

**BS 10:2009**

*Incorporating Corrigendum No. 1*



**BSI Standards Publication**

# **Specification for flanges and bolting for pipes, valves and fittings**

**bsi.**

...making excellence a habit.™

**Publishing and copyright information**

The BSI copyright notice displayed in this document indicates when the document was last issued.

© The British Standards Institution 2012  
Published by British Standards Limited 2012

ISBN 978 0 580 78738 6

ICS 23.040.60

The following BSI references relate to the work on this standard:

Committee reference PSE/15

Draft for comment 08/30174939 DC

**Publication history**

First published as BS 10-1:1947, BS 10-2:1926, BS 10-3:1929, BS 10-4:1931  
and BS 10-5:1932

First published as BS 10, December 1962

Second (present) edition, April 2009

**Amendments issued since publication**

Date	Text affected
------	---------------

---

April 2011	See foreword
------------	--------------

## Contents

Foreword *iii*

1	Scope	1
2	Normative references	1
3	Design temperature and pressure	2
4	Designation	2
5	Flange dimensions	2
6	Flange materials	3
7	Attachment of flanges	4
8	Hydraulic testing of flange joints	4
9	Certification	4
10	Low temperature flanges and bolting	6

### Annexes

Annex A (informative)	Information to be supplied by the purchaser	33
Annex B (informative)	Minimum requirements of steel to be used for flanges in Table A to Table H	34
Annex C (normative)	Bolts and nuts	37
Bibliography		41

### List of figures

Figure 1	Shaped stud bolt (see C.4)	25
Figure 2	Application diagram for bolts and stud-bolts <span style="border: 1px solid black; padding: 0 2px;">C1</span> text deleted <span style="border: 1px solid black; padding: 0 2px;">C1</span>	26
Figure 3	Steel or copper alloy plain flange	28
Figure 4	Steel boss flange	29
Figure 5	Integrally forged or cast steel flange for valves only	30
Figure 6	Steel welding neck flange (see Table D to Table T)	31
Figure 7	Integrally cast iron flanges (see Table F and Table H)	32

### List of tables

Table 1	Flange materials – minimum requirements	3
Table 2	Temperature/pressure ratings for carbon steel flanges [see Annex B]	5
Table A	Dimensions of plain, boss, integrally cast or forged flanges (for ratings see Table 2 and Annex B)	7
Table D	Dimensions of plain, boss, integrally cast or forged and welding neck flanges (for ratings see Table 2 and Annex B)	9
Table E	Dimensions of plain, boss, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B)	12
Table F	Dimensions of plain, boss, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B)	14
Table H	Dimensions of plain, boss, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B)	16
Table J	Dimensions of plain, boss, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B)	18
Table K	Dimensions of plain, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B)	19
Table R	Dimensions of plain, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B)	21
Table S	Dimensions of plain, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B)	22
Table T	Dimensions of plain, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B)	24
Table B.1	Grey cast iron properties	34
Table B.2	Temperature/pressure ratings for grey cast iron and malleable cast iron flanges [see Clauses 5g) and 5h)]	35

Table B.3 – Temperature/pressure ratings for copper alloy flanges sizes ½ in to 3 in (inclusive) [see Clause 5j)] 35

Table B.4 – Temperature/pressure ratings for copper alloy flanges sizes over 3 in [see Clause 5f)] 36

Table C.1 – Application of bolts and stud-bolts [see Figure 2a) and Figure 2b)] 37

Table C.2 – Materials, dimensions and finish of bolts, stud-bolts and nuts 39

#### Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 42, an inside back cover and a back cover.

## Foreword



### Publishing information

This British Standard is published by  BSI Standards Limited, under licence from The British Standards Institution  and came into effect on 30 April 2009. It was prepared by Technical Committee PSE/15, *Flanges*. A list of organizations represented on this committee can be obtained on request to its secretary.

### Supersession

This British Standard supersedes BS 10:1962, which is withdrawn.

### Information about this document

The start and finish of text introduced or altered by Corrigendum No. 1 is indicated in the text by tags  and .

It should be noted that, apart from cast iron flanges, the hydraulic test pressure applied to a flange joint is limited to one-and-a-half times the highest rated pressure of the flange (see Clause 8).

This is a full revision of the standard, and introduces the following principal changes:

- Materials have been updated;
- The standard has been re-arranged to reflect the most common used materials and types in service;
- Review of tables:

BS 10 flanges have been in use since 1904 and have been developed continuously to meet increasing pressure and temperature requirements. At the time of this revision, flange joints with carbon steel pipe flanges for high temperatures and pressures to the British Standard tables have been in service throughout the world for periods equal to the economic life of primary plant. The tables have therefore remained in the standard for guidance.

*NOTE* When it is required to convert the figures in this standard from imperial units into metric units it is recommended that the conversion factors and the table of conversion contained in BS 350, "Conversion factors and tables", be used. Attention is also drawn to BS 2856, "Precise conversion of inch and metric sizes on engineering drawings".

### Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

*Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.*

### Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

**Compliance with a British Standard cannot confer immunity from legal obligations.**

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

## 1 Scope

This British Standard specifies requirements for a series of carbon steel, alloy steel, cast iron and copper alloy flanges, and also appropriate bolts and nuts, for use with pipes, valves and fittings containing steam, oil, compressed air or water.

*NOTE 1 The use of flanges complying with this standard for temperatures below  $-17.8\text{ }^{\circ}\text{C}$  ( $0\text{ }^{\circ}\text{F}$ ) should be agreed between purchaser and manufacturer. These flanges may also be used on pipes, valves and fittings carrying other fluids for which the same requirements for safety and joint tightness are appropriate.*

The applicability relationship between temperature and pressure for the above materials is specified for each table of flanges in Table 2 and Annex B.

*NOTE 2 The types of gasket, and gasket materials, and the surface finish of the jointing face are matters for agreement between the purchaser and the manufacturer. When a raised jointing face is specified the outside diameter of the gasket should extend at least to the outside diameter of the raised face. For steel flanges when a raised jointing face is not specified, the gasket should be within the bolt holes.*

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 21, *Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions)*

BS 84, *Parallel screw threads of Whitworth form – Requirements*

BS 916, *Specification for black bolts screws and nuts – Hexagon & square, with B.S.W. threads, and partly machined bolts, screws & nuts, hexagon & square with B.S.W. or B.S.F. threads*

BS 1580-1, *Unified screw threads – Part 1: Screw threads with diameters  $\frac{1}{4}$  in and larger – Requirements*

BS 1769, *Specification for unified black hexagon bolts, screws and nuts – (UNC and UNF threads) – heavy series*

BS 3410, *Specification for metal washers for general engineering purposes*

BS EN 10090, *Wrought steels in the form of bars, billets, and forgings, up to 6 in ruling section, for automobile and general engineering purposes – En series*

BS EN 10025-2, *Hot rolled products of structural steels – Part 2: Technical delivery conditions for non-alloy structural steels*

BS EN 10222-2, *Steel forgings for pressure purposes – Part 2: Ferritic and martensitic steels with specified elevated temperature properties*

BS EN 13480 Parts 1-5, *Metallic industrial piping*

BS EN 14324, *Brazing – Guidance on the application of brazed joints*

BS ISO 10204, *Iron ores – Determination of magnesium – Flame atomic absorption spectrometric method*

### 3 Design temperature and pressure

**3.1** The design temperature and pressure shall be stated by the purchaser. The tables provided in this standard are for guidance only and are based on historical data contained in previous revisions of this standard. If verification is required, this shall be the responsibility of the purchaser. One method of verification that could be used is BS EN 1591-1.

**3.2** Where there is an appropriate application standard the purchaser shall ensure that the design temperature and pressure stated conform to the requirements of that standard.

*NOTE* The temperature-pressure ratings given in Table 2 and Annex B are design temperatures and pressures.

**3.3** The pressure ratings, with the exception of those in the second column in Table B.2, shall be applied to installations subject to moderate shock such as might occur in an efficiently designed and operated boiler feed main.

**3.4** Where a system might be subject to more severe shock, the purchaser shall make a suitable allowance when stating the design pressure or the flange table.

### 4 Designation

Flange sizes shall be designated by the nominal bores of their respective pipes as given in the first and last column of each table.

### 5 Flange dimensions

#### 5.1 General

Flange dimensions shall conform to those specified in the appropriate tables and Figure 3 to Figure 7.

*NOTE* The thicknesses and diameters of flanges specified are minima.

#### 5.2 Raised jointing faces for steel flanges only (see Figure 3 to Figure 6)

*NOTE 1* Raised jointing faces specified in Table H, Table J and Table K are recommended only for steel flanges.

If a raised jointing face is required on a steel flange specified in Table A, Table D, Table E and Table F, the diameter shall be  $\frac{1}{4}$  in less than the diameter of the inscribed circle touching the bolt holes.

*NOTE 2* Raised jointing faces are not specified in Table H, Table J and Table K because it is not customary to use them on these flanges.

Raised jointing faces as specified in Table R, Table S and Table T shall be used.

#### 5.3 Flange thicknesses (see Figure 3 to Figure 7)

*NOTE 1* The thickness ( $T$ ) specified in the tables includes a raised jointing face having a height not exceeding  $\frac{1}{16}$  in. Where there is no raised face,  $T$  is the thickness of the flange. If the height of the raised jointing face is more than  $\frac{1}{16}$  in, the thickness ( $T$ ) is increased by an equivalent amount.

The backs of integrally cast steel flanges shall be machined.



*NOTE 2 This machining may be either by spot-facing at the bolt holes or by back-facing at the option of the manufacturer (see Figure 5). The backs of other flanges may be left unmachined at the option of the manufacturer unless otherwise specified by the purchaser.*

After machining, the thickness of the flange shall be not less than the thickness specified.

## 5.4 Flange drilling

Unless otherwise specified by the purchaser all bolt holes shall be drilled, shall be equally spaced on the bolt pitch circle diameter, and in the case of integral flanges the bolt holes shall be drilled off centres.

For ½ inch and ⅝ inch bolts, the diameters of the holes shall be ⅛ inch larger than the diameters of the bolts, except that for cast iron flanges with ⅝ inch bolts the holes can be ⅛ inch larger than the diameters of the bolts. For ¾ inch bolts and larger, the diameter of the holes shall be not greater than ⅛ inch larger than the diameters of the bolts in all cases.

## 6 Flange materials

**6.1** Steel flanges either forged, stamped or plate shall be manufactured from materials conforming to the minimum requirements as set out in Table 1.

*NOTE Alternative materials can be used providing that the mechanical properties at operating temperature are not inferior to those given in the specifications set out in Table 1.*

Table 1 Flange materials – minimum requirements

Flange table	Temperature range –17.8 °C to 427 °C inc. (0 °F to 800 °F inc.)
A to J inclusive	BS EN 10025-2, S235JR
K to T inclusive	BS EN 10025-2, S275JR BS EN 10222-2, P245GH

*NOTE For the minimum requirements of steel that can be used for flanges in Table A to Table H inclusive for temperatures from –17.8 °C (0 °F) to 260 °C (500 °F), see Annex B.*

**6.2** Flanges shall be free from laminations and surface defects.

**6.3** Where welding neck flanges are made from wrought steel the direction of the fibres of the material in the neck shall be parallel to the longitudinal axis of the flange.

**6.4** If the purchaser requires certificates of the process, chemical analysis of the specified elements and physical properties of the materials, this shall be stated on the order.  $\square_{C1}$  (See Clause 9).  $\square_{C1}$

**6.5** When the purchaser requires the individual flange he has ordered to be marked to identify the materials used, the system of marking to be employed shall be the subject of agreement between the purchaser and the manufacturer.

## 7 Attachment of flanges

7.1 The method of securing flanges (other than integral flanges) to pipes and fittings supplied complete by manufacturers shall be in accordance with the appropriate application standard. Where there is no appropriate application standard, the methods of attachment shall be the subject of agreement between the purchaser and the manufacturer.

*NOTE* Where there is no appropriate application standard, the methods shown in BS EN 13480, Parts 1 to 5 and BS EN 12449 should be regarded as minimum requirements.

7.2 If flanges are to be supplied loose, they shall, unless otherwise specifically called for by the purchaser, be prepared for attachment to pipes as follows.

- a) *Steel flanges.*
  - 1) Boss flanges, sizes 6 in and smaller, screwed in accordance with BS 21.
  - 2) Boss flanges, sizes 7 in to 12 in machined in the bore to slip over the outside diameter of the pipe or fitting; suitable for welding.
  - 3) Plain flanges ½ in thick and thicker, machined in the bore; suitable for welding-on to form one of the types in the appropriate application standard as required by the purchaser. The purchaser shall specify the type of preparation required.
  - 4) Welding neck flanges, machined in the bore to a diameter to be specified by the purchaser, and suitably bevelled for welding to pipes or fittings.
- b) *Copper alloy flanges.* Machined in the bore to slip over the outside diameter of the pipe or fitting; suitable for fusion welding (where applicable).

## 8 Hydraulic testing of flange joints

8.1 This standard does not specify the hydraulic test pressures for flanged pipes or components, details of which shall be obtained from the appropriate standards which specify test pressures for pipes or components but in any case, the test pressure to be applied to the joint shall not exceed one-and-a-half times the highest rated pressures for steel and copper alloy flanges, and twice the highest rated pressures for cast iron flanges.

8.2 Where flanged assemblies are not covered by any standard specifying test pressures but incorporate flanges conforming to this standard, or where any assembly is to be used for duties of a special nature, the test pressure shall be agreed between the purchaser and the manufacturer.

## 9 Certification

The flange manufacturer shall use respective procedures to ensure material traceability and to avoid material exchange and shall be able to provide retrospective certification for the base material used. Certificates shall be provided in accordance with BS ISO 10204, Type 2.1 as a minimum but the purchaser may also request a 2.2 or 3.1 certificate at their option.

Table 2 Temperature/pressure ratings for carbon steel flanges [see Annex B]

Table	Temperature °C										Maximum hydraulic test pressure (lbf/in <sup>2</sup> )
	-17.8 to 121.1	-17.8 to 232.2	260.0	287.8	315.6	343.3	371.1	399	427		
	Temperature °F										
	0 to 250	0 to 450	500	550	600	650	700	750	800		
	Pressure (lbf/in <sup>2</sup> )										
A	50 <sup>A)</sup>	25 <sup>B)</sup>	—	—	—	—	—	—	—	—	75
D	—	100	95	85	80	70	65	55	50	150	
E	—	200	185	170	155	140	130	115	100	300	
F	—	300	280	255	235	215	195	170	150	450	
H	—	500	465	430	395	355	320	285	250	750	
J	—	700	650	600	550	500	450	400	350	1 050	
K	—	900	835	770	705	645	580	515	450	1 350	
R	—	1 200	1 115	1 030	945	855	770	685	600	1 800	
S	—	1 800	1 670	1 545	1 415	1 285	1 155	1 030	900	2 700	
T	—	2 800	2 600	2 400	2 200	2 000	1 800	1 600	1 400	4 200	

NOTE Intermediate values above 450°F (232.2°C) may be obtained by linear interpolation.

A) It is customary in the gas industry to limit the use of Table A flanges to working gas pressures not exceeding 30 lbf/in<sup>2</sup>. It is recommended that this limitation be also applied to compressed air.

B) This rating applies to temperatures above 121.1 °C (250 °F) up to and including 232.2 °C (450 °F) and does not apply to flange sizes above 36 in.

## 10 Low temperature flanges and bolting

### COMMENTARY ON CLAUSE 10

*Alternative materials may be used provided that the mechanical properties at operating temperature are not inferior to those given in the specifications referred to below.*

Flanges and bolting for low temperature duty shall conform to the following minimum requirements.

- a) Steel flanges either plate, stamped, forged or cast and bolting material intended for use with pipes in accordance with BS 3603. Pressure ratings for these shall be stated by the purchaser.
- b) Where copper alloy flanges to this standard are used for temperatures down to  $-200\text{ }^{\circ}\text{C}$  ( $-328\text{ }^{\circ}\text{F}$ ), pressure ratings for these flanges shall be stated by the purchaser. Guidance is provided in Table B.3 or Table B.4, temperature range  $-17.8\text{ }^{\circ}\text{C}$  to  $121.1\text{ }^{\circ}\text{C}$  ( $0\text{ }^{\circ}\text{F}$  to  $250\text{ }^{\circ}\text{F}$ ), and is based on historical data contained in previous revisions of this standard.

