63		138	4
150	159.0		300	250	26	8	M24	24	28 26	186	192	161.5	48	50	5.0	6.3	22	9	5	218	159.63		164	4
175	193.7		330	280	26	12	M24	—	28	216	217	197.0	50	50	4.0	5.5	23	9	5	242	194.63		200	5
200	219.1		360	310	26	12	M24	26	30	246	246	222.0	50	50	6.0	7.5	24	9	5	278	220.03		225	5
250	267.0		425	370	30	12	M27	30	32	296	298	269.0	54	50	7.0	8.5	26	9	5	335	268.13		273	5
250	273.0		425	370	30	12	M27	30	32	—	298	275.0	54	50	7.0	8.5	26	9	5	335	274.13		279	7
300	323.9		485	430	30	16	M27	34	— 32	—	348	327.0	—	50	8.0	9.5	28	11	5	395	325.03		329	7
350	368.0		555	490	33	16	M30	38	— 36	—	404	—	—	—	—	—	32	—	5	450	369.13		374	—
400	419.0		620	550	36	16	M33	42	— 38	—	458	—	—	—	—	—	34	—	5	505	420.13		426	—
500	508.0		730	660	36	20	M33	50	— 42	—	564	—	—	—	—	—	38	—	5	615	509.13		517	—
NOTE 1 For code 321 flanges in sizes up to and including DN 100 and for bolting to flanges with raised faces the appropriate thicknesses <i>C</i> <sub>1</sub> in Table 11 (PN 40) apply.																								
NOTE 2 Codes 304 and 305 flanges, codes 312 and 314 in the sizes DN 65 to DN 250, code 321 in the sizes DN 250 may be used with inside bolt circle gaskets.																								
NOTE 3 See clause 8 for joint facings.																								



NOTE. Dimension  $N_3$  is measured at the intersection of the projections of the hub draft angle and the back face of the flange.

Figure 6 — Dimensions of PN 40 flanges (see Table 11)



Table 11 — Dimensions of PN 40 flanges (see Figure 6)

Nominal size	Tube outside diameter	Mating dimensions					Flange thickness			Neck diameter	Collar thickness	Cladding thickness	Collar or raised face diameter	Bore of collar	Bore of flange
		Outside diameter	Diameter of bolt circle	Diameter of bolt hole	Bolting										
					Number	Size	C <sub>2</sub>	C <sub>1</sub>	C <sub>1</sub> <sup>a</sup>						
DN	A	D	K	L			C <sub>2</sub>	C <sub>1</sub>	C <sub>1</sub> <sup>a</sup>	N <sub>3</sub>	F	F	D <sub>1</sub>	B <sub>1</sub>	B <sub>2</sub>
Codes affected	302, 305, 321						302 305	321	321	321	302	305	302 305	302	302
	mm	mm	mm	mm			mm	mm	mm	mm	mm	mm	mm	mm	mm
10	16.0	90	60	14	4	M12	16	9	12	16	12	5	40	16.07	18
15	20.0	95	65	14	4	M12	16	9	12	21	12	5	45	20.08	22
20	25.0	105	75	14	4	M12	16	9	12	28	14	5	58	25.08	28
25	30.0	115	85	14	4	M12	18	11	14	35	14	5	68	30.08	33
32	38.0	140	100	18	4	M16	18	11	15	42	14	5	78	38.10	42
40	44.5	150	110	18	4	M16	18	13	16	52	14	5	88	44.60	50
50	57.0	165	125	18	4	M16	20	13	17	64	16	5	102	57.23	62
65	76.1	185	145	18	8	M16	20	14	17	79	16	5	122	76.33	81
80	88.9	200	160	18	8	M16	22	16	19	94	18	5	138	89.13	94
100	108.0	235	190	22	8	M20	22	19	21	116	20	5	162	108.38	113
125	133.0	270	220	26	8	M24	24	—	—	—	22	5	188	133.63	138
150	159.0	300	250	26	8	M24	24	—	—	—	22	5	218	159.63	164
200	219.1	375	320	30	12	M27	30	—	—	—	26	5	285	220.03	225
250	267.0	450	385	33	12	M30	36	—	—	—	30	5	345	268.13	278
250	273.0	450	385	33	12	M30	36	—	—	—	30	5	345	274.13	278
300	323.9	515	450	33	16	M30	40	—	—	—	34	5	410	325.03	329
350	368.0	580	510	36	16	M33	46	—	—	—	38	5	465	369.13	374
400	419.0	660	585	39	16	M36	50	—	—	—	42	5	535	420.13	426
NOTE 1 See clause 8 for joint facings.															
<sup>a</sup> For codes 321 flanges C <sub>1</sub> * thicknesses are applicable when required for flanges with a raised face of 1.6 mm or when required to be used with inside bolt circle gaskets or codes 304, 305 and 307 flanges.															