*NOTE 9% aluminium bronze to BS 2032 is a suitable bolting material for the above low temperature range, but other copper alloys may be used by agreement between the purchaser and the supplier.*

Table A Dimensions of plain, boss, integrally cast or forged flanges (for ratings see Table 2 and Annex B)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe <sup>A)</sup>	Diameter of flange	Bolt circle diameter	No. of bolts	Diameter of bolts <sup>B)</sup>	Dimensions of boss (Fig 4) <sup>C)</sup>			Thickness of flange			
						Boss length	Diameter at small end of boss	Maximum diameter at root of boss	Grey cast iron integrally cast or screwed on with boss	Malleable cast iron screwed on with boss	Copper alloy cast or wrought integral or boss or plain (Fig. 3)	Wrought steel integral or plain (Fig. 3) or boss (Fig. 4)
	H	D	P	N	O	A	B	E	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>
in	in	in	in		in	in	in	in	in	in	in	in
1/2	27/32	3 3/4	2 5/8	4	1/2	3/8	1 5/16	1 1/2	1/2	3/16	1/4	3/16 D)
3/4	1 1/16	4	2 7/8	4	1/2	7/16	1 1/2	1 3/4	1/2	3/16	1/4	3/16 D)
1	1 11/32	4 1/2	3 1/4	4	1/2	7/16	1 7/8	2 1/16	1/2	3/16	5/16	3/16 D)
1 1/4	1 11/16	4 3/4	3 7/16	4	1/2	7/16	2 3/16	2 9/32	5/8	1/4	5/16	1/4 D)
1 1/2	1 29/32	5 1/4	3 7/8	4	1/2	1/2	2 7/16	2 3/4	5/8	1/4	3/8	1/4 D)
2	2 3/8	6	4 1/2	4	5/8	1/2	2 15/16	3 1/8	5/8	5/16	3/8	5/16 D)
2 1/2	3	6 1/2	5	4	5/8	5/8	3 9/16	3 21/32	1 1/16	5/16	7/16	5/16 D)
3	3 1/2	7 1/4	5 3/4	4	5/8	5/8	4 3/16	4 13/32	1 1/16	3/8	1/2	3/8 D)
3 1/2	4	8	6 1/2	4	5/8	1 1/16	4 11/16	5 1/8	3/4	3/8	9/16	3/8 D)
4	4 1/2	8 1/2	7	4	5/8	3/4	5 1/4	5 1/2	3/4	3/8	5/8	3/8 D)
5	5 1/2	10	8 1/4	4	5/8	3/4	6 5/16	6 3/4	3/4	1/2	1 1/16	1/2
6	6 1/2	11	9 1/4	4	5/8	3/4	7 5/16	7 3/4	13/16	1/2	1 1/16	1/2
	6 5/8											
7	7 5/8	12	10 1/4	8	5/8	7/8	8 3/8	8 3/4	13/16	—	3/4	1/2
8	8 5/8	13 1/4	11 1/2	8	5/8	7/8	9 1/2	10	7/8	—	3/4	1/2
9	9 5/8	14 1/2	12 3/4	8	5/8	1	10 1/2	11 1/8	7/8	—	3/4	5/8
10	10 3/4	16	14	8	3/4	1 1/16	11 3/4	12 3/16	15/16	—	3/4	5/8
12	12 3/4	18	16	8	3/4	1 1/8	13 3/4	14 3/16	15/16	—	7/8	3/4
13	14	19 1/4	17 1/4	8	3/4	—	—	—	15/16	—	7/8	3/4
14	15 E)	20 3/4	18 1/2	8	7/8	—	—	—	1	—	1	7/8
15	16	21 3/4	19 1/2	8	7/8	—	—	—	1	—	1	7/8
16	—	22 3/4	20 1/2	12	7/8	—	—	—	1 1/16	—	1	7/8
17	18	24	21 3/4	12	7/8	—	—	—	1 1/16	—	1 1/16	7/8
18	—	25 1/4	23	12	7/8	—	—	—	1 1/16	—	1 1/16	7/8
19	20	26 1/2	24	12	7/8	—	—	—	1 1/8	—	1 1/8	7/8
20	—	27 3/4	25 1/4	12	7/8	—	—	—	1 1/8	—	1 1/8	1
21	22	29	26 1/2	12	7/8	—	—	—	1 1/8	—	1 1/8	1

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Table A Dimensions of plain, boss, integrally cast or forged flanges (for ratings see Table 2 and Annex B) (continued)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe <sup>A)</sup>	Diameter of flange	Bolt circle diameter	No. of bolts	Diameter of bolts <sup>B)</sup>	Dimensions of boss (Fig 4) <sup>C)</sup>			Thickness of flange			
						Boss length	Diameter at small end of boss	Maximum diameter at root of boss	Grey cast iron integrally cast or screwed on with boss	Malleable cast iron screwed on with boss	Copper alloy cast or wrought integral or plain (Fig. 3)	Wrought steel integral or plain (Fig. 3) or boss (Fig. 4)
	<i>H</i>	<i>D</i>	<i>P</i>	<i>N</i>	<i>O</i>	<i>A</i>	<i>B</i>	<i>E</i>	<i>T</i> <sub>1</sub>	<i>T</i> <sub>2</sub>	<i>T</i> <sub>3</sub>	<i>T</i> <sub>4</sub>
in	in	in	in	in	in	in	in	in	in	in	in	in
22	—	30	27 1/2	12	1	—	—	—	1 3/16	—	1 3/16	1
23	24	31	28 1/2	12	1	—	—	—	1 3/16	—	1 3/16	1
24	—	32 1/2	29 3/4	12	1	—	—	—	1 3/16	—	1 3/16	1
26	26	33 1/4	30 3/4	16	1	—	—	—	1 1/4	—	—	1
27	28	34 1/4	31 3/4	16	1	—	—	—	1 1/4	—	—	1
29	30	36 1/4	33 3/4	20	1	—	—	—	1 1/4	—	—	1
30	—	37 1/4	34 3/4	20	1	—	—	—	1 1/4	—	—	1
33	34	40 1/2	38	20	1	—	—	—	1 1/4	—	—	1 1/8
35	36	42 1/2	40	24	1	—	—	—	1 1/4	—	—	1 1/8
36	—	43 1/2	41	24	1	—	—	—	1 3/8	—	—	1 1/8
39	40	46 1/2	44	24	1	—	—	—	1 3/8	—	—	1 1/8
42	43	49 1/2	47	28	1	—	—	—	1 3/8	—	—	1 1/4
45	—	52 3/4	50 1/4	28	1	—	—	—	1 1/2	—	—	1 1/4
48	49	55 3/4	53 1/4	28	1	—	—	—	1 1/2	—	—	1 1/4
54	55	63 1/4	60 1/4	32	1 1/4	—	—	—	1 3/4	—	—	1 3/8
60	61	70 1/4	67	32	1 1/4	—	—	—	1 7/8	—	—	1 1/2
66	67 1/4	76 1/2	73 1/4	32	1 1/4	—	—	—	2 1/8	—	—	1 5/8
72	73 1/4	83	79 1/2	36	1 3/8	—	—	—	2 3/8	—	—	1 3/4

A) (H) For availability of steel pipe sizes, refer to BS EN 10216, BS EN 10217. See BS 4622 and BS 4722 for outside diameters of cast iron pipes. See BS EN 12449 for the sizes of copper pipes for use with copper alloy flanges up to 8 in bore.

B) (O) For 1/2 in and 3/8 in bolts, the diameters of the holes shall be 1/16 in larger than the bolts and for 3/4 in bolts and sizes above, the diameters shall be not more than 1/8 in larger than the bolts. For cast iron flanges the diameters of the bolt holes may be 1/8 in larger than the bolts of sizes 5/8 in and above. For 7/8 in bolts and sizes above, the diameters shall be not more than 1/8 in larger than the bolts.

C) (A, B and E) Tapers are not specified but shall be such that the maximum diameters at root of boss are not exceeded.

D) (T<sub>4</sub>) It may be impracticable to use thicknesses less than 1/2 in except for boss and integral flanges.

E) (H) It is recommended that this size for steel pipes should be avoided wherever possible. C1

Table D Dimensions of plain, boss, integrally cast or forged and welding neck flanges (for ratings see Table 2 and Annex B)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe A)	Diameter of flange	Bolt circle diameter	No. of bolts	Diameter of bolts B)	Dimensions of boss (Fig 4) C)			Dimensions of cast iron necks (Fig. 7)			Dimensions of steel welding necks (Fig. 6)				Thickness of flange				
						Boss length	Diameter at small end of boss	Maximum diameter at root of boss	Diameter at large end of neck	Length of taper	Diameter at large end of neck	Diameter at small end of neck D)	Total length of neck	Length of taper	Grey cast iron integrally screwed on with boss	Copper alloy cast or wrought integral or boss or plain (Fig. 3)	Wrought steel integral or plain (Fig. 3) or boss or welding neck (Fig. 4) or welding neck (Fig. 6) (except for valves)	Cast steel integral or plain (Fig. 3) or boss or welding neck (Fig. 6) (except for valves)	Forged or cast steel integral (Fig. 5) or welding valves (for only)	
H	D	P	N	O	A	B	E	C	G	J	K	L	M	T <sub>1</sub>	T <sub>3</sub>	T <sub>5</sub>	T <sub>6</sub>	T <sub>9</sub>		
in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	
1/2	3 3/4	2 5/8	4	1/2	3/8	1 5/16	1 1/2	—	—	1 1/16	7/8	7/8	5/8	1/2	1/4	3/16 E)	3/8 E)	3/8		
3/4	4	2 7/8	4	1/2	7/16	1 1/2	1 3/4	—	—	1 5/16	1 3/32	7/8	5/8	1/2	1/4	3/16 E)	3/8 E)	3/8		
1	4 1/2	3 1/4	4	1/2	7/16	1 7/8	2 1/16	—	—	1 11/16	1 3/8	7/8	5/8	1/2	5/16	3/16 E)	3/8 E)	3/8		
1 1/4	4 3/4	3 7/16	4	1/2	7/16	2 3/16	2 9/32	—	—	1 15/16	1 23/32	1	5/8	1/2	5/16	1/4 E)	1/2	1/2		
1 1/2	5 1/4	3 7/8	4	1/2	1/2	2 7/16	2 3/4	—	—	2 5/16	1 15/16	1 1/8	5/8	3/4	3/8	1/4 E)	1/2	1/2		
2	6	4 1/2	4	5/8	1/2	2 15/16	3 1/8	—	—	2 3/4	2 19/32	1 1/8	3/4	11/16	3/8	5/16 E)	9/16	9/16		
2 1/2	6 1/2	5	4	5/8	5/8	3 9/16	3 21/32	—	—	3 1/4	3 1/32	1 1/4	7/8	11/16	7/16	5/16 E)	9/16	9/16		
3	7 1/4	5 3/4	4	5/8	5/8	4 3/16	4 13/32	—	—	4	3 17/32	1 3/8	1	3/4	1/2	3/8 E)	9/16	9/16		
3 1/2	8	6 1/2	4	5/8	11/16	4 11/16	5 1/8	—	—	4 1/2	4 1/16	1 3/8	1	3/4	9/16	3/8 E)	9/16	9/16		
4	8 1/2	7	4	5/8	3/4	5 1/4	5 1/2	—	—	5 1/8	4 9/16	1 5/8	1 1/4	3/4	5/8	3/8 E)	11/16	11/16		
5	10	8 1/4	8	5/8	3/4	6 5/16	6 3/4	—	—	6	5 9/16	1 3/4	1 1/4	13/16	11/16	1/2	11/16	11/16		
6	11	9 1/4	8	5/8	3/4	7 5/16	7 3/4	—	—	7 1/4	6 9/16	1 7/8	1 1/4	13/16	11/16	1/2	11/16	11/16		
7	12	10 1/4	8	5/8	7/8	8 3/4	8 3/4	—	—	8 1/4	7 23/32	2	1 3/8	7/8	3/4	1/2	3/4	3/4		
8	13 1/4	11 1/2	8	5/8	7/8	9 1/2	10	—	—	9 1/2	8 23/32	2	1 3/8	7/8	3/4	1/2	3/4	3/4		
9	14 1/2	12 3/4	8	5/8	1	10 1/2	11 1/8	—	—	10 5/8	9 3/4	2 1/4	1 1/2	7/8	3/4	5/8	3/4	3/4		
10	16	14	8	3/4	1 1/16	11 3/4	12 3/16	—	—	11 1/2	10 7/8	2 1/2	1 3/4	1	3/4	5/8	3/4	3/4		
12	18	16	12	3/4	1 1/8	13 3/4	14 3/16	—	—	13 1/2	12 29/32	2 3/4	2	1	7/8	3/4	7/8	7/8		
13	19 1/4	17 1/4	12	3/4	—	—	—	—	—	15	14 5/32	2 7/8	2 1/8	1	7/8	3/4	7/8	7/8		
14	20 3/4	18 1/2	12	7/8	—	—	—	—	—	16	15 5/32	2 7/8	2 1/8	1 1/8	1	7/8	1	1		
15	21 3/4	19 1/2	12	7/8	—	—	—	—	—	17	16 3/16	3	2 1/4	1 1/8	1	7/8	1	1		

Table D Dimensions of plain, boss, integrally cast or forged and welding neck flanges (for ratings see Table 2 and Annex B) (continued)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe A)	Diameter of flange	Bolt circle diameter	No. of bolts	Diameter of bolts	Dimensions of boss (Fig 4) C)			Dimensions of cast iron necks (Fig. 7)			Dimensions of steel welding necks (Fig. 6)				Thickness of flange				
						Boss length	Diameter at small end of boss	Maximum diameter at root of boss	Diameter at large end of neck	Length of taper	Diameter at large end of neck	Diameter at small end of neck D)	Total length of neck	Length of taper	J	K	L	M	T <sub>1</sub>	T <sub>3</sub>
in	H	D	P	N	O	A	B	E	C	G	J	K	L	M	T <sub>1</sub>	T <sub>3</sub>	T <sub>5</sub>	T <sub>6</sub>	T <sub>9</sub>	
16	—	22 3/4	20 1/2	12	7/8	—	—	—	—	—	—	—	—	—	1 1/8	1	7/8	1	1	
17	18	24	21 3/4	12	7/8	—	—	—	—	—	—	—	—	—	1 1/8	1 1/8	1	1 1/8	1 1/8	
18	—	25 1/4	23	12	7/8	—	—	—	—	—	—	—	—	—	1 1/4	1 1/8	1	1 1/8	1 1/8	
19	20	26 1/2	24	12	7/8	—	—	—	—	—	—	—	—	—	1 1/4	1 1/8	1	1 1/8	1 1/8	
20	—	27 3/4	25 1/4	16	7/8	—	—	—	—	—	—	—	—	—	1 1/4	1 1/4	1 1/8	1 1/4	1 1/4	
21	22	29	26 1/2	16	7/8	—	—	—	—	—	—	—	—	—	1 3/8	1 1/4	1 1/8	1 1/4	1 1/4	
22	—	30	27 1/2	16	1	—	—	—	—	—	—	—	—	—	1 3/8	1 1/4	1 1/8	1 1/4	1 1/4	
23	24	31	28 1/2	16	1	—	—	—	—	—	—	—	—	—	1 3/8	1 3/8	1 1/8	1 3/8	1 3/8	
24	—	32 1/2	29 3/4	16	1	—	—	—	—	—	—	—	—	—	1 3/8	1 3/8	1 1/4	1 3/8	1 3/8	
27	28	35 3/4	33 1/4	20	1	—	—	—	—	—	—	—	—	—	1 1/2	—	1 3/8	1 1/2	1 1/2	
29	30	38 1/4	35 1/2	20	1 1/8	—	—	—	—	—	—	—	—	—	1 1/2	—	1 5/8	1 5/8	1 1/2	
30	—	39 1/4	36 1/2	20	1 1/8	—	—	—	—	—	—	—	—	—	1 5/8	—	1 5/8	1 5/8	1 5/8	
33	34	43	40	20	1 1/4	—	—	—	—	—	—	—	—	—	1 5/8	—	1 3/4	1 3/4	1 5/8	
35	36	45	42	24	1 1/4	—	—	—	—	—	—	—	—	—	1 3/4	—	1 7/8	1 7/8	1 3/4	
36	—	46 1/4	43	24	1 1/4	—	—	—	—	—	—	—	—	—	1 3/4	—	1 7/8	1 7/8	1 3/4	
39	40	49 1/2	46 1/4	24	1 1/4	—	—	—	—	—	—	—	—	—	1 3/4	—	2	2	1 3/4	
42	43	52 1/2	49 1/4	28	1 1/4	—	—	—	—	—	—	—	—	—	1 7/8	—	2 1/8	2 1/8	1 7/8	
45	—	55 3/4	52 1/2	28	1 1/4	—	—	—	—	—	—	—	—	—	2	—	2 1/4	2 1/4	2	
48	49	58 3/4	55 1/2	32	1 1/4	—	—	—	—	—	—	—	—	—	2	—	2 3/8	2 3/8	2	
54	55	63 1/4	60 1/4	36	1 1/4	—	—	—	—	—	—	—	—	—	2 1/4	—	2 3/8	2 3/8	2 1/4	
60	61	70 1/4	67	40	1 3/8	—	—	—	—	—	—	—	—	—	2 3/8	—	2 1/2	2 1/2	2 3/8	



Table D Dimensions of plain, boss, integrally cast or forged and welding neck flanges (for ratings see Table 2 and Annex B) (continued)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe A)	Diameter of flange	Bolt circle diameter	No. of bolts	Diameter of bolts B)	Dimensions of boss (Fig 4) C)			Dimensions of steel welding necks (Fig. 6)			Thickness of flange							
						Boss length	Diameter at small end of boss	Maximum diameter at root of boss	Diameter at large end of neck	Length of taper	Diameter at large end of neck	Diameter at small end of neck D)	Total length of neck	Length of taper	Grey cast iron integrally cast or wrought screw on with boss	Copper alloy cast or wrought integral or boss or plain (Fig. 3)	Wrought steel integral or plain (Fig. 3) or boss or welding neck (Fig. 4) or neck (Fig. 6) (except for valves)	Cast steel integral or plain (Fig. 3) or boss or welding neck (Fig. 6) (except for valves)	Forged or cast steel integral (Fig. 5) or welding valves (for only)
H	D	P	O	N	A	B	E	C	G	J	K	L	M	T <sub>1</sub>	T <sub>3</sub>	T <sub>5</sub>	T <sub>6</sub>	T <sub>9</sub>	
in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in
66	76 1/2	73 1/4	1 3/8	40	—	—	—	—	—	—	—	—	—	2 1/2	—	2 5/8	2 5/8	2 1/2	2 1/2
72	83	79 1/2	1 1/2	44	—	—	—	—	—	—	—	—	—	2 5/8	—	2 7/8	2 7/8	2 5/8	2 5/8
78	89 1/2	86	1 1/2	44	—	—	—	82	2 7/8	—	—	—	—	2 3/4	—	3	—	—	—
84	96 3/4	92 3/4	1 3/4	44	—	—	—	88 1/4	2 7/8	—	—	—	—	2 7/8	—	3 1/4	—	—	—
96	109 1/4	105 1/4	1 3/4	52	—	—	—	100 3/4	3 1/2	—	—	—	—	3 1/4	—	3 5/8	—	—	—
108	121 3/4	117 3/4	1 3/4	56	—	—	—	113 1/4	4 1/4	—	—	—	—	3 1/2	—	4	—	—	—
120	135	130 1/2	2	60	—	—	—	125 1/2	4 1/4	—	—	—	—	3 3/4	—	4 1/2	—	—	—

A) (H) For availability of steel pipe sizes, refer to BS EN 10216, BS EN 10217. See BS 4622 and BS 4722 for outside diameters of cast iron pipes. See BS EN 12449 for the sizes of copper pipes for use with copper alloy flanges up to 8 in bore.

B) (O) For 1/2 in and 3/8 in bolts, the diameters of the holes shall be 1/16 in larger than the bolts and for 3/4 in bolts and sizes above, the diameters shall be not more than 1/8 in larger than the bolts. For cast iron flanges the diameters of the bolt holes may be 1/8 in larger than the bolts of sizes 5/8 in and above. For 7/8 in bolts and sizes above, the diameters shall be not more than 1/8 in larger than the bolts.

C) (A, B & E) Tapers are not specified but shall be such that the maximum diameters at root of boss are not exceeded.

D) (K) The diameters tabulated apply to pipes with outside diameters in accordance with H. For pipes designated by their bores, dimension K shall be such that the difference between the corresponding diameters K and H is maintained.

E) (T<sub>5</sub> and T<sub>6</sub>) It may be impracticable to use thicknesses less than 1/2 in except for boss and integral flanges.  $\sqrt{C_1}$

F) (H) It is recommended that this size for steel pipes should be avoided wherever possible.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Table E Dimensions of plain, boss, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe A)	Diam-eter of flange	Bolt circle diam-eter	No. of bolts	Diam-eter of bolts B)	Dimensions of boss (Fig.4) C)			Dimensions of steel welding necks (Fig. 6)			Thickness of flange					
						Boss length	Diam-eter at small end of boss	Maxi-mum diam-eter at root of boss	Diam-eter at large end of neck D)	Diam-eter at small end of neck	Total length of neck	Length of taper	T <sub>1</sub>	T <sub>3</sub>	T <sub>5</sub>	T <sub>6</sub>	T <sub>9</sub>
in	H	D	P	N	O	A	B	E	J	K	L	M	T <sub>1</sub>	T <sub>3</sub>	T <sub>5</sub>	T <sub>6</sub>	T <sub>9</sub>
1/2	27/32	3 3/4	2 5/8	4	1/2	3/8	1 5/16	1 1/2	1 1/16	7/8	7/8	5/8	1/2	1/4	1/4 E)	3/8 E)	3/8
3/4	1 1/16	4	2 7/8	4	1/2	7/16	1 1/2	1 3/4	1 5/16	1 3/32	7/8	5/8	1/2	1/4	1/4 E)	3/8 E)	3/8
1	1 11/32	4 1/2	3 1/4	4	1/2	7/16	1 7/8	2 1/16	1 11/16	1 3/8	7/8	5/8	1/2	5/16	9/32 E)	3/8 E)	3/8
1 1/4	1 11/16	4 3/4	3 7/16	4	1/2	7/16	2 3/16	2 9/32	1 15/16	1 23/32	1	5/8	5/8	5/16	5/16 E)	1/2	1/2
1 1/2	1 29/32	5 1/4	3 7/8	4	1/2	1/2	2 7/16	2 3/4	2 5/16	1 15/16	1 1/8	3/4	5/8	3/8	11/32 E)	1/2	1/2
2	2 3/8	6	4 1/2	4	5/8	1/2	2 15/16	3 1/8	2 3/4	2 13/32	1 1/8	3/4	3/4	3/8	3/8 E)	9/16	9/16
2 1/2	3	6 1/2	5	4	5/8	5/8	3 9/16	3 21/32	3 1/4	3 1/32	1 1/4	7/8	3/4	7/16	13/32 E)	9/16	9/16
3	3 1/2	7 1/4	5 3/4	4	5/8	5/8	4 3/16	4 13/32	4	3 17/32	1 3/8	1	3/4	1/2	7/16 E)	9/16	9/16
3 1/2	4	8	6 1/2	8	5/8	11/16	4 11/16	5 1/8	4 1/2	4 1/16	1 3/8	1	3/4	9/16	15/32 E)	9/16	9/16
4	4 1/2	8 1/2	7 1/4	8	5/8	3/4	5 1/4	5 1/2	5 1/8	4 9/16	1 5/8	1 1/4	7/8	5/8	1/2	11/16	11/16
5	5 1/2	10	8 1/4	8	5/8	3/4	6 5/16	6 3/4	6	5 9/16	1 3/4	1 1/4	7/8	11/16	9/16	11/16	11/16
6	6 1/2	11	9 1/4	8	3/4	3/4	7 5/16	7 1/2	7 1/4	6 9/16	1 7/8	1 1/4	7/8	11/16	11/16	11/16	11/16
	6 5/8									6 23/32							
7	7 5/8	12	10 1/4	8	3/4	7/8	8 3/8	8 1/2	8 1/4	7 23/32	2	1 3/8	1	3/4	3/4	3/4	3/4
8	8 5/8	13 1/4	11 1/2	8	3/4	7/8	9 1/2	9 13/16	9 1/2	8 23/32	2	1 3/8	1	3/4	3/4	3/4	3/4
9	9 5/8	14 1/2	12 3/4	12	3/4	1	10 1/2	10 15/16	10 5/8	9 3/4	2 1/4	1 1/2	1	13/16	13/16	13/16	13/16
10	10 3/4	16	14	12	3/4	1 1/16	11 3/4	12 3/16	11 1/2	10 7/8	2 1/2	1 3/4	1	7/8	7/8	7/8	7/8
12	12 3/4	18	16	12	7/8	1 1/8	13 3/4	13 15/16	13 1/2	12 29/32	2 3/4	2	1 1/8	1	1	1	1
13	14	19 1/4	17 1/4	12	7/8	—	—	—	15	14 5/32	2 7/8	2 1/8	1 1/8	1	1	1	1
14	15 F)	20 3/4	18 1/2	12	7/8	—	—	—	16	15 5/32	2 7/8	2 1/8	1 1/4	1	1 1/8	1 1/8	1
15	16	21 3/4	19 1/2	12	7/8	—	—	—	17	16 3/16	3	2 1/4	1 1/4	1	1 1/4	1 1/4	1
16	—	22 3/4	20 1/2	12	7/8	—	—	—	—	—	—	—	1 1/4	1	1 1/4	1 1/4	1
17	18	24	21 3/4	12	7/8	—	—	—	—	—	—	—	1 3/8	1 1/8	1 3/8	1 3/8	1 1/8
18	—	25 1/4	23	16	7/8	—	—	—	—	—	—	—	1 3/8	1 1/8	1 3/8	1 3/8	1 1/8

Table E Dimensions of plain, boss, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B) (continued)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe <sup>A)</sup>	Diameter of flange	Bolt circle diameter	No. of bolts	Diameter of bolts	Dimensions of boss (Fig. 4) C)			Dimensions of steel welding necks (Fig. 6)			Thickness of flange					
						Boss length	Diameter at small end of boss	Maximum diameter at root of boss	Diameter at large end of neck <sup>D)</sup>	Diameter at small end of neck	Total length of neck	Length of taper	Grey cast iron integrally cast or screwed on with boss	Copper alloy cast or wrought integral or plain (Fig. 3)	Wrought steel integral or plain boss (Fig. 4) or welding neck (Fig. 6) (except for valves)	Cast steel integral or plain boss (Fig. 3) or welding neck (Fig. 6) (except for valves)	Forged or cast steel integral (Fig. 5) (for valves only)
<i>H</i>	<i>D</i>	<i>P</i>	<i>O</i>	<i>N</i>	<i>A</i>	<i>B</i>	<i>E</i>	<i>J</i>	<i>K</i>	<i>L</i>	<i>M</i>	<i>T</i> <sub>1</sub>	<i>T</i> <sub>3</sub>	<i>T</i> <sub>5</sub>	<i>T</i> <sub>6</sub>	<i>T</i> <sub>9</sub>	
in	in	in	in		in	in	in	in	in	in	in	in	in	in	in	in	in
19	20	26 1/2	7/8	16	—	—	—	—	—	—	—	1 3/8	1 1/4	1 1/2	1 1/2	1 1/4	1 1/4
20	—	27 3/4	7/8	16	—	—	—	—	—	—	—	1 1/2	1 1/4	1 1/2	1 1/2	1 1/4	1 1/4
21	22	29	1	16	—	—	—	—	—	—	—	1 1/2	1 3/8	1 5/8	1 5/8	1 3/8	1 3/8
22	—	30	1	16	—	—	—	—	—	—	—	1 1/2	1 3/8	1 3/4	1 3/4	1 3/4	1 3/8
23	24	31	1	16	—	—	—	—	—	—	—	1 5/8	1 3/8	1 3/4	1 3/4	1 3/4	1 3/8
24	—	32 1/2	1 1/8	16	—	—	—	—	—	—	—	1 5/8	1 1/2	1 7/8	1 7/8	1 1/2	1 1/2
27	28	35 3/4	1 1/8	20	—	—	—	—	—	—	—	1 3/4	—	2	2	1 3/4	1 3/4
29	30	38 1/4	1 1/4	20	—	—	—	—	—	—	—	1 7/8	—	2 1/8	2 1/8	2 1/8	1 7/8
30	—	39 1/4	1 1/4	20	—	—	—	—	—	—	—	1 7/8	—	2 1/8	2 1/8	2 1/8	1 7/8
33	34	43	1 1/4	20	—	—	—	—	—	—	—	2	—	2 1/4	2 1/4	2 1/4	2
35	36	45	1 1/4	24	—	—	—	—	—	—	—	2	—	2 1/2	2 1/2	2 1/2	2
36	—	46 1/4	1 1/4	24	—	—	—	—	—	—	—	2	—	2 1/2	2 1/2	2 1/2	2
39	40	49 1/2	1 3/8	24	—	—	—	—	—	—	—	2 1/8	—	2 5/8	2 5/8	2 5/8	2 1/8
42	43	52 1/2	1 3/8	28	—	—	—	—	—	—	—	2 1/4	—	2 3/4	2 3/4	2 3/4	2 1/4
45	—	55 3/4	1 3/8	28	—	—	—	—	—	—	—	2 3/8	—	3	3	3	2 3/8
48	49	58 3/4	1 3/8	32	—	—	—	—	—	—	—	2 3/8	—	3 1/8	3 1/8	3 1/8	2 3/8

A) (H) For availability of steel pipe sizes, refer to BS EN 10216, BS EN 10217. See BS 4622 and BS 4722 for outside diameters of cast iron pipes. See BS EN 12449 for the sizes of copper pipes for use with copper alloy flanges up to 8 in bore.

B) (O) For 1/2 in and 5/8 in bolts, the diameters of the holes shall be 1/16 in larger than the bolts and for 3/4 in bolts and sizes above, the diameters shall be not more than 1/8 in larger than the bolts. For cast iron flanges the diameters of the bolt holes may be 1/8 in larger than the bolts of sizes 5/8 in and above. For 7/8 in bolts and sizes above, the diameters shall be not more than 1/8 in larger than the bolts.

C) (A, B & E) Tapers are not specified but shall be such that the maximum diameters at root of boss are not exceeded.

D) (K) The diameters tabulated apply to pipes with outside diameters in accordance with H. For pipes designated by their bores, dimension K shall be such that the difference between the corresponding diameters K and H is maintained.

E) (T<sub>5</sub> and T<sub>6</sub>) It may be impracticable to use thicknesses less than 1/2 in except for boss and integral flanges.

F) (H) It is recommended that this size for steel pipes should be avoided wherever possible.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Table F Dimensions of plain, boss, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe A)	Diam-eter of flange	Bolt circle diameter	No. of bolts	Diam-eter of bolts B)	Dimensions of boss (Fig. 4) C)			Dimensions of cast iron necks (Fig. 7)			Dimensions of steel welding necks (Fig. 6)				Thickness of flange			
						Boss length	Diam-eter at small end of boss	Maxi-mum diam-eter at root of boss	Diam-eter at large end of neck	Length of taper	C	G	J	Diam-eter at small end of neck D)	Total length of neck	Length of taper	Grey cast iron integrally screwed on boss	Copper alloy cast or wrought integral or boss or plain (Fig. 3)	Cast or wrought steel integral or plain boss (Fig. 4) or welding neck (Fig. 6) (except for valves)
	H	D	P	N	O	A	B	E	C	G	J	K	L	M	T <sub>1</sub>	T <sub>3</sub>	T <sub>7</sub>	T <sub>9</sub>	
1/2	in	3 3/4	in	4	in	3/8	1 5/16	1 1/2	1	1/2	1 1/16	7/8	7/8	5/8	1/2	in	in	in	
3/4	in	4	in	4	in	7/16	1 1/2	1 3/4	1 1/4	1/2	1 5/16	1 3/32	7/8	5/8	1/2	5/16	3/8 E)	3/8	
1	in	4 3/4	in	4	in	7/16	1 7/8	2 1/16	1 3/8	1/2	1 11/16	1 3/8	1 1/8	5/8	1/2	3/8	3/8 E)	3/8	
1 1/4	in	5 1/4	in	4	in	7/16	2 3/16	2 1/2	2	5/8	2 1/16	1 23/32	1 3/8	3/4	5/8	3/8	1/2	1/2	
1 1/2	in	5 1/2	in	4	in	1/2	2 7/16	2 3/4	2 1/4	5/8	2 5/16	1 15/16	1 3/8	3/4	5/8	7/16	1/2	1/2	
2	in	6 1/2	in	4	in	1/2	2 15/16	3 21/32	3	3/4	2 3/4	2 13/32	1 3/8	3/4	3/4	7/16	5/8	5/8	
2 1/2	in	7 1/4	in	8	in	5/8	3 9/16	4 13/32	3 5/8	3/4	3 3/8	3 1/32	1 1/2	3/4	3/4	1/2	5/8	5/8	
3	in	8	in	8	in	5/8	4 3/16	5 1/8	4 1/8	3/4	4	3 17/32	1 3/4	1	3/4	9/16	5/8	5/8	
3 1/2	in	8 1/2	in	8	in	11/16	4 11/16	5 21/32	4 3/4	7/8	4 1/2	4 1/16	1 3/4	1	7/8	5/8	3/4	3/4	
4	in	9	in	8	in	3/4	5 1/4	6	5 1/4	7/8	5 1/8	4 9/16	2	1 1/4	7/8	11/16	3/4	3/4	
5	in	11	in	8	in	3/4	6 5/16	7 1/2	6 1/2	1	6 1/4	5 9/16	2 1/4	1 1/2	1	3/4	7/8	7/8	
6	in	12	in	12	in	3/4	7 5/16	8 1/2	7 5/8	1	7 1/4	6 9/16	2 1/4	1 1/2	1	7/8	7/8	7/8	
7	in	13 1/4	in	12	in	3/4	8 3/8	9 13/16	8 5/8	1	8 3/8	7 23/32	2 1/4	1 1/2	1	7/8	7/8	7/8	
8	in	14 1/2	in	12	in	3/4	9 1/2	11	9 5/8	1 1/8	9 1/2	8 23/32	2 5/8	1 3/4	1 1/8	1	1	1	
9	in	16	in	12	in	7/8	10 1/2	11 15/16	10 3/4	1 1/8	10 5/8	9 3/4	2 7/8	2	1 1/8	1	1 1/8	1	
10	in	17	in	12	in	7/8	11 3/4	12 15/16	11 3/4	1 1/8	11 3/4	10 7/8	2 7/8	2	1 1/8	1	1 1/8	1	
12	in	19 1/4	in	16	in	7/8	13 3/4	15 3/16	14	1 1/4	13 7/8	12 29/32	3 1/8	2 1/4	1 1/4	1 1/8	1 1/4	1 1/8	
13	in	20 3/4	in	16	in	1	—	—	15 1/8	1 1/4	15 1/4	14 5/32	3 3/8	2 1/2	1 1/4	1 1/8	1 3/8	1 1/8	
14	in	21 3/4	in	16	in	1	—	—	16 1/8	1 3/8	16 1/4	15 5/32	3 3/8	2 1/2	1 3/8	1 1/4	1 3/8	1 1/4	
15	in	22 3/4	in	16	in	1	—	—	17 1/4	1 3/8	17 1/4	16 3/16	3 3/8	2 1/2	1 3/8	1 1/4	1 1/2	1 1/4	
16	in	24	in	20	in	1	—	—	18 1/4	1 3/8	—	—	—	—	1 3/8	1 1/4	1 5/8	1 1/4	
17	in	25 1/4	in	20	in	1	—	—	19 3/8	1 1/2	—	—	—	—	1 1/2	1 3/8	1 3/4	1 3/8	
18	in	26 1/2	in	20	in	1 1/8	—	—	20 1/2	1 1/2	—	—	—	—	1 1/2	1 3/8	1 3/4	1 3/8	