Table 12 — Tolerances

Dimension	Flange code	Tolerance	Size
Bore diameter $B_1$	301, 302, 307, 312, 314	mm + 0.05 - 0	≤ DN 65
		+ 0.1 - 0	> DN 65 ≤ DN 200
		+ 0.25 - 0	> DN 200 ≤ DN 500
		+ 1.5 <sup>a</sup> - 0	> DN 200 ≤ DN 350
		+ 2.0 <sup>a</sup> - 0	> DN 350 ≤ DN 500
		+ 3.0 - 0	> DN 500
Bore diameter $B_2$	302, 304, 307	+ 1.0 - 0	≤ DN 100
		+ 1.5 - 0	> DN 100 ≤ DN 300
	302, 304	+ 2.0 - 0	> DN 300 ≤ DN 800
		+ 4.0 - 0	> DN 800
	307	+ 2.0 - 0	> DN 300 ≤ DN 900
		+ 4.0 - 0	> DN 900
Length through hub $H_1$	312, 314	+ 1.5 - 0	≤ DN 100
		+ 2.5 - 0	> DN 100 ≤ DN 800
		+ 3.5 - 0	> DN 800
Length through collar $H_2$	304	± 1.5	≤ DN 65
		± 2	> DN 65
	307	+ 1.5 - 0	≤ DN 200
		+ 2.5 - 0	> DN 200 ≤ DN 800
		+ 3.5 - 0	> DN 800

Table 12 — Tolerances

Dimension	Flange code	Tolerance	Size
Hub neck $N_1$ or collar diameter $N_3$	304	mm $\pm 0.5$	$\leq$ DN 65
		$\pm 1.0$	$>$ DN 65 $\leq$ DN 150
		$\pm 1.5$	$>$ DN 150 $\leq$ DN 300
		$\pm 2$	$>$ DN 300
	307, 312, 314	$\pm 0.5$	$\leq$ DN 65
		$\pm 1.0$	$>$ DN 65 $\leq$ DN 150
		$\pm 2.0$	$>$ DN 150 $\leq$ DN 400
		$\pm 3.0$	$>$ DN 400 $\leq$ DN 800
		$\pm 4.0$	$>$ DN 800
	321	$+1.5$ $-0$	$\leq$ DN 65
		$+2.5$ $-0$	$>$ DN 65 $\leq$ DN 150
		$+3.5$ $-0$	$>$ DN 150 $\leq$ DN 400
		$+5.0$ $-0$	$>$ DN 400 $\leq$ DN 800
		$+10.0$ $-0$	$>$ DN 800
Outside diameter $D$	All codes (machined)	$\pm 1.0$	$\leq$ DN 200
		$\pm 1.5$	$>$ DN 200 $\leq$ DN 300
		$\pm 2.0$	$>$ DN 300
	All codes (unmachined)	$\pm 2.0$	$\leq$ DN 300
		$\pm 3.0$	$>$ DN 300 $\leq$ DN 400
		$\pm 5.0$	$>$ DN 400
Flange thickness $C_1, C_2$	All codes	$+3.5$ $-0$	$\leq$ 25 mm thickness
		$+5.0$ $-0$	$>$ 25 mm $\leq$ 50 mm thickness
		$+7.5$ $-0$	$>$ 50 mm $\leq$ 75 mm thickness
		$+10.0$ $-0$	$>$ 75 mm thickness
Collar or cladding diameter $D_1$	304, 305	$\pm 1.0$	$\leq$ DN 80
		$\pm 2.0$	$>$ DN 80 $\leq$ DN 1200
		$\pm 3.0$	$>$ DN 1200
	302, 307	$+1.0$ $-0$	$\leq$ 65
		$+2.0$ $-0$	$>$ DN 65 $\leq$ DN 400
		$+3.0$ $-0$	$>$ DN 400