Table F Dimensions of plain, boss, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B) (continued)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe <sup>A)</sup>	Diameter of flange	Bolt circle diameter	No. of bolts	Diameter of bolts <sup>B)</sup>	Dimensions of boss (Fig. 4) <sup>C)</sup>			Dimensions of cast iron necks (Fig. 7)		Dimensions of steel welding necks (Fig. 6)				Thickness of flange			
						Boss length	Diameter at small end of boss	Maximum diameter at root of boss	Diameter at large end of neck	Length of taper	Diameter at large end of neck	Diameter at small end of neck <sup>D)</sup>	Total length of neck	Length of taper	Grey cast iron integrally cast or screwed on with boss (Fig. 3)	Copper alloy cast or wrought integral or plain (Fig. 3)	Cast or wrought steel integral or plain boss or welding neck (except for valves) (Fig. 4)	Cast or wrought steel integral (Fig. 5) or boss (Fig. 4) or welding neck (Fig. 6) (for valves only)
	<i>H</i>	<i>D</i>	<i>P</i>	<i>N</i>	<i>O</i>	<i>A</i>	<i>B</i>	<i>E</i>	<i>C</i>	<i>G</i>	<i>J</i>	<i>K</i>	<i>L</i>	<i>M</i>	<i>T<sub>1</sub></i>	<i>T<sub>3</sub></i>	<i>T<sub>7</sub></i>	<i>T<sub>9</sub></i>
in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in
19	20	27 3/4	25 1/4	20	1 1/8	—	—	—	21 5/8	1 1/2	—	—	—	—	1 1/2	1 3/8	1 3/4	1 3/8
20	—	29	26 1/2	24	1 1/8	—	—	—	22 3/4	1 5/8	—	—	—	—	1 5/8	1 1/2	2	1 1/2
21	22	30	27 1/2	24	1 1/8	—	—	—	23 3/4	1 5/8	—	—	—	—	1 5/8	1 1/2	2	1 1/2
22	—	31	28 1/2	24	1 1/8	—	—	—	24 3/4	1 5/8	—	—	—	—	1 5/8	1 1/2	2 1/8	1 1/2
23	24	32 1/2	29 3/4	24	1 1/4	—	—	—	25 7/8	1 3/4	—	—	—	—	1 3/4	1 5/8	2 1/4	1 5/8
24	—	33 1/2	30 3/4	24	1 1/4	—	—	—	27	1 3/4	—	—	—	—	1 3/4	1 5/8	2 1/4	1 5/8
27	28	36 3/4	33 3/4	24	1 1/4	—	—	—	30 1/4	1 7/8	—	—	—	—	1 7/8	—	2 3/8	1 7/8
29	30	39	36	24	1 1/4	—	—	—	32 1/2	2	—	—	—	—	2	—	2 5/8	2
30	—	40	37	28	1 1/4	—	—	—	33 1/2	2	—	—	—	—	2	—	2 5/8	2
33	34	43	40	32	1 1/4	—	—	—	36 1/2	2 1/8	—	—	—	—	2 1/8	—	2 3/4	2 1/8
35	36	45 3/4	42 1/2	32	1 3/8	—	—	—	38 3/4	2 1/4	—	—	—	—	2 1/4	—	3	2 1/4
36	—	46 3/4	43 1/2	32	1 3/8	—	—	—	39 3/4	2 1/4	—	—	—	—	2 1/4	—	3	2 1/4
39	40	50 1/4	47	36	1 3/8	—	—	—	43	2 3/8	—	—	—	—	2 3/8	—	3 1/4	2 3/8
42	43	53 1/4	50	36	1 3/8	—	—	—	46	2 1/2	—	—	—	—	2 1/2	—	3 3/8	2 1/2
45	—	57	53 1/2	36	1 1/2	—	—	—	49 1/4	2 5/8	—	—	—	—	2 5/8	—	3 5/8	2 5/8
48	49	60 1/4	56 3/4	40	1 1/2	—	—	—	52 1/2	2 5/8	—	—	—	—	2 5/8	—	3 3/4	2 5/8

A) (H) For availability of steel pipe sizes, refer to BS EN 10216, BS EN 10217. See BS 4622 and BS 4722 for outside diameters of cast iron pipes. See BS EN 12449 for the sizes of copper pipes for use with copper alloy flanges up to 8 in bore.

B) (O) For 1/2 in and 5/8 in bolts, the diameters of the holes shall be 1/16 in larger than the bolts and for 3/4 in bolts and sizes above, the diameters shall be not more than 1/8 in larger than the bolts. For cast iron flanges the diameters of the bolt holes may be 1/8 in larger than the bolts of sizes 5/8 in and above.

C) (A, B & E) Tapers are not specified but shall be such that the maximum diameters at root of boss are not exceeded.

D) (K) The diameters tabulated apply to pipes with outside diameters in accordance with H. For pipes designated by their bores, dimension K shall be such that the difference between the corresponding diameters K and H is maintained.

E) (T<sub>7</sub>) It may be impracticable to use thicknesses less than 1/2 in except for boss flanges or integral flanges.

F) (H) It is recommended that this size for steel pipes should be avoided wherever possible.

Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013

Table H Dimensions of plain, boss, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe (A)	Diameter of flange	Bolt circle diameter	No. of bolts	Diameter of bolts (B)	Dimensions of boss (Fig. 4) (C)			Dimensions of cast iron necks (Fig. 7)			Dimensions of steel welding necks (Fig. 6)				Diameter of raised face (see Clause 4) (Figs 3, 4, 5, 6)	Thickness of flange			
						Boss length	Diameter at small end of boss	Maximum diameter at root of boss	Diameter at large end of neck	Length of taper	Diameter at large end of neck	Diameter at small end of neck (D)	Total length of neck	Length of taper	J		K	L	M	F
in	H	D	P	N	O	A	B	E	C	G	J	K	L	M	F	T <sub>1</sub>	T <sub>3</sub>	T <sub>7</sub>	T <sub>9</sub>	
1/2	27/32	4 1/2	3 1/4	4	5/8	3/8	1 5/16	1 7/8	1	1/2	1 3/16	7/8	1 1/8	5/8	2 1/4	5/8	in	in	in	
3/4	1 1/16	4 1/2	3 1/4	4	5/8	7/16	1 1/2	1 7/8	1 3/8	1/2	1 3/8	1 3/32	1 1/8	5/8	2 1/4	5/8	in	1/2	1/2	
1	1 11/32	4 3/4	3 7/16	4	5/8	7/16	1 7/8	2 1/16	1 3/4	1/2	1 11/16	1 3/8	1 1/8	5/8	2 1/2	3/4	7/16	9/16	9/16	
1 1/4	1 11/16	5 1/4	3 7/8	4	5/8	7/16	2 3/16	2 1/2	2 1/8	5/8	2 1/16	1 23/32	1 3/8	3/4	3	7/8	7/16	11/16	11/16	
1 1/2	1 29/32	5 1/2	4 1/8	4	5/8	1/2	2 7/16	2 3/4	2 1/2	5/8	2 5/16	1 15/16	1 3/8	3/4	3 1/4	7/8	1/2	11/16	11/16	
2	2 3/8	6 1/2	5	4	5/8	1/2	2 15/16	3 21/32	3 1/8	3/4	2 3/4	2 13/32	1 3/8	3/4	4	1	1/2	3/4	3/4	
2 1/2	3	7 1/4	5 3/4	8	5/8	5/8	3 9/16	4 13/32	3 3/4	3/4	3 3/8	3 1/32	1 1/2	3/4	4 1/2	1	9/16	3/4	3/4	
3	3 1/2	8	6 1/2	8	5/8	5/8	4 3/16	5 1/8	4 1/2	3/4	4	3 17/32	1 3/4	1	5	1 1/8	5/8	7/8	7/8	
3 1/2	4	8 1/2	7	8	5/8	11/16	4 11/16	5 21/32	5 1/8	7/8	4 1/2	4 1/16	1 3/4	1	5 1/2	1 1/8	11/16	7/8	7/8	
4	4 1/2	9	7 1/2	8	5/8	3/4	5 1/4	6	5 5/8	7/8	5 1/8	4 9/16	2	1 1/4	6	1 1/4	3/4	1	1	
5	5 1/2	11	9 1/4	8	3/4	3/4	6 5/16	7 1/2	6 3/4	1	6 1/4	5 9/16	2 1/4	1 1/2	7	1 3/8	7/8	1 1/8	1 1/8	
6	6 1/2	12	10 1/4	12	3/4	3/4	7 5/16	8 1/2	7 7/8	1	7 1/4	6 9/16	2 1/4	1 1/2	8 1/4	1 3/8	1	1 1/8	1 1/8	
	6 5/8											6 23/32								
7	7 5/8	13 1/4	11 1/2	12	3/4	7/8	8 3/8	9 13/16	9 1/8	1	8 3/8	7 23/32	2 1/4	1 1/2	9 1/4	1 1/2	1 1/8	1 1/4	1 1/4	
8	8 5/8	14 1/2	12 3/4	12	3/4	7/8	9 1/2	11	10 1/4	1 1/8	9 1/2	8 23/32	2 3/8	1 3/4	10 1/4	1 1/2	1 1/4	1 1/4	1 1/4	
9	9 5/8	16	14	12	7/8	1	10 1/2	11 15/16	11 3/8	1 1/8	10 5/8	9 3/4	2 7/8	2	11 1/4	1 5/8	1 3/8	1 3/8	1 3/8	
10	10 3/4	17	15	12	7/8	1 1/16	11 3/4	12 15/16	12 3/8	1 1/8	11 3/4	10 7/8	2 7/8	2	12 1/4	1 5/8	1 3/8	1 3/8	1 3/8	
12	12 3/4	19 1/4	17 1/4	16	7/8	1 1/8	13 3/4	15 3/16	14 5/8	1 1/4	13 7/8	12 29/32	3 1/8	2 1/4	14 1/4	1 3/4	1 1/2	1 5/8	1 1/2	
13	14	20 3/4	18 1/2	16	1	—	—	—	15 3/4	1 1/4	15 1/4	14 5/32	3 3/8	2 1/2	15 1/2	1 7/8	1 5/8	1 3/4	1 5/8	
14	15 <sup>E)</sup>	21 3/4	19 1/2	16	1	—	—	—	16 3/4	1 3/8	16 1/4	15 5/32	3 3/8	2 1/2	16 1/2	1 7/8	1 5/8	1 7/8	1 5/8	
15	16	22 3/4	20 1/2	16	1	—	—	—	17 7/8	1 3/8	17 1/4	16 3/16	3 3/8	2 1/2	17 1/2	2	1 3/4	2	1 3/4	
16	—	24	21 3/4	20	1	—	—	—	19	1 3/8	—	—	—	—	19	2	1 3/4	2 1/8	1 3/4	
17	18	25 1/4	23	20	1	—	—	—	20 1/8	1 1/2	—	—	—	—	20	2 1/8	1 7/8	2 1/4	1 7/8	

Table H Dimensions of plain, boss, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B) (continued)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe A)	Diameter of flange	Bolt circle diameter	No. of bolts	Diameter of bolts B)	Dimensions of boss (Fig. 4) C)		Dimensions of cast iron necks (Fig. 7)		Dimensions of steel welding necks (Fig. 6)			Diameter of raised face (see Clause 4) (Figs 3, 4, 5, 6)	Thickness of flange					
						Boss length	Diameter at small end of boss	Maximum diameter at root of boss	Diameter at large end of neck	Length of taper	Diameter at large end of neck	Diameter at small end of neck D)		Total length of neck	Length of taper	Grey cast iron integrally cast or screwed on with boss	Copper alloy cast or wrought integral or plain (Fig. 3)	Cast or wrought steel integral or plain (Fig. 3) or boss (Fig. 4) or welding neck (Fig. 6) (except for valves)	Forged or cast steel integral or plain (Fig. 5) (for valves only)
	H	D	P	N	O	A	B	E	C	G	J	K	L	M	F	T <sub>1</sub>	T <sub>3</sub>	T <sub>7</sub>	T <sub>9</sub>
in	in	in	in		in	in	in	in	in	in	in	in	in	in	in	in	in	in	in
18	—	26 1/2	24	20	1 1/8	—	—	—	21 1/4	1 1/2	—	—	—	21	2 1/8	1 7/8	2 3/4	2 3/4	1 7/8
19	20	27 3/4	25 1/4	20	1 1/8	—	—	—	22 3/8	1 1/2	—	—	—	22 1/2	2 1/4	2	2 1/2	2 1/2	2
20	—	29	26 1/2	24	1 1/8	—	—	—	23 1/2	1 5/8	—	—	—	23 1/2	2 1/4	2	2 5/8	2 5/8	2
21	22	30	27 1/2	24	1 1/8	—	—	—	24 1/2	1 5/8	—	—	—	24 1/2	2 3/8	2 1/8	2 3/4	2 3/4	2 1/8
22	—	31	28 1/2	24	1 1/8	—	—	—	25 1/2	1 3/4	—	—	—	25 1/2	2 3/8	2 1/8	2 3/4	2 3/4	2 1/8
23	24	32 1/2	29 3/4	24	1 1/4	—	—	—	26 1/2	1 3/4	—	—	—	26 1/2	2 1/2	2 1/4	3	3	2 1/4
24	—	33 1/2	30 3/4	24	1 1/4	—	—	—	28	1 3/4	—	—	—	27 1/2	2 1/2	2 1/4	3	3	2 1/4

A) (H) For availability of steel pipe sizes, refer to BS EN 10216, BS EN 10217. See BS 4622 and BS 4722 for outside diameters of cast iron pipes. See BS EN 12449 for the sizes of copper pipes for use with copper alloy flanges up to 8 in bore.

B) (O) For 3/8 in bolts, the diameters of the holes shall be 1/16 in larger than the bolts and for 3/4 in bolts and sizes above, the diameters shall be not more than 1/8 in larger than the bolts. For cast iron flanges the diameters of the bolt holes may be 1/8 in larger than the bolts of sizes 5/8 in and above.

C) (A, B & E) Tapers are not specified but shall be such that the maximum diameters at root of boss are not exceeded.

D) (K) The diameters tabulated apply to pipes with outside diameters in accordance with H. For pipes designated by their bores, dimension K shall be such that the difference between the corresponding diameters K and H is maintained.

E) (H) It is recommended that this size for steel pipes should be avoided wherever possible.

Table J Dimensions of plain, boss, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe A)	Diameter of flange	Bolt circle diameter	No. of bolts	Diameter of bolts B)	Dimensions of boss (Fig. 4) C)			Dimensions of steel welding necks (Fig. 6)				Thickness of flange		
						Boss length	Diameter at small end of boss	Maximum diameter at root of boss	Diameter at large end of neck	Diameter at small end of neck D)	Total length of neck	Length of taper	Diameter of raised face (see Clause 4) (Figs 3, 4, 5, 6)	Copper alloy cast or wrought integral or boss or plain (Fig. 3)	Cast or wrought steel integral or plain (Fig. 3) or boss (Fig. 4) or welding neck (Fig. 6) (except for valves)
H	D	P	N	O	A	B	E	J	K	L	M	F	T <sub>3</sub>	T <sub>7</sub>	T <sub>9</sub>
1/2	27/32	4 1/2	3 1/4	4	5/8	3/8	1 5/16	1 7/8	1 3/16	7/8	1 1/8	2 1/4	5/8	5/8	5/8
3/4	1 1/16	4 1/2	3 1/4	4	5/8	7/16	1 1/2	1 7/8	1 3/8	1 3/32	5/8	2 1/4	5/8	5/8	5/8
1	1 11/32	4 3/4	3 7/16	4	5/8	7/16	1 7/8	2 1/16	1 11/16	1 3/8	5/8	2 1/2	3/4	3/4	3/4
1 1/4	1 11/16	5 1/4	3 7/8	4	5/8	7/16	2 3/16	2 1/2	2 1/16	1 23/32	3/4	3	3/4	3/4	3/4
1 1/2	1 29/32	5 1/2	4 1/8	4	5/8	1/2	2 7/16	2 3/4	2 5/16	1 15/16	3/4	3 1/4	7/8	7/8	7/8
2	2 3/8	6 1/2	5	4	3/4	1/2	2 15/16	3 7/16	2 3/4	2 13/32	3/4	4	1	1	1
2 1/2	3	7 1/4	5 3/4	8	3/4	5/8	3 9/16	4 3/16	3 3/8	3 1/32	3/4	4 1/2	1	1	1
3	3 1/2	8	6 1/2	8	3/4	5/8	4 3/16	4 15/16	4	3 17/32	1	5	1 1/4	1 1/4	1 1/4
3 1/2	4	8 1/2	7	8	3/4	11/16	4 11/16	5 7/16	4 1/2	4 1/16	1	5 1/2	1 1/4	1 1/4	1 1/4
4	4 1/2	9	7 1/2	8	3/4	3/4	5 1/4	5 13/16	5 1/8	4 9/16	1 1/4	6	1 3/8	1 3/8	1 3/8
5	5 1/2	11	9 1/4	8	7/8	3/4	6 5/16	7 11/32	6 1/4	5 9/16	1 1/2	7	1 1/2	1 1/2	1 1/2
6	6 1/2	12	10 1/4	12	7/8	3/4	7 5/16	8 11/32	7 1/4	6 3/16	1 1/2	8 1/4	1 1/2	1 1/2	1 1/2
	6 5/8									6 23/32					
7	7 5/8	13 1/4	11 1/2	12	7/8				8 3/8	7 23/32	1 1/2	9 1/4	1 5/8	1 5/8	1 5/8
8	8 5/8	14 1/2	12 3/4	12	7/8				9 1/2	8 23/32	1 3/4	10 1/4	1 5/8	1 5/8	1 5/8
9	9 5/8	16	14	12	1				10 5/8	9 3/4	2	11 1/4		1 3/4	1 3/4
10	10 3/4	17	15	12	1				11 3/4	10 7/8	2	12 1/4		1 7/8	1 7/8
12	12 3/4	19 1/4	17 1/4	16	1				13 7/8	12 29/32	2 1/4	14 1/4		2	2
13	14	20 3/4	18 1/2	16	1 1/8				15 1/4	14 5/32	2 1/2	15 1/2		2 1/8	2
14	15 E)	21 3/4	19 1/2	16	1 1/8				16 1/4	15 5/32	2 1/2	16 1/2		2 1/4	2 1/8
15	16	22 3/4	20 1/2	16	1 1/8				17 1/4	16 3/16	2 1/2	17 1/2		2 3/8	2 1/8
16		24	21 3/4	20	1 1/8							19		2 1/2	2 1/4
17	18	25 1/4	23	20	1 1/8							20		2 5/8	2 3/8
18		26 1/2	24	20	1 1/4							21		2 3/4	2 3/8
19	20	27 3/4	25 1/4	20	1 1/4							22 1/2		2 7/8	2 1/2



Table J Dimensions of plain, boss, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B) (continued)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe A)	Diameter of flange	Bolt circle diameter	No. of bolts	Diameter of bolts B)	Dimensions of boss (Fig. 4) C)			Dimensions of steel welding necks (Fig. 6)			Diameter of raised face (see Clause 4) (Figs 3, 4, 5, 6)	Thickness of flange		
						Boss length	Diameter at small end of boss	Maximum diameter at root of boss	Diameter at large end of neck	Diameter at small end of neck D)	Total length of neck		Length of taper	Copper alloy cast or wrought integral or boss or plain (Fig. 3)	Cast or wrought steel integral or plain (Fig. 3) or boss or welding neck (Fig. 6) (except for valves)
H	D	P	N	O	A	B	E	J	K	L	M	F	T <sub>3</sub>	T <sub>7</sub>	T <sub>9</sub>
in	in	in	in	in	in	in	in	in	in	in	in	in	in	in	in
20	—	29	26 1/2	24	1 1/4	—	—	—	—	—	—	23 1/2	—	3 1/8	2 1/2
21	22	30	27 1/2	24	1 1/4	—	—	—	—	—	—	24 1/2	—	3 1/4	2 5/8
22	—	31	28 1/2	24	1 1/4	—	—	—	—	—	—	25 1/2	—	3 3/8	2 5/8
23	24	32 1/2	29 3/4	24	1 3/8	—	—	—	—	—	—	26 1/2	—	3 1/2	2 3/4
24	—	33 1/2	30 3/4	24	1 3/8	—	—	—	—	—	—	27 1/2	—	3 5/8	2 3/4

A) (H) For availability of steel pipe sizes, refer to BS EN 10216, BS EN 10217. See BS 4622 and BS 4722 and BS EN 12449 for the sizes of copper pipes for use with copper alloy flanges up to 8 in bore.

B) (O) For 5/8 in bolts, the diameters of the holes shall be 1/16 in larger than the bolts and for 3/4 in bolts and sizes above, the diameters shall be not more than 1/8 in larger than the bolts.

C) (A, B & E) Tapers are not specified but shall be such that the maximum diameters at root of boss are not exceeded.

D) (K) The diameters tabulated apply to pipes with outside diameters in accordance with H. For pipes designated by their bores, dimension K shall be such that the difference between the corresponding diameters K and H is maintained.

E) (H) It is recommended that this size for steel pipes should be avoided wherever possible.

Table K Dimensions of plain, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe A)	Diameter of flange	Bolt circle diameter	No. of bolts	Diameter of bolts B)	Dimensions of steel welding necks (Fig. 6)			Diameter of raised face (see Clause 4) (Figs 3, 5, 6)	Thickness of flange		
						Diameter at large end of neck	Diameter at small end of neck C)	Total length of neck		Length of taper	Copper alloy cast or wrought integral or boss or plain (Fig. 3)	Cast or wrought steel integral or plain (Fig. 3) or welding neck (Fig. 6) (except for valves)
H	D	P	N	O	J	K	L	M	F	T <sub>3</sub>	T <sub>8</sub>	T <sub>9</sub>
in	in	in	in	in	in	in	in	in	in	in	in	in
1/2	27/32	4 1/2	3 1/4	4	5/8	7/8	1 1/8	5/8	2 1/2	3/4	3/4	3/4
3/4	1 1/16	4 1/2	3 1/4	4	5/8	1 3/32	1 1/8	5/8	2 1/2	3/4	3/4	3/4
1	1 11/32	5	3 3/4	4	5/8	1 3/4	1 3/8	3/4	3	7/8	7/8	7/8
1 1/4	1 11/16	5 1/4	3 7/8	4	5/8	2 1/16	1 3/8	3/4	3	7/8	7/8	7/8

Table K Dimensions of plain, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B) (continued)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe A)	Diameter of flange	Bolt circle diameter	No. of bolts	Diameter of bolts B)	Dimensions of steel welding necks (Fig. 6)			Diameter of raised face (see Clause 4) (Figs 3, 5, 6)	Thickness of flange		
						Diameter at large end of neck	Diameter at small end of neck C)	Total length of neck		Length of taper	Diameter of raised face	Copper alloy cast or wrought integral or boss or plain (Fig. 3)
H	D	P	N	O	J	K	L	M	F	T <sub>3</sub>	T <sub>8</sub>	T <sub>9</sub>
in	in	in		in	in	in	in	in	in	in	in	in
1 1/2	1 29/32	6	4 1/2	4	3/4	2 5/16	1 15/16	3/4	3 1/2	1	1	1
2	2 3/8	6 1/2	5	8	5/8	2 3/4	2 13/32	3/4	4	1	1	1
2 1/2	3	7 1/4	5 3/4	8	3/4	3 3/8	3 1/32	3/4	4 1/2	1 1/8	1 1/8	1 1/8
3	3 1/2	8	6 1/2	8	3/4	4	3 17/32	1	5	1 1/4	1 1/4	1 1/4
3 1/2	4	9	7 1/4	8	7/8	4 1/2	4 1/16	1	5 1/2	1 1/4	1 1/4	1 1/4
4	4 1/2	9 1/2	7 3/4	8	7/8	5 1/8	4 9/16	1 1/4	6	1 3/8	1 3/8	1 3/8
5	5 1/2	11	9 1/4	12	7/8	6 1/4	5 9/16	1 1/2	7	1 5/8	1 5/8	1 5/8
6	6 5/8	12	10 1/4	12	7/8	7 1/4	6 23/32	1 1/2	8 1/4	1 5/8	1 5/8	1 5/8
7	7 5/8	13 1/2	11 1/2	12	1	8 3/8	7 23/32	1 1/2	9 1/4	1 3/4	1 3/4	1 3/4
8	8 5/8	14 1/2	12 1/2	12	1	9 1/2	8 23/32	1 3/4	10 1/4	1 7/8	1 7/8	1 7/8
9	9 5/8	16	14	16	1	10 5/8	9 3/4	2	11 1/4	—	2	2
10	10 3/4	17	15	16	1	11 3/4	10 7/8	2	12 1/4	—	2	2
12	12 3/4	19 1/4	17	16	1 1/8	13 7/8	12 29/32	2 1/4	14 1/4	—	2 1/4	2 1/4
13	14	21 1/2	19	16	1 1/4	15 3/8	14 5/32	2 3/4	15 1/2	—	2 1/2	2 3/8
14	15 D)	22 1/2	20	16	1 1/4	16 3/8	15 5/32	2 3/4	16 1/2	—	2 5/8	2 3/8
15	16	23 3/4	21 1/4	20	1 1/4	17 1/2	16 3/16	3	17 1/2	—	2 7/8	2 1/2
16	—	24 3/4	22 1/4	20	1 1/4	—	—	—	19	—	3	2 5/8
17	18	25 3/4	23 1/2	20	1 1/4	19 1/2	18 3/16	3	20	—	3 1/4	2 7/8
18	20	28 1/4	25 3/4	20	1 3/8	21 3/4	20 1/4	3	22 1/2	—	3 1/2	3
20	22	31	28	20	1 1/2	23 1/2	22 1/4	3 1/4	24 1/2	—	3 7/8	3 1/4
22	24	34 1/4	30 3/4	20	2	25 1/4	24 1/4	3 1/4	26 1/2	—	4 1/8	3 1/2

A) (H) For availability of steel pipe sizes, refer to BS EN 10216, BS EN 10217. See BS 4622 and BS 4722. See BS EN 12449 for the sizes of copper pipes for use with copper alloy flanges up to 8 in bore.

B) (O) For 5/8 in bolts, the diameters of the holes shall be 1/16 in larger than the bolts and for 3/4 in bolts and sizes above, the diameters shall be not more than 1/8 in larger than the bolts.

C) (K) The diameters tabulated apply to pipes with outside diameters in accordance with H. For pipes designated by their bores, dimension K shall be such that the difference between the corresponding diameters K and H is maintained.

D) (H) It is recommended that this size for steel pipes should be avoided wherever possible.

Table R Dimensions of plain, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe A)	Diameter of flange	Bolt circle diameter	No. of bolts	Diameter of bolts B)	Dimensions of necks for integrally cast or forged steel flanges (Fig. 5) (valves only)		Dimensions of steel welding necks (Fig. 6)				Diameter of raised face (see Clause 4) (Figs 3, 5, 6)		Thickness of flange	
						Diameter at large end of neck	Length of taper	Diameter at large end of neck	Diameter at small end of neck C)	Total length of neck	Length of taper	F	F	T <sub>8</sub>	T <sub>9</sub>
in	H	D	P	N	O	C	G	J	K	L	M	F	F	T <sub>8</sub>	T <sub>9</sub>
1/2	27/32	4 1/2	3 1/4	4	5/8	1 1/4	3/4	1 3/16	7/8	1 1/8	5/8	2 1/2	2 1/2	3/4	3/4
3/4	1 1/16	4 1/2	3 1/4	4	5/8	1 1/2	3/4	1 3/8	1 23/32	1 1/8	5/8	2 1/2	2 1/2	3/4	3/4
1	1 11/32	5	3 3/4	4	5/8	1 3/4	7/8	1 3/4	1 3/8	1 3/8	3/4	3	3	7/8	7/8
1 1/4	1 11/16	5 1/4	3 7/8	4	5/8	2 1/8	7/8	2 1/16	1 23/32	1 3/8	3/4	3	3	7/8	7/8
1 1/2	1 29/32	6	4 1/2	4	3/4	2 3/8	1	2 5/16	1 15/16	1 3/8	3/4	3 1/2	3 1/2	1	1
2	2 3/8	6 1/2	5	8	5/8	3	1	2 3/4	2 13/32	1 3/8	3/4	4	4	1	1
2 1/2	3	7 1/4	5 3/4	8	3/4	3 7/8	1 1/8	3 3/8	3 1/32	1 1/2	3/4	4 1/2	4 1/2	1 1/8	1 1/8
3	3 1/2	8	6 1/2	8	3/4	4 1/2	1 1/4	4	3 17/32	1 3/4	1	5	5	1 1/4	1 1/4
3 1/2	4	9	7 1/4	8	7/8	5 1/8	1 1/4	4 1/2	4 1/16	1 3/4	1	5 1/2	5 1/2	1 1/4	1 1/4
4	4 1/2	9 1/2	7 3/4	8	7/8	5 3/4	1 3/8	5 1/8	4 9/16	2	1 1/4	6	6	1 3/8	1 3/8
5	5 1/2	11	9 1/4	12	7/8	6 7/8	1 5/8	6 1/4	5 9/16	2 1/4	1 1/2	7	7	1 5/8	1 5/8
6	6 5/8	12	10 1/4	12	7/8	8	1 3/4	7 3/8	6 23/32	2 5/8	1 3/4	8 1/4	8 1/4	1 3/4	1 3/4
7	7 5/8	13 1/2	11 1/2	12	1	9 1/4	1 7/8	8 1/2	7 23/32	2 5/8	1 3/4	9 1/4	9 1/4	1 7/8	1 7/8
8	8 5/8	14 1/2	12 3/4	12	1	10 1/4	2	9 5/8	8 23/32	2 7/8	2	10 1/4	10 1/4	2	2
9	9 5/8	16	14	16	1	11 1/2	2 1/8	10 5/8	9 3/4	3	2	11 1/4	11 1/4	2 1/8	2 1/8
10	10 3/4	17	15 1/4	16	1	12 1/2	2 1/4	12	10 7/8	3 5/8	2 1/2	12 1/4	12 1/4	2 3/8	2 1/4
12	12 3/4	20	18	16	1 1/8	15	2 1/2	14 1/8	12 29/32	4	2 3/4	14 1/4	14 1/4	2 3/4	2 1/2
13	14	21 3/4	19 1/2	16	1 1/4	16 1/2	2 5/8	15 1/2	14 5/32	4 1/4	3	15 1/2	15 1/2	2 7/8	2 5/8
14	15 D)	23	20 3/4	16	1 1/4	17 3/4	2 3/4	16 5/8	15 5/32	4 1/2	3 1/4	16 1/2	16 1/2	3 1/8	2 3/4
15	16	24	21 3/4	20	1 1/4	18 3/4	2 7/8	17 3/4	16 3/16	4 7/8	3 1/2	17 1/2	17 1/2	3 1/4	2 7/8
16	—	25 1/4	23	20	1 1/4	20	3	—	—	—	—	19	19	3 1/2	3
17	18	26 1/2	24	20	1 1/4	21	3 3/8	20	18 3/16	5 1/8	3 3/4	20	20	3 5/8	3 1/8
18	20	29	26 1/2	20	1 3/8	23	3 1/4	22 1/2	20 1/4	5 3/8	4	22	22	3 7/8	3 1/4

Table R Dimensions of plain, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B) (continued)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe A)	Diameter of flange	Bolt circle diameter	No. of bolts	Diameter of bolts B)	Dimensions of necks for integrally cast or forged steel flanges (Fig. 5) (valves only)			Dimensions of steel welding necks (Fig. 6)			Thickness of flange					
						Diameter at large end of neck	Length of taper	Diameter at large end of neck	Diameter at small end of neck C)	Total length of neck	Length of taper	Cast or wrought steel integral or plain (Fig. 3) or welding neck (Fig. 6) (except for valves)	Forged or cast steel integral (Fig. 5) (for valves only)				
														Diameter C	G	J	K
in	H	D	P	N	O	in	in	in	in	in	in	in	in	in	in	in	in
20	22	31 3/4	28 3/4	20	1 1/2	25	3 1/2	24 1/4	22 1/4	5 3/8	4	24 1/2	4 1/8	3 1/2			
22	24	35 1/4	31 3/4	20	2	27 1/2	3 3/4	26 1/4	24 1/4	5 5/8	4 1/4	26 1/2	4 1/2	3 3/4			

A) (H) For availability of steel pipe sizes, refer to BS EN 10216, BS EN 10217.

B) (O) For 5/8 in bolts, the diameters of the holes shall be 1/16 in larger than the bolts and for 3/4 in bolts and sizes above, the diameters shall be not more than 1/8 in larger than the bolts.

C) (K) The diameters tabulated apply to pipes with outside diameters in accordance with H. For pipes designated by their bores, dimension K shall be such that the difference between the corresponding diameters K and H is maintained.

D) (H) It is recommended that this size for steel pipes should be avoided wherever possible.

Table S Dimensions of plain, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe A)	Diameter of flange	Bolt circle diameter	No. of bolts	Diameter of bolts B)	Dimensions of necks for integrally cast or forged steel flanges (Fig. 5) (valves only)			Dimensions of steel welding necks (Fig. 6)				Thickness of flange				
						Diameter at large end of neck	Length of taper	Diameter at large end of neck	Diameter at small end of neck C)	Total length of neck	Length of taper	Cast or wrought steel integral or plain (Fig. 3) or welding neck (Fig. 6) (except for valves)	Forged or cast steel integral (Fig. 5) (for valves only)				
														Diameter C	G	J	K
in	H	D	P	N	O	in	in	in	in	in	in	in	in	in	in	in	in
1/2	27/32	5	3 1/2	4	3/4	1 3/8	7/8	1 5/16	7/8	1 1/2	7/8	2 1/2	7/8	7/8			
3/4	1 1/16	5	3 1/2	4	3/4	1 5/8	7/8	1 1/2	1 3/32	1 1/2	7/8	2 1/2	7/8	7/8			
1	1 1/32	5 1/2	4	4	3/4	2	1	1 7/8	1 3/8	1 3/4	1	3	1	1			
1 1/4	1 11/16	5 3/4	4 1/4	4	3/4	2 1/4	1 1/8	2 1/4	1 29/32	1 7/8	1 1/8	3 1/4	1 1/8	1 1/8			
1 1/2	1 29/32	6 1/4	4 3/4	4	3/4	2 1/2	1 1/8	2 9/16	1 15/16	2	1 1/4	3 1/2	1 1/8	1 1/8			
2	2 3/8	6 3/4	5 1/4	8	3/4	3 1/8	1 1/4	3	2 13/32	2	1 1/4	3 1/2	1 1/4	1 1/4			

Table S Dimensions of plain, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B) (continued)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe A)	Diameter of flange	Bolt circle diameter	No. of bolts	Diameter of bolts B)	Dimensions of necks for integrally cast or forged steel flanges (Fig. 5) (valves only)		Dimensions of steel welding necks (Fig. 6)				Thickness of flange	
						Diameter at large end of neck	Length of taper	Diameter at large end of neck	Diameter at small end of neck C)	Total length of neck	Length of taper	Diameter of raised face (see Clause 4) (Figs 3, 5, 6)	Cast or wrought steel integral or plain (Fig. 3) or welding neck (Fig. 6) (except for valves)
<i>H</i>	<i>D</i>	<i>P</i>	<i>N</i>	<i>O</i>	<i>C</i>	<i>G</i>	<i>J</i>	<i>K</i>	<i>L</i>	<i>M</i>	<i>F</i>	<i>T<sub>8</sub></i>	<i>T<sub>9</sub></i>
in	in	in	in	in	in	in	in	in	in	in	in	in	in
2 1/2	3	7 1/4	8	3/4	4 1/8	1 1/4	3 5/8	3 1/32	2 1/8	1 1/4	4	1 1/4	1 1/4
3	3 1/2	8	8	7/8	4 5/8	1 3/8	4 1/8	3 17/32	2 1/8	1 1/4	4 1/2	1 3/8	1 3/8
3 1/2	4	9 1/4	8	7/8	5 1/4	1 1/2	4 5/8	4 1/16	2 1/8	1 1/4	5	1 1/2	1 1/2
4	5	9 3/4	8	1	5 3/4	1 5/8	5 1/2	5 1/16	2 3/8	1 1/2	6 1/4	1 5/8	1 5/8
4 1/2	5 1/2	10 1/2	8	1	6 1/4	1 5/8	6	5 9/16	2 3/8	1 1/2	7	1 5/8	1 5/8
5	6	11 1/4	12	7/8	7	1 3/4	6 3/4	6 1/16	2 3/8	1 1/2	7 1/2	1 3/4	1 3/4
6	6 5/8	12 3/4	12	1	8 3/8	2	7 5/8	6 23/32	3	2	8 1/4	2	2
7	7 5/8	14 3/4	12	1 1/8	9 7/8	2 1/4	8	7 3/32	3	2	9 3/4	2 1/4	2 1/4
8	8 5/8	16 1/4	12	1 1/4	11 1/8	2 1/2	9 5/8	7 23/32	3 3/8	2 1/4	10 3/4	2 1/2	2 1/2
9	9 5/8	17 1/4	16	1 1/2	12 1/4	2 5/8	10 3/4	8 23/32	4	2 3/4	11 3/4	2 7/8	2 5/8
10	10 3/4	18 1/4	16	1 3/8	13 1/2	2 7/8	11 1/4	10 7/8	4 3/8	3	13	3 1/8	2 7/8
11	11 3/4	19	16	1 1/2	14 1/2	3 1/8	12 1/4	11 7/8	5	3 1/2	14	3 3/8	3 1/8
12	12 3/4	20	16	1 5/8	15 1/2	3 1/4	13 1/4	12 29/32	5	3 1/2	15	3 5/8	3 1/4
13	14	22 3/4	16	1 3/4	16	3 1/2	14 1/2	14 5/32	5 1/4	3 3/4	16 1/4	3 7/8	3 1/2
14	15 D)	24	20	1 7/8	17 1/4	3 3/4	15 3/4	15 5/32	5 5/8	4	17 1/4	4 1/8	3 3/4
15	16	25 1/2	20	2	18 1/2	4	16 7/8	16 3/16	—	—	18 1/2	4 3/8	4
16	18	27 1/2	20	2 1/8	19 3/4	4 1/4	18	—	6 1/4	4 1/2	19 1/2	4 5/8	4 1/4
		29 1/4	20	2 3/8	20 3/4	4 1/4	20 1/4	18 3/16	—	—	—	—	—

A) (*H*) For availability of steel pipe sizes, refer to BS EN 10216, BS EN 10217.B) (*O*) The diameters of the bolt holes shall be not more than 1/8 in larger than the bolts.C) (*K*) The diameters tabulated apply to pipes with outside diameters in accordance with *H*. For pipes designated by their bores, dimension *K* shall be such that the difference between the corresponding diameters *K* and *H* is maintained.D) (*H*) It is recommended that this size for steel pipes should be avoided wherever possible.