Table 12 — Tolerances

Dimension	Flange code	Tolerance	Size
Facing height $F$	302, 304	mm $\pm 0.5$	$\leq$ DN 125
		$\pm 1.0$	$>$ DN 125 $\leq$ DN 500
		$\pm 1.5$	$>$ DN 500
	305	$\pm 0.3$	$\leq$ DN 250
		$\pm 0.6$	$>$ DN 250
	307	$+ 1.0$ $- 0$	$\leq$ DN 65
		$+ 2.0$ $- 0$	$>$ DN 65 $\leq$ DN 500
		$+ 3.0$ $- 0$	$>$ DN 500
Diameter of bolt circle $K$	All codes	$\pm 0.9$	Bolt sizes M12 to M24
		$\pm 1.4$	Bolt sizes M27 to M45
Centre-to-centre of adjacent bolt holes	All codes	$\pm 0.45$	Bolt sizes M12 to M24
		$\pm 0.7$	Bolt sizes M27 to M45
Concentricity (see note 1)	All codes	1.0	$\leq$ DN 100
		2.0	$>$ DN 100
Parallelism between bolting bearing surfaces and flange jointing faces	All codes (machined surfaces)	$1^{\circ}$	All sizes
	All codes (unmachined surfaces)	$2^{\circ}$	
NOTE 1 Concentricity is between $K$ and any machined diameter. This tolerance does not apply if a suitable machined diameter does not exist.			
NOTE 2 Miscellaneous radii chamfers should be regarded as maximum unless otherwise specified. Tolerances on the pitch circle diameter and centre-to-centre of adjacent bolt holes are determined by the difference between the bolt and the bolt hole diameter and thus in conjunction cannot exceed the clearance together with any tolerance on the diameter of the bolt hole.			
a These tolerances apply only to codes 301, 302, 307, 312 and 314 flanges intended for attachment by fusion welding.			

Table 13 — Pressure/temperature ratings (general applications)

PN	Temperature (see notes)						
	– 10 °C to 120 °C	150 °C	180 °C	200 °C	220 °C	250 °C	260 °C
	Maximum non-shock gauge pressure						
	bar <sup>a</sup>	bar	bar	bar	bar	bar	bar
6	6.0	6.0	6.0	5.0	4.0	2.5	2.0
10	10.0	10.0	10.0	8.5	7.0	5.0	4.0
16	16.0	16.0	16.0	13.5	11.3	8.0	7.0
25	25.0	25.0	25.0	21.2	17.5	12.2	10.5
40	40.0	38.5	34.0	30.0	25.5	19.5	17.5
NOTE 1 Flanges larger than DN 250 are limited to a maximum temperature of 120 °C.							
NOTE 2 Flanges in alloy CZ 110 are limited to a maximum temperature of 200 °C.							
NOTE 3 Flange sizes up to and including DN 250 in alloy AB 2, alloy CA 104 and alloy CN 107 may be used up to and including 350 °C and the rating at 260 °C applies.							
NOTE 4 PN 6, PN 10, PN 16 and PN 25 flanges used in conjunction with copper tubes to BS 2871-1 up to and including DN 50 and attached by soft solder (see BS 864-2), are limited to the following maximum operating temperature and/or pressures:							
6 bar at 110 °C							
10 bar at 65 °C							
16 bar at 30 °C							
NOTE 5 All flanges attached by silver brazing to copper or copper alloy tubes are limited to a maximum operating temperature of 200 °C.							
NOTE 6 For the suitability of copper alloy and steel components and bolting at low temperatures reference should be made to the appropriate application standard.							
<sup>a</sup> 1 bar = 10 <sup>5</sup> N/m <sup>2</sup> = 10 <sup>5</sup> Pa.							

## Appendix A Information to be supplied by purchaser

The following information should be supplied by the purchaser in his enquiry and/or order:

- a) Number and Section of this British Standard, i.e. BS 4504-3.3;
- b) Nominal size: DN followed by the appropriate number (see clause 3);
- c) Nominal pressure: PN followed by the appropriate number (see clause 4);
- d) Flange code number (see 2.2);
- e) The tube size where a flange can be made to suit more than one tube size (see Table 7 to Table 10);
- f) Material designation (for both the copper alloy and steel component where applicable) (see 5.1);
- g) Any protective coating (galvanizing, painting) of the steel components (see clause 5 and 9.1);

## Appendix B Application and installation

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

**B.1** When using bolting materials of other than copper alloy the purchaser should take into account the pressure, flange material and the related gasket so that the joint remains tight under the expected operating conditions.