Table T Dimensions of plain, integrally cast or forged, and welding neck flanges (for ratings see Table 2 and Annex B)

Flange size designation (nominal bore of pipe)	Approximate outside diameter of steel pipe A)	Diameter of flange	Bolt circle diameter	No. of bolts	Diameter of bolts B)	Dimensions of necks for integrally cast or forged steel flanges (Fig. 5) (valves only)		Dimensions of steel welding necks (Fig. 6)				Thickness of flange	
						Diameter at large end of neck	Length of taper	Diameter at large end of neck	Diameter at small end of neck C)	Total length of neck	Length of taper	Diameter of raised face (see Clause 4) (Figs 3, 5, 6)	Cast or wrought steel integral or plain (Fig. 3) or welding neck (Fig. 6) (except for valves)
H	D	P	N	O	C	G	J	K	L	M	F	T <sub>8</sub>	T <sub>9</sub>
in	in	in		in	in	in	in	in	in	in	in	in	in
1/2	27/32	5 1/2	4	3/4	1 3/4	1	1 5/16	7/8	1 1/2	7/8	2 1/2	1	1
3/4	1 1/16	5 1/2	4	3/4	2	1	1 1/2	1 3/32	1 1/2	7/8	2 1/2	1	1
1	1 11/32	5 3/4	4	3/4	2 1/4	1 1/8	1 7/8	1 3/8	1 3/4	1	3	1 1/8	1 1/8
1 1/4	1 11/16	6 1/4	4	7/8	2 1/2	1 1/4	2 1/4	1 23/32	1 7/8	1 1/8	3 1/4	1 1/4	1 1/4
1 1/2	2 3/8	6 3/4	8	3/4	2 3/4	1 3/8	3	2 19/32	2	1 1/4	3 1/2	1 3/8	1 3/8
2	3	7 1/4	8	3/4	3 1/2	1 3/8	3 3/8	3 1/32	2 1/8	1 1/4	4	1 3/8	1 3/8
2 1/2	3 1/2	8	8	7/8	4 1/2	1 5/8	4 1/4	3 17/32	2 3/8	1 1/2	4 1/2	1 5/8	1 5/8
3	4	9 1/4	8	1	5 1/4	1 7/8	4 3/4	4 1/16	2 3/8	1 1/2	5	1 7/8	1 7/8
3 1/2	4 1/2	10 1/2	8	1 1/8	6	2 1/8	5 3/8	4 9/16	2 3/4	1 3/4	5 3/4	2 1/8	2 1/8
4	5	11 1/4	8	1 1/8	6 3/4	2 1/4	6	5 1/16	3	2	6 1/4	2 1/4	2 1/4
4 1/2	5 1/2	11 3/4	12	1	7 1/2	2 3/8	6 5/8	5 9/16	3 1/4	2 1/4	7	2 3/8	2 3/8
5	6 5/8	12 3/4	12	1 1/8	8 1/4	2 5/8	7 3/4	6 23/32	3 5/8	2 1/2	8 1/4	2 5/8	2 5/8
6	7 5/8	14 3/4	12	1 1/4	9 3/4	2 7/8	9	7 23/32	4	2 3/4	9	2 7/8	2 7/8
7	8 5/8	17	12	1 3/8	11 1/4	3 1/4	10 1/2	8 23/32	4 1/2	3	9 3/4	3 1/4	3 1/4
8	9 5/8	18 3/4	12	1 1/2	12 1/2	3 1/2	11 1/4	9 3/4	4 1/2	3	11 3/4	3 1/2	3 1/2
	10 3/4						12	10 7/8					
9	11 3/4 D)	20	16	1 3/8	13 1/2	3 3/4	13 1/2	11 7/8	5 1/8	3 1/2	13	3 3/4	3 3/4
10	12 3/4	22	16	1 1/2	15	4 1/4	14 3/4	12 29/32	5 3/4	4	14	4 1/4	4 1/4
11	14	24 1/4	16	1 3/4	16 1/2	4 1/2	16	14 5/32	5 7/8	4	15	4 1/2	4 1/2
12	15 D)	25 3/4	16	1 3/4	18	4 3/4	17 3/8	15 5/32	6 3/4	4 3/4	16 1/4	4 3/4	4 3/4
13	16	27 3/4	16	2	19 1/2	5 1/8	18 1/2	16 3/16	7 1/8	5	17 1/4	5 1/8	5 1/8

A) (H) For availability of steel pipe sizes, refer to BS EN 10216, BS EN 10217.

B) (O) The diameters of the bolt holes shall be not more than 1/8 in larger than the bolts.

C) (K) The diameters tabulated apply to pipes with outside diameters in accordance with H. For pipes designated by their bores, dimension K shall be such that the difference between the corresponding diameters K and H is maintained.

D) (H) It is recommended that this size for steel pipes should be avoided wherever possible.

Figure 1 Shaped stud bolt (see C.4)

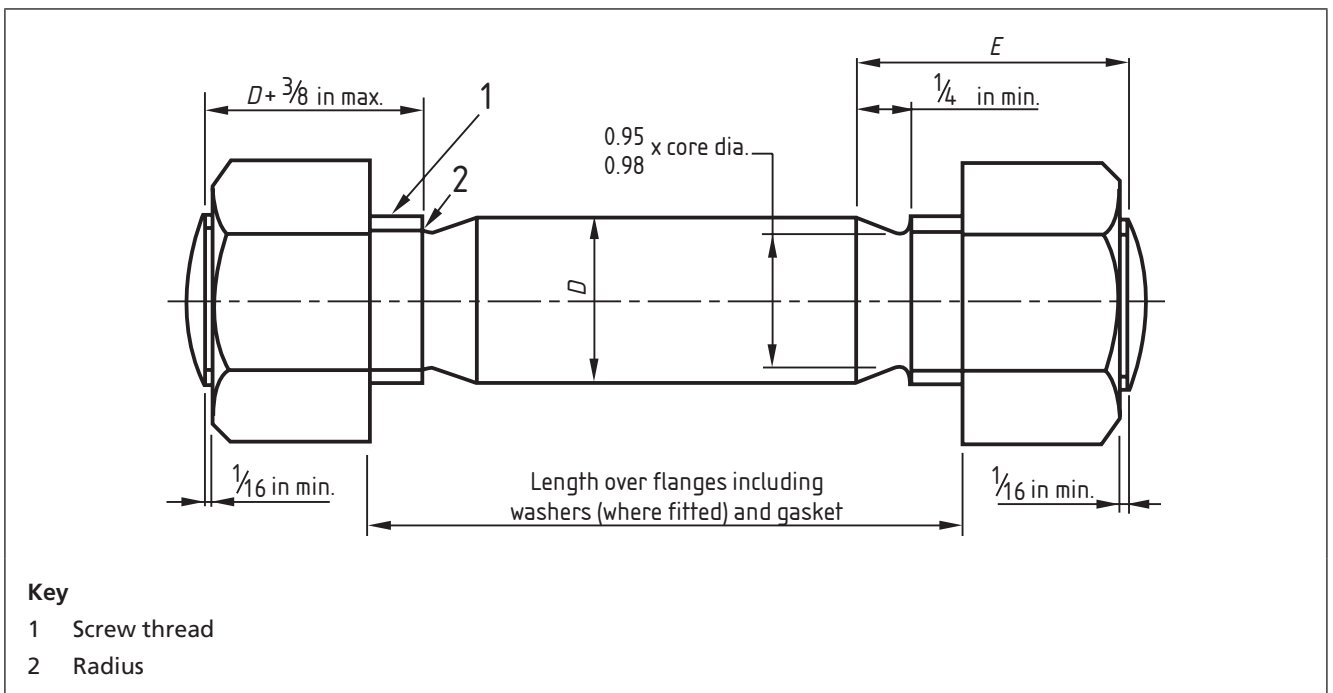
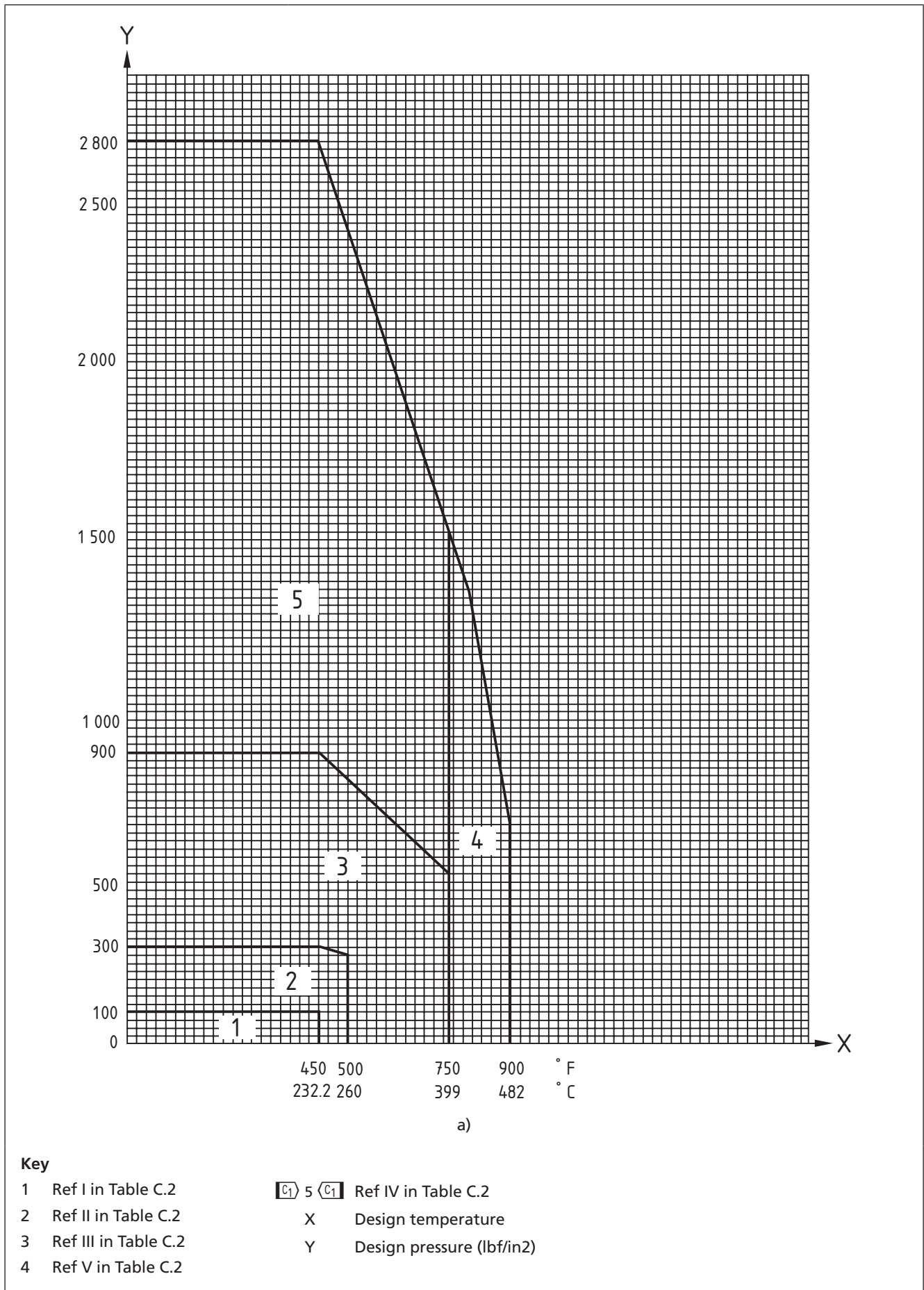


Figure 2 Application diagram for bolts and stud-bolts: carbon and flanges



Licensed copy: Lee Shau Kee Library, HKUST, Version correct as of 03/01/2015, (c) The British Standards Institution 2013



Figure 2 Application diagram for bolts and stud-bolts: alloy steel flanges (continued)

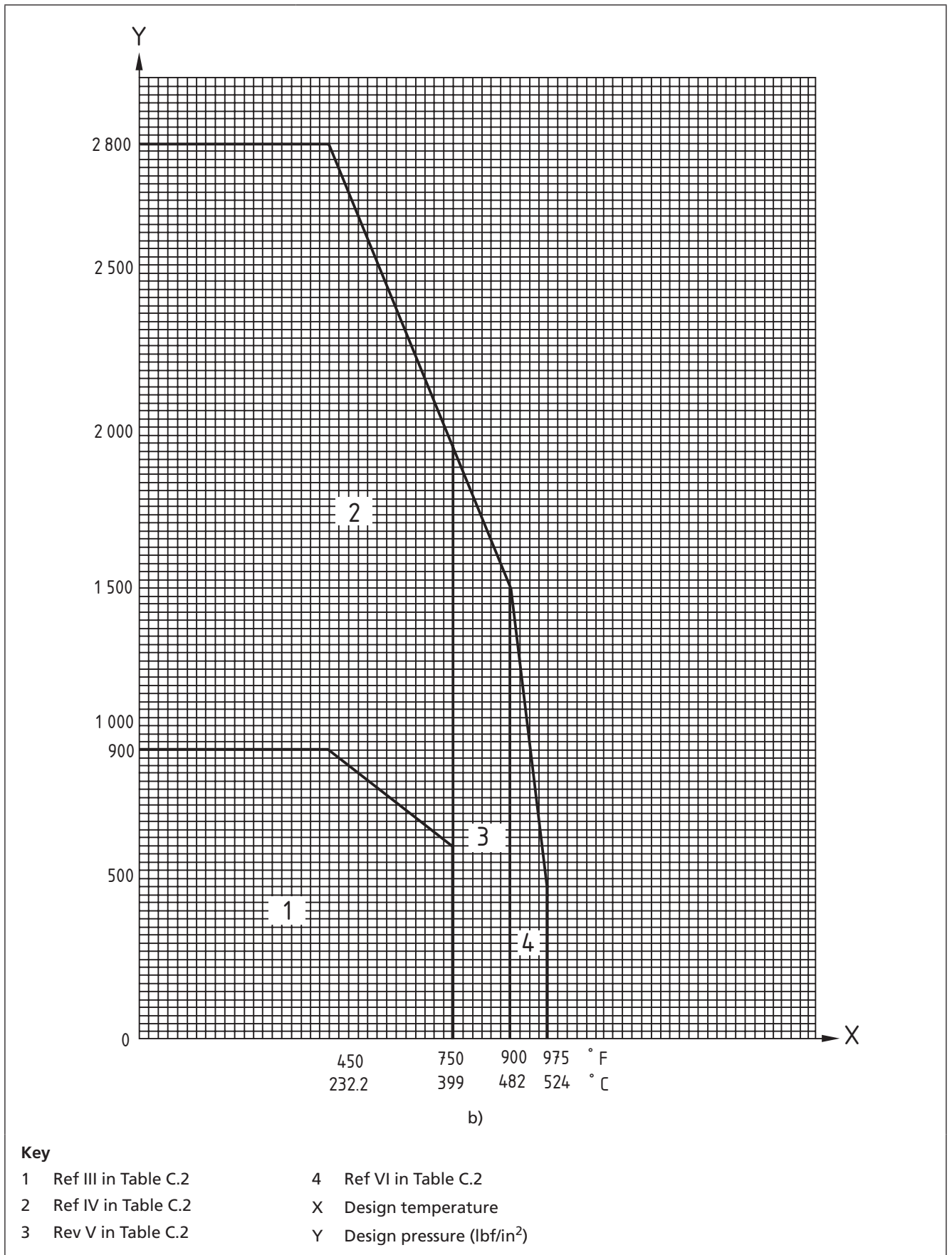


Figure 3 Steel or copper alloy plain flange

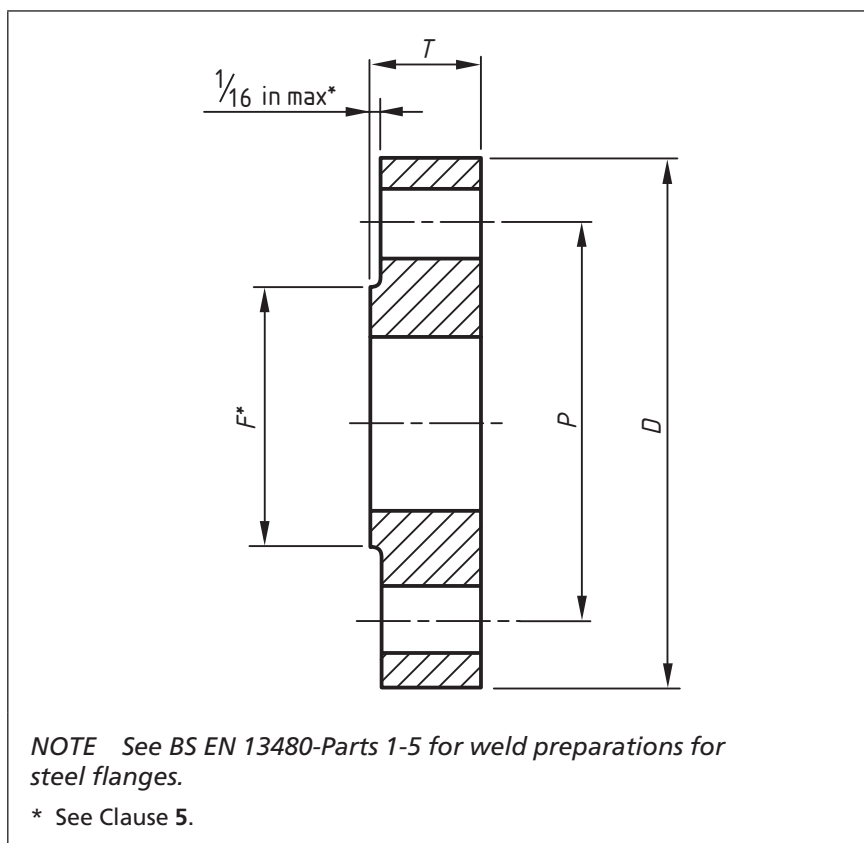


Figure 4 Steel boss flange

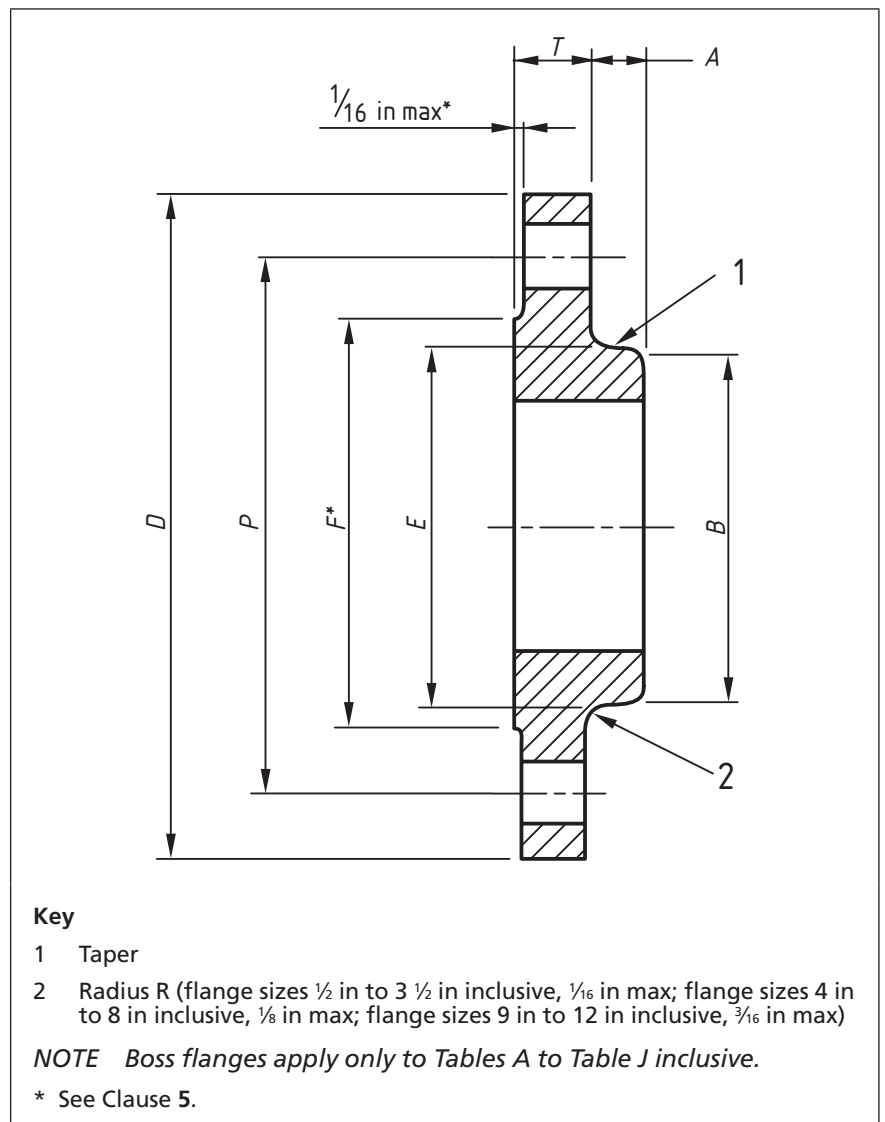


Figure 5 Integrally forged or cast steel flange for valves only

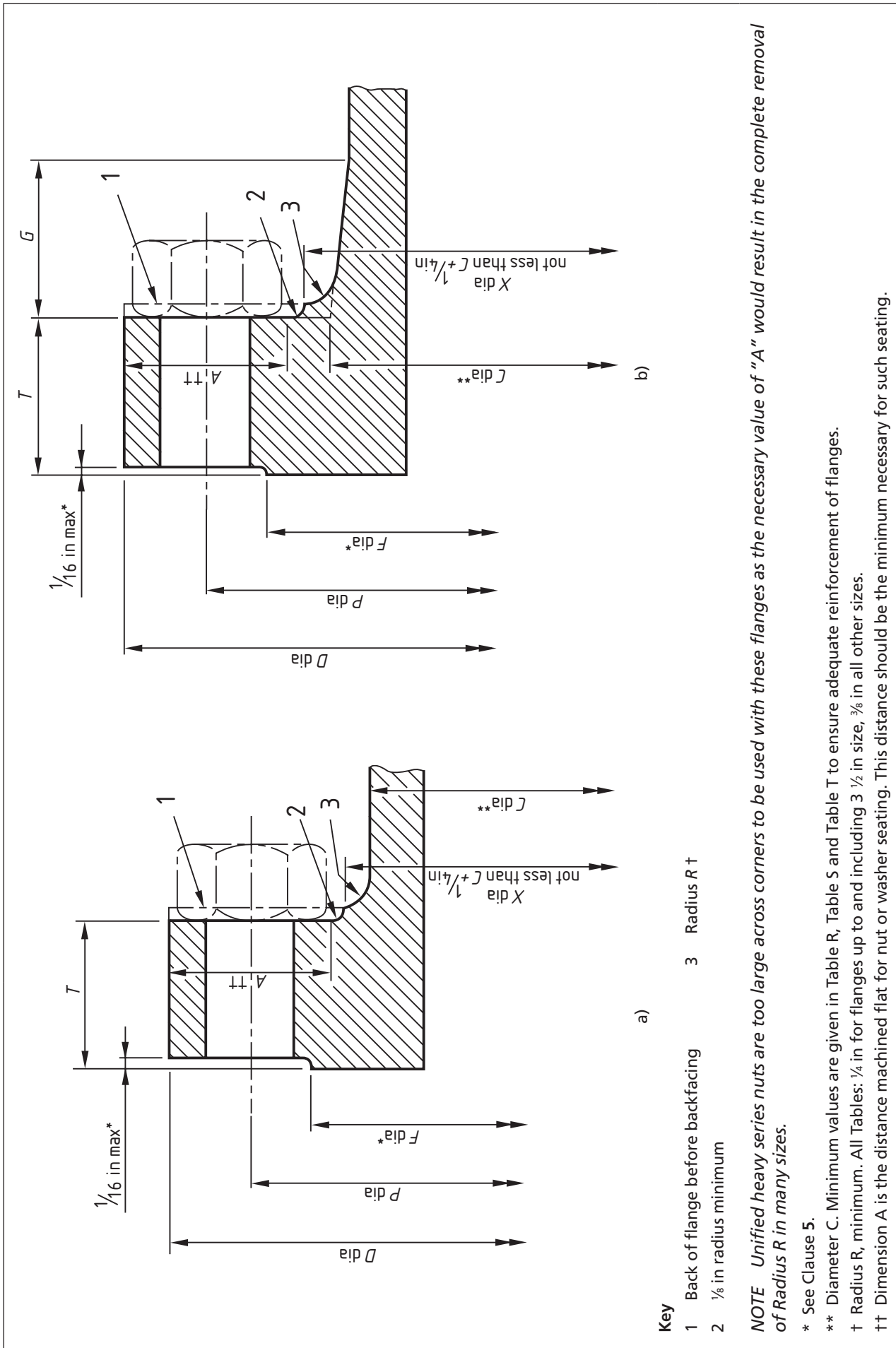


Figure 6 Steel welding neck flange (see Table D to Table T)

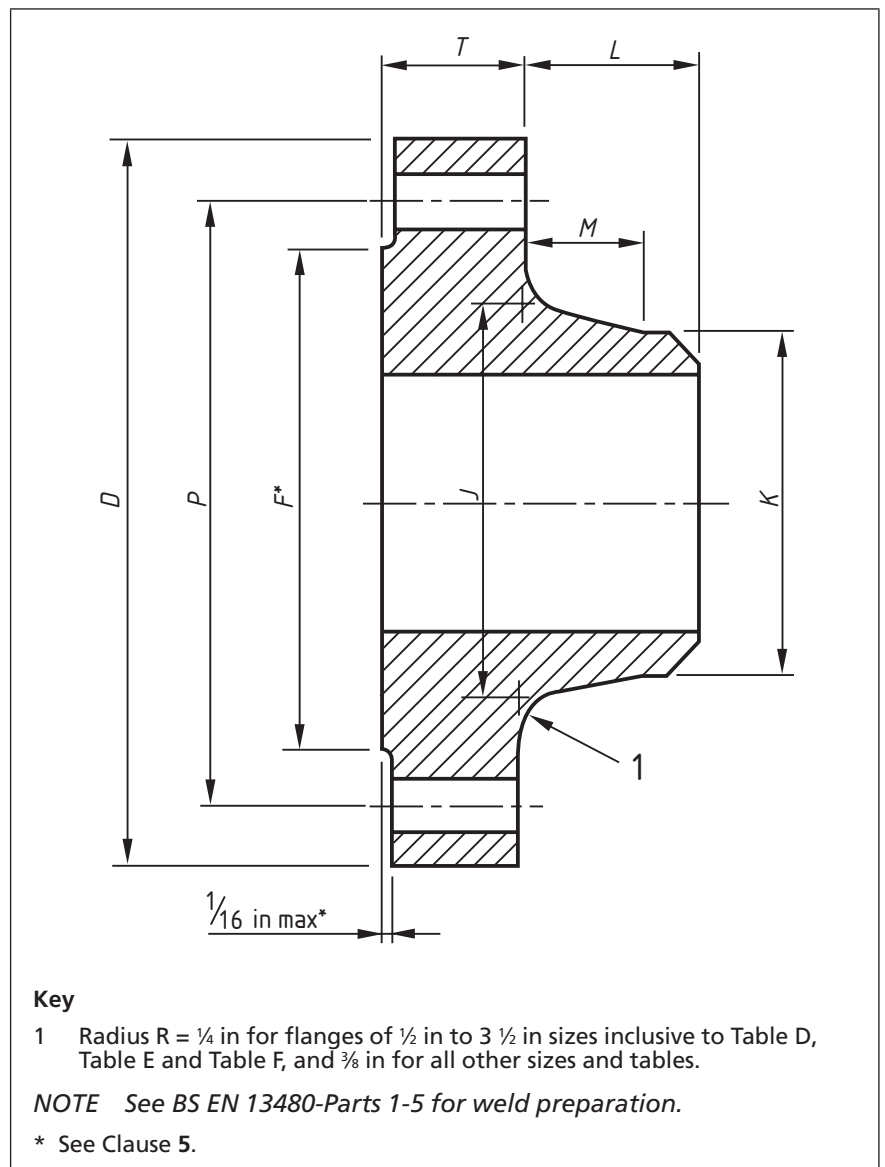
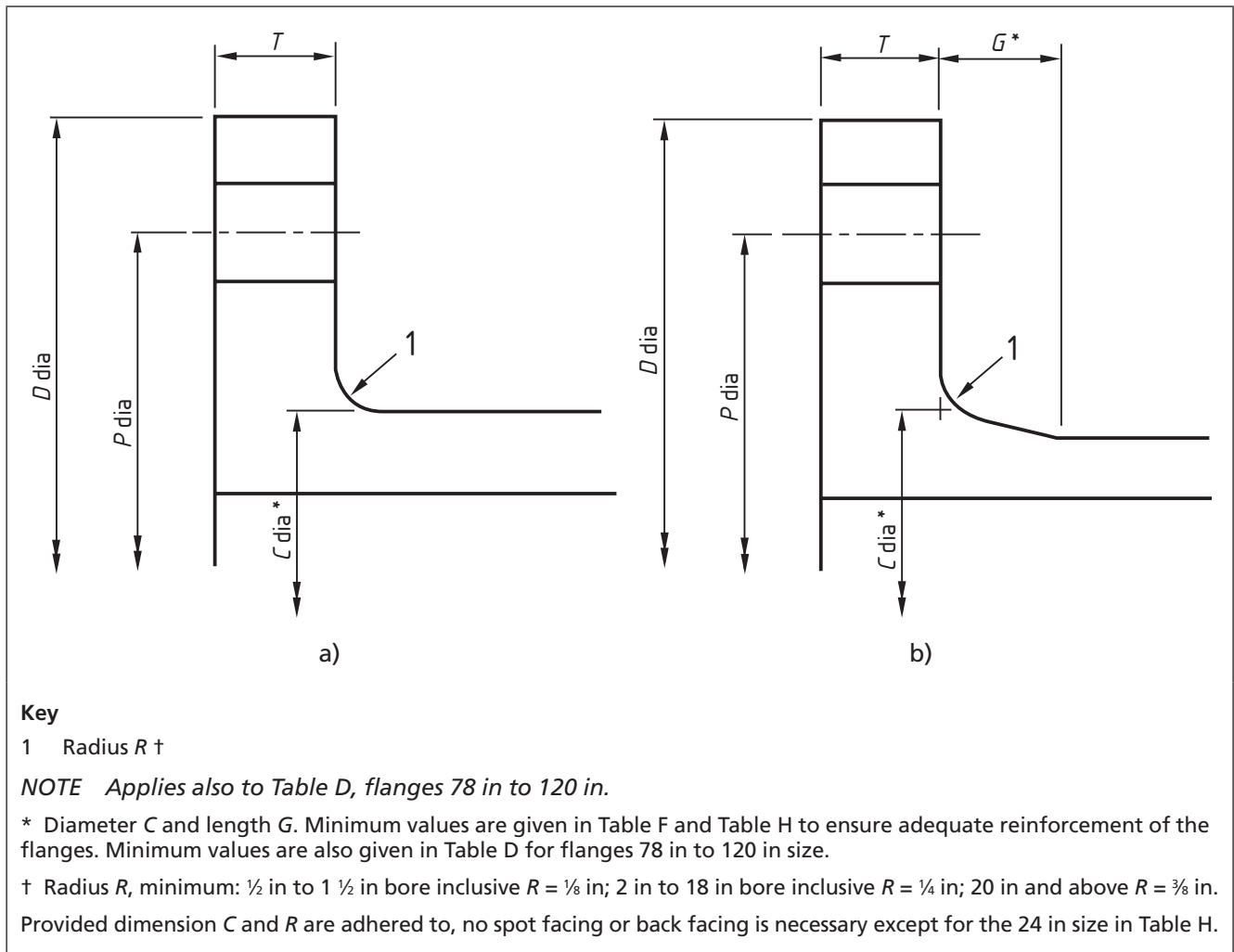


Figure 7 Integrally cast iron flanges (see Table F and Table H)



## Annex A (informative) Information to be supplied by the purchaser

It is recommended that, in the enquiry or order, the purchaser should specify the following.

- a) The design temperature and pressure for which the flanges are required, or the Flange Table (see Clause 3).
- b) Flange size designation (see Clause 4).
- c) The material required (see Clause 6).
- d) The type of flange if supplied loose and the preparation for attachment to pipes, if other than as specified in 7.2.
- e) If the flanges are required undrilled (see 5.4).
- f) If the backs of the flanges are required to be unmachined for other than a cast steel integral flange (see 5.3).
- g) If a raised jointing face is required for steel flanges, Tables A to Table F inclusive (see 5.2).
- h) If the flanges are to be marked to identify the material (see Clause 6).
- i) If certificates are required of the process, chemical analysis and physical properties of the material (see Clause 6).
- j) If a particular type of stud-bolt is required (see C.4).
- k) If bolts, stud-bolts and nuts are to be marked to identify the material (see Annex C).

## Annex B (informative)

**Minimum requirements of steel to be used for flanges in Table A to Table H**

- a) *Analysis*: Carbon 0.26 per cent maximum; Sulfur 0.035 per cent maximum; Phosphorus 0.035 per cent maximum

*Tensile strength*: 22 tonf/in<sup>2</sup> minimum (340 Nmm<sup>2</sup>)

*Elongation*: Percentage elongation on gauge length of  $5.65\sqrt{S_0}$  not less than 600 divided by the tensile strength (tonf/in<sup>2</sup>) of the test piece.