**B.2** Application of the ratings to flanged joints at either high or low temperature should consider the effect of the risk of leakage due to forces and movement described in the connecting pipes.

**B.3** Flanges may be required to be pressure 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 fabricated or manufactured. Any test pressure should not exceed 1.5 times the allowable pressure at 20 °C rounded off to the next higher whole bar increment.

## Appendix C Comparison of copper alloy and composite flange descriptions and code numbers specified in BS 4504-3.3:1989 and BS 4504-2:1974

Table 14 — Copper alloy and composite flange descriptions and code numbers specified in BS 4504-3.3:1989 and BS 4504-2:1974

Description of flange type	Code number in BS 4504-3.3:1989	Type number superseded in BS 4504-2:1974
Plate flange in copper alloy for brazing or welding	301	—
Loose flange in steel with a plate collar in copper alloy for brazing or welding	302	—
Loose flange in steel with a weld-neck collar in copper alloy for welding	304	25
Blank flange in copper alloy or in steel clad with the jointing face in copper alloy	305	—
Loose flange in steel with a slip-on collar in copper alloy for soft soldering, brazing or welding	307	24
Hubbed slip-on flange in copper alloy for soft soldering, brazing or welding	312	22
Hubbed slip-on flange in copper alloy for soft soldering, brazing or welding supplied with tube stops	314	—
Integral flange in copper alloy	321	21
Slip-on composite for brazing	—	23
Slip-on composite for welding	—	26

## Publications referred to

- BS 864, *Capillary and compression tube fittings of copper and copper alloy.*
- BS 864-2, *Specification for capillary and compression fittings for copper tubes.*
- BS 1134, *Method for the assessment of surface texture.*
- BS 1134-1, *Method and instrumentation.*
- BS 1400, *Specification for copper alloy ingots and copper alloy and high conductivity copper castings.*
- BS 1503, *Specification for steel forgings (including semi-finished forged products) for pressure purposes.*
- BS 1560, *Circular flanges for pipes, valves and fittings (Class designated).*
- BS 1560-3, *Steel, cast iron and copper alloy flanges.*
- BS 1560-3.3, *Specification for copper alloy and composite flanges<sup>3)</sup>.*
- BS 1723, *Brazing.*
- BS 2871, *Specification for copper and copper alloys. Tubes.*
- BS 2871-1, *Copper tubes for water, gas and sanitation.*
- BS 2871-2, *Copper and copper alloy tubes for general purposes.*
- BS 2872, *Specification for copper and copper alloys. Forging stock and forgings.*
- BS 2874, *Specification for copper and copper alloy rods and sections (other than forging stock).*
- BS 2875, *Specification for copper and copper alloys. Plate.*
- BS 3692, *Specification for ISO metric precision hexagon bolts, screws and nuts. Metric units.*
- BS 4190, *Specification for ISO metric black hexagon bolts, screws and nuts.*
- BS 4320, *Specification for metal washers for general engineering purposes. Metric series.*
- BS 4360, *Specification for weldable structural steels.*
- BS 4439, *Specification for screwed studs for general purposes. Metric series.*
- BS 4865, *Dimensions of gaskets for flanges to BS 4504.*
- BS 4865-1, *Specification for dimensions of non-metallic flat gaskets<sup>3)</sup>.*
- BS 4865-2, *Specification for spiral wound gaskets for use with steel flanges<sup>3)</sup>.*
- BS 4865-3, *Specification for non-metallic envelope gaskets<sup>3)</sup>.*
- BS 4865-4, *Specification for corrugated flat or grooved metallic and filled metallic gaskets for use with steel flanges<sup>3)</sup>.*
- BS 4882, *Specification for bolting for flanges and pressure containing purposes.*
- BS 5750, *Quality systems<sup>3)</sup>.*
- ISO 6708, *Pipe components — Definition of nominal size.*
- ISO 7005, *Metallic flanges.*
- ISO 7005-3, *Copper alloy and composite flanges<sup>3)</sup>.*
- ISO 7268, *Pipe components — Definition of nominal pressure.*

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<sup>3)</sup> Referred to in foreword only.



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