- b) Cast carbon steel to BS 592, Grade A, in BS EN 10293 or BS 1504-161, Grade A.
- c) Forged carbon-molybdenum steel to BS 1503-240, Grade A.
- d) Cast carbon-molybdenum steel to BS 1398 in BS EN 10293 or BS 1504-240.
- e) Forged chromium molybdenum steel to BS 1503-620 or BS 3604.
- f) Cast chromium molybdenum steel to BS 1504-621.
- g) Grey cast iron having mechanical properties at least equivalent to those set out in Table B.1 (see also Table 6).
- h) Malleable cast iron to BS 309 or BS 310.
- i) Copper alloys having mechanical properties at least equivalent to those specified in BS 1400-LG2-C, or BS 1400-LG3-C.

*NOTE* Other grades of alloy steels, cast iron and copper alloys having superior properties are available for which the temperature-pressure ratings have not yet been evaluated. Spheroidal or nodular cast iron to BS 2789 may be used at temperatures not exceeding 650 °F (343.3 °C).

Table B.1 Grey cast iron properties

Table	Temperature		
	0°F to 250°F –17.8°C to 121.1°C	0°F to 375°F –17.8°C to 190.6°C	up to 430°F –17.8°C to 221°C
A, D and E	BS EN 1561, Grade 12 BS 2035	BS EN 1561, Grade 12	BS EN 1561, Grade 14
F and H	BS EN 1561, Grade 12	BS EN 1561, Grade 12	BS EN 1561, Grade 14



Table B.2 Temperature/pressure ratings for grey cast iron and malleable cast iron flanges  
[see Clauses 5g) and 5h)]

Table	Temperature °C					Maximum hydraulic test pressure (lbf/in <sup>2</sup> )
	-17.8 to 121.1	-17.8 to 148.9	-17.8 to 176.7	-17.8 to 190.6	-17.8 to 221.0	
	Temperature °F					
	0 to 250	0 to 300	0 to 350	0 to 375	0 to 430	
	Pressure (lbf/in <sup>2</sup> )					
	Boiler feed pipe installations etc			Steam		
A <sup>A)</sup>	50 <sup>B), C), D)</sup>	—	—	—	25 <sup>E)</sup>	100
D	100 <sup>B), C)</sup>	75	—	—	50	200
E	200 <sup>B), C)</sup>	—	150	—	100	400
F	300 <sup>C)</sup>	—	—	200	190 <sup>F)</sup>	600
H	500 <sup>C)</sup>	BS EN 13480-Parts 1-5 limits the use of CI feed pipes to 200 lbf/in <sup>2</sup>			190 <sup>G)</sup>	1 000

A) In sizes 27 in to 48 in inclusive, it is recommended that for cast iron valves, Table D flanges be specified instead of Table A.

B) Flanges of material as defined in BS 2035, Clause 4 should be used for these ratings only.

C) These ratings do not apply to boiler feed pipe installation or other water pipes, valves and fittings subject to shock.

D) It is customary in the gas industry to limit the use of Table A flanges to working gas pressures not exceeding 30 lbf/in<sup>2</sup>. It is recommended that this limitation be also applied to compressed air.

E) This rating does not apply to flange sizes above 36 in.

F) This rating applies only up to and including the 12 in flange size. Above this size reduce the pressure rating to 150 lbf/in<sup>2</sup>.

G) This is the maximum pressure allowable for cast iron at 221 °C (430 °F).

Table B.3 Temperature/pressure ratings<sup>A)</sup> for copper alloy flanges sizes ½ in to 3 in (inclusive)  
[see Clause 5j)]

Table	Temperature °C						Maximum hydraulic test pressure (lbf/in <sup>2</sup> )
	-17.8 to 121.1	148.9	176.7	204.4	232.2	260.0	
	Temperature °F						
	0 to 250	300	350	400	450	500	
	Pressure (lbf/in <sup>2</sup> )						
A <sup>B)</sup>	50 <sup>C)</sup>	—	—	—	25 <sup>D)</sup>	—	75
D <sup>B)</sup>	100	95	95	80	65	50	150
E <sup>B)</sup>	200	200	200	165	130	100	300
F	300	200	300	245	195	150	450
H	500	500	500	410	330	250	750
J	550	525	525	440	390	350	825
K	700	670	670	555	500	450	1 050

NOTE Intermediate values may be obtained by linear interpolation, except for Table A.

A) The above ratings agree with those adopted in the revised edition of BS 2060 where applicable.

B) The dimensions of Table A, Table D and Table E up to 3 in size are identical.

C) It is customary in the gas industry to limit the use of Table A flanges to working gas pressures not exceeding 30 lbf/in<sup>2</sup>. It is recommended that this limitation be also applied to compressed air.

D) This rating applies to temperatures above 121.1°C (250°F) up to and including 232.2°C (450°F).

Table B.4 Temperature/pressure ratings for copper alloy flanges sizes over 3 in [see Clause 5f)]

Table	Temperature °C							Maximum hydraulic test pressure (lbf/in <sup>2</sup> )
	-17.8 to 121.1	148.9	176.7	204.4	232.2	260.0		
	Temperature °F							
	0 to 250	300	350	400	450	500		
	Pressure (lbf/in <sup>2</sup> )							
	Over 3 in to 24 in	Over 3 in to 8 in						
A	50 <sup>A)</sup>	—	—	—	—	25 <sup>B)</sup>	—	75
D	100	—	95	90	80	65	50	150
E	175	—	165	155	135	120	100	265
F	250	—	240	220	195	175	150	375
H	400	—	380	350	320	285	250	600
J	—	550	525	485	440	390	350	825
K	—	700	670	615	555	500	450	1 050

NOTE Intermediate values may be obtained by linear interpolation, except for Table A.

A) It is customary in the gas industry to limit the use of Table A flanges to working gas pressures not exceeding 30 lbf/in<sup>2</sup>. It is recommended that this limitation be also applied to compressed air.

B) This rating applies to temperatures above 121.1°C (250°F) up to and including 232.2°C (450°F).

## Annex C (normative) Bolts and nuts

### c.1 Application

Bolts, stud-bolts and nuts shall comply with the minimum requirements, corresponding to the various flange tables and temperature limits, specified in Table 2.

Table C.1 Application of bolts and stud-bolts [see Figure 2a) and Figure 2b)]

Flange tables	Design temperature not exceeding	Reference for bolts or stud-bolts (see Table C.2, Column 1)	Type
A and D	232.2 °C (450 °F)	I	Bolt
D, E and F	260 °C (500 °F)	II	Bolt or stud-bolt
	399 °C (750 °F)	III	Bolt or stud-bolt
	427 °C (800 °F)	V	Stud-bolt
H, J and K	399 °C (750 °F)	III	Bolt or stud-bolt
	482 °C (900 °F)	V	Stud-bolt
	524 °C (975 °F)	VI	Stud-bolt
R, S and T	399 °C (750 °F)	IV	Bolt or stud-bolt
	482 °C (900 °F)	V	Stud-bolt
	524 °C (975 °F)	VI	Stud-bolt

### c.2 Dimensions, finish and materials.

Hexagon headed bolts with hexagon nuts or stud-bolts with hexagon nuts shall be used, the dimensions and finish of which shall comply conform to the requirements of Table 3.

*NOTE 1 The materials specified in Table 3 are typical and materials to other specifications, having similar or superior properties, may be used by agreement between the purchaser and the manufacturer.*

Free cutting steel shall not be used for design temperatures exceeding 232.2 °C (450 °F).

For design temperatures up to and including 260 °C (500 °F), steels for bolts, stud-bolts and nuts shall contain not more than 0.060% of sulfur or phosphorus and for design temperatures over 260 °C (500 °F) shall contain not more than 0.050% of sulfur or phosphorus.

*NOTE 2 The minimum yield stresses specified for alloy steels apply to the material in the hardened and tempered condition.*

Alloy steels shall have creep relaxation properties and impact properties adequate for the design temperature and shall be agreed between the purchaser and the manufacturer.

### C.3 Nuts

*NOTE* Nuts may be made from steel to the same specification as that used for the bolts or stud-bolts to which they are fitted but, for design temperatures over 287.8 °C (550 °F), it is recommended that nuts should be made from a material having a lower tensile strength than that for the bolts, provided that it is suitable for the design temperature.

### C.4 Stud-bolts

Stud-bolts for design temperatures not exceeding 399 °C (750 °F) shall be:

- screwed each end and plain in centre; or
- screwed full length.

For design temperatures above 399 °C (750 °F) and not exceeding 482 °C (900 °F) stud-bolts shall be:

- screwed each end and shaped in accordance with Figure 1; or
- screwed full length.

For design temperatures above 482 °C (900 °F) stud bolts shall be screwed each end and shaped in accordance with Figure 1.

### C.5 Washers

Washers, where used, shall be of steel and shall be:

- for bolts or stud-bolts references I, II or III (see Table 3), manufactured in accordance with BS 3410; or
- for bolts or stud-bolts references IV, V or VI (see Table 3), manufactured in accordance with BS 3410, Part 1, except that for design temperatures above 482 °C (900 °F) the steel shall be to BS EN 10090 En 2E, 3A or 4, unless otherwise agreed between purchaser and manufacturer.

Washers shall not be fitted where the partial removal of the radius or fillet at the back of the flange by spot-facing or back-facing would result in the removal of the radius or fillet to an extent greater than that indicated in Figure 5 for integrally cast or forged steel flanges.

*NOTE 1* The use of washers may necessitate the partial removal of the radius or fillet at the back of the flange by spot-facing or back-facing.

*NOTE 2* For references III to VI inclusive (see Table 3) it is desirable to mark the nuts, bolts and stud-bolts to identify the materials used. When the purchaser requires this to be done, the system of marking to be employed should be the subject of agreement between the purchaser and the manufacturer.

Table C.2 Materials, dimensions and finish of bolts, stud-bolts and nuts

Ref.	Materials	Typical material specifications		Screw threads (BS 84 or BS 1580-1)	Specifications for dimensions (except screw threads) and finish	
		Bolts and stud-bolts	Nuts		Bolts and nuts, and nuts of stud-bolts	Stud-bolts
I	Carbon steel	BS 916 or BS 1769 Min. tensile strength 26 tonf/in <sup>2</sup>	BS 916 or BS 1769 Min. tensile strength 26 tonf/in <sup>2</sup>	BSW or UNC	BS 916 or BS 1769 (all black all over)	—
II	Carbon steel	BS 916 or BS 1769 Min. tensile strength 28 tonf/in <sup>2</sup> Not more than 0.060% sulfur or phosphorus	BS 916 or BS 1769 Min. tensile strength 28 tonf/in <sup>2</sup> Not more than 0.060% sulfur or phosphorus	BSW or UNC	BS 916 or BS 1769 (all black all over)	Shaped as Figure 1 or screwed full length or screwed each end and plain in centre
III	Carbon steel	Tensile strength 35/40 tonf/in <sup>2</sup> Min. yield stress 18 tonf/in <sup>2</sup> Min. elongation 20% on 2 in gauge length For design temperatures not exceeding 260°C (500°F) not more than 0.060% sulfur or phosphorus. For design temperatures over 260°C (500°F) not more than 0.050% sulfur or phosphorus.	Tensile strength 32/38 tonf/in <sup>2</sup> Min. yield stress 16 tonf/in <sup>2</sup> Min. elongation 20% on 2 in gauge length Alternatively, Tensile strength 35/40 tonf/in <sup>2</sup> Min. yield stress 18 tonf/in <sup>2</sup> Min. elongation 20% on 2 in gauge length In each case, for design temperature not exceeding 260 °C (500 °F) not more than 0.060% sulfur or phosphorus. For design temperatures over 260 °C (500 °F) not more than 0.050% sulfur or phosphorus	BSW or BSF or UNC or 8 UN (sizes over 1 in)	BS 916 or BS 1769 (all black all over)	Shaped as Figure 1 or screwed full length or screwed each end and plain in centre

Table C.2 Materials, dimensions and finish of bolts, stud-bolts and nuts (*continued*)

Ref.	Materials	Typical material specifications		Screw threads (BS 84 or BS 1580-1)	Specifications for dimensions (except screw threads) and finish	
		Bolts and stud-bolts	Nuts		Bolts and nuts, and nuts of stud-bolts	Stud-bolts
IV	Carbon steel	BS 1083, Grade R; or BS 1768, Grade S. Not more than 0.050% sulfur or phosphorus.	Tensile strength 35/40 tonf/in <sup>2</sup> Min. yield stress 18 tonf/in <sup>2</sup> Min. elongation 20% on 2 in gauge length Alternatively, Tensile strength 45/55 tonf/in <sup>2</sup> Min. yield stress 23 tonf/in <sup>2</sup> Min. elongation 20% on 2 in gauge length In each case, not more than 0.050% sulfur or phosphorus.	BSW or BSF or UNC or 8 UN (sizes over 1 in)	BS 916 or BS 1769 (all with heads and nuts machined on bearing face). Alternatively, BS 1083 BS 1768	Shaped as Figure 1 or screwed full length or screwed each end and plain in centre
V	Alloy steel	BS EN 10090 En 20B(T), hardened and tempered. Min. yield stress 44 tonf/in <sup>2</sup>	Carbon-molybdenum to BS 1506-240 Alternatively, BS EN 10090 En 20B(T) hardened and tempered. Alternatively, for design temperatures not exceeding 454 °C (850 °F) carbon steel. Tensile strength 35/40 tonf/in <sup>2</sup> Min. yield stress 18 tonf/in <sup>2</sup> Min. elongation 20% on 2 in gauge length Not more than 0.050% sulfur or phosphorus.	BSF or UNC (sizes 1 in and below) 8 UN (sizes over 1 in)	(Nuts only) BS 916 or BS 1769 (all machined on bearing face) Alternatively, BS 1083 or BS 1768	Shaped as Figure 1 except as stated in C.4
VI	Alloy steel	Chromium molybdenum or chromium molybdenum vanadium steel with creep relaxation and impact properties adequate for the design temperature which shall be agreed between the purchaser and the manufacturer. For design temperatures not exceeding 510 °C (950 °F), carbon-molybdenum nuts to BS 1506-240 may be used.		BSF or UNC (sizes 1 in and below) 8 UN (sizes over 1 in)	(Nuts only) BS 916 or BS 1769 (all machined on bearing face) Alternatively, BS 1083 or BS 1768	Shaped as Figure 1 except as stated in C.4

**NOTE** For sizes above 1 in (Ref. III, V and VI), 8 UN threads to BS 1580 are specified.

## Bibliography

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 309, *Particleboards – Definition and classification*

BS 310, *Wood-based panels – Determination of modulus of elasticity in bending and of bending strength*

BS 350, *Conversion factors for units*

BS 1083, *Specification for precision hexagon bolts, screws and nuts (B.S.W. & B.S.F. threads)*

BS 1400, *Specification for copper alloy ingots and copper alloy and high conductivity copper castings*

BS 1503, *Specification for steel forgings for pressure purposes*

BS 1504, *Specification for steel castings for pressure purposes*

BS 1768, *Specification for Unified precision hexagon bolts, screws, & nuts (UNC & UNF threads) – Normal series*

BS 2035, *Specification for cast iron flanged pipes and flanged fittings*

BS 2789, *Specification for spheroidal graphite or nodular graphite cast iron*

BS 2856, *Precise conversion of inch and metric sizes on engineering drawings*

BS 3603, *Specification for carbon and alloy steel pipes and tubes with specified low temperature properties for pressure purposes*

BS 3604 (all parts), *Steel pipes and tubes for pressure purposes: ferritic alloy steel with specified elevated temperature properties*

BS 4622, *Specification for grey iron pipes and fittings*

BS EN 1561, *Founding – Grey cast irons*

BS EN 1591-1, *Flanges and their joints – Design rules for gasketed circular flange connections – Part 1: Calculation method*

BS EN 10216 (all parts), *Seamless steel tubes for pressure purposes – Technical delivery conditions*

BS EN 10217 (all parts), *Welded steel tubes for pressure purposes – Technical delivery conditions*

BS EN 10293, *Steel castings for general engineering uses*

BS EN 12449, *Copper and copper alloys – Seamless, round tubes for general purposes*







# British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

## About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards-based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

## Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at [bsigroup.com/standards](http://bsigroup.com/standards) or contacting our Customer Services team or Knowledge Centre.

## Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at [bsigroup.com/shop](http://bsigroup.com/shop), where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

## Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to [bsigroup.com/subscriptions](http://bsigroup.com/subscriptions).

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

**PLUS** is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit [bsigroup.com/shop](http://bsigroup.com/shop).

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email [bsmusales@bsigroup.com](mailto:bsmusales@bsigroup.com).

## BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

## Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

## Copyright

All the data, software and documentation set out in all British Standards and other BSI publications are the property of and copyrighted by BSI, or some person or entity that owns copyright in the information used (such as the international standardization bodies) and has formally licensed such information to BSI for commercial publication and use. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI. Details and advice can be obtained from the Copyright & Licensing Department.

## Useful Contacts:

### Customer Services

**Tel:** +44 845 086 9001

**Email (orders):** [orders@bsigroup.com](mailto:orders@bsigroup.com)

**Email (enquiries):** [cservices@bsigroup.com](mailto:cservices@bsigroup.com)

### Subscriptions

**Tel:** +44 845 086 9001

**Email:** [subscriptions@bsigroup.com](mailto:subscriptions@bsigroup.com)

### Knowledge Centre

**Tel:** +44 20 8996 7004

**Email:** [knowledgecentre@bsigroup.com](mailto:knowledgecentre@bsigroup.com)

### Copyright & Licensing

**Tel:** +44 20 8996 7070

**Email:** [copyright@bsigroup.com](mailto:copyright@bsigroup.com)