

Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, Class designated —

Part 3: Copper alloy flanges

The European Standard EN 1759-3:2003 has the status of a British Standard

ICS 23.040.60

National foreword

This British Standard is the official English language version of EN 1759-3:2003, including Corrigendum July 2004. It supersedes BS 1560-3.3:1989 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PSE/15, Flanges, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 28, an inside back cover and a back cover.

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English version

Flanges and their joints - Circular flanges for pipes, valves,
fittings and accessories, Class designated - Part 3: Copper alloy
flanges

Brides et leurs assemblages - Brides circulaires pour tubes,
appareils de robinetterie, raccords et accessoires,
désignées Class - Partie 3: Brides en alliages de cuivre

Flansche und ihre Verbindungen - Runde Flansche für
Rohre, Armaturen, Formstücke und Zubehörteile, nach
Class bezeichnet - Teil 3: Flansche aus Kupferlegierungen

This European Standard was approved by CEN on 27 June 2003.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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Contents

Page

Foreword.....	3
Introduction	3
1 Scope	4
2 Normative references	6
3 Terms and definitions.....	6
4 Designation	7
4.1 General.....	7
4.2 Standard designation	7
4.3 Information to be supplied by the equipment manufacturer.....	7
5 General requirements.....	8
5.1 Materials	8
5.2 Repairs.....	8
5.3 Bolting	8
5.4 Gaskets	8
5.5 Pressure/temperature (p/T) ratings.....	8
5.6 Dimensions	9
5.7 Flange facings.....	9
5.8 Spot facing or back facing	10
5.9 Tolerances	10
5.10 Marking	10
Annex A (informative) Information to be supplied by the equipment manufacturer.....	21
Annex B (informative) Application and installation	22
Annex C (informative) Use of metric bolting in lieu of imperial bolting	23
C.1 General.....	23
C.2 Gaskets	23
C.3 Comparable nominal bolt sizes.....	23
C.4 Imperial/metric bolt comparisons	23
Annex D (informative) Approximate masses of flanges and collars.....	24
Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 97/23/EC	27
Bibliography	28

Foreword

Due to the incorrect hatching, all figures were replaced.

This document (EN 1759-3:2003) has been prepared by Technical Committee CEN /TC 74, "Flanges and their joints" the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2004, and conflicting national standards shall be withdrawn at the latest by March 2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of the Pressure Equipment Directive (PED)¹. For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this standard.

EN 1759 consists of the following parts:

- *Part 1: Steel flanges (draft stage);*
- *Part 3: Copper alloy flanges (draft stage);*
- *Part 4: Aluminium alloy flanges (draft stage).*

The annexes A, B, C, D and ZA are informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This standard is related, but not identical, to ISO 7005-3 in respect of flanges having designations Class 150 and Class 300. Outside diameters and mating dimensions are in accordance with ANSI B16.24.

Information on the use of metric bolting in lieu of imperial bolting which can be used with these flanges is given in an informative annex.

The mating dimensions of the flanges of this standard are compatible with Class designated flanges of other materials in accordance with the other parts of EN 1759.

¹) Directive 97/23 EC of the European Parliament and of the Council of 29 May 1997 on the approximation of the Laws of the Member States concerning pressure equipment; OIEC L 181.

1 Scope

This European Standard specifies requirements for circular copper alloy flanges and copper alloy collars combined with loose steel plate flanges in Class designations Class 150 and Class 300 and nominal sizes from DN 10 to DN 900 (NPS ½ to NPS 36) in the types shown in Table 1.

This standard also specifies dimensions and tolerances, materials and their associated pressure/temperature (p/T) ratings, flange facings and related surface finish, weld repairs and marking together with information on bolting, gaskets, application and installation and approximate flange masses.

The flanges specified, with the exception of integral (type 21) flanges, are for attachment to copper or copper alloy tubes in accordance with EN 12449.

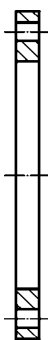
NOTE 1 The size of copper and copper alloy tubes is designated by reference to the outside diameter in millimetres.

NOTE 2 See also annex B.

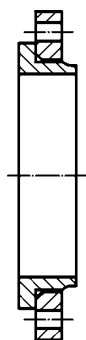
NOTE 3 Non-gasketed pipe joints are outside the scope of this standard.

Table 1 — Types of flanges and collars

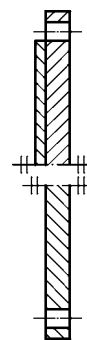
Type No.	Description
01	Plate flange in copper alloy for brazing or welding
04	Loose plate flange in steel with a weld-neck collar (type 34) in copper alloy, for welding
05	Blank flange in copper alloy
05C	Blank flange in steel clad with a copper alloy jointing face
07	Loose plate flange in steel with a slip-on collar (type 37) in copper alloy, for soft soldering, brazing or welding
11	Weld-neck flange in copper alloy for welding
12	Hubbed slip-on flange in copper alloy, for soft soldering, brazing or welding
14	Hubbed slip-on flange in copper alloy supplied with tube stops, for soft soldering, brazing or welding
21	Integral flange in copper alloy as part of some other equipment or component
34	Weld-neck collar in copper alloy
37	Slip-on collar in copper alloy



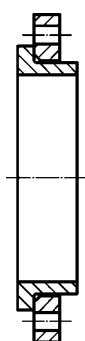
Type 01
Plate flange in copper alloy
for brazing or welding



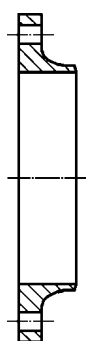
Type 04, 34
Loose plate flange in steel with a
weld-neck collar (type 34) in copper
alloy, for welding



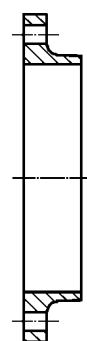
Type 05, 05C
05 Blank flange in copper alloy
05C Blank flange in steel clad with a
copper alloy jointing face



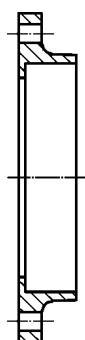
Type 07, 37
Loose plate flange in steel with a
slip-on collar (type 37) in copper
alloy, for soft soldering, brazing or
welding



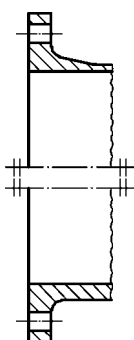
Type 11
Weld-neck flange in copper alloy for
welding



Type 12
Hubbed slip-on flange in copper
alloy, for soft soldering, brazing or
welding



Type 14
Hubbed slip-on flange in copper
alloy supplied with tube stops, for
soft soldering, brazing or welding



Type 21
Integral flange in copper alloy as
part of some other equipment or
component



Steel component



Copper alloy component

Figure 1 — Types of flanges and collars

2 Normative references

This European Standard incorporates by dated or undated references, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 1652, *Copper and copper alloys — Plate, sheet, strip and circles for general purposes.*

EN 1982, *Copper and copper alloys — Ingots and castings.*

EN 10028-2, *Flat products made of steels for pressure purposes — Part 2: Non-alloy and alloy steels with specified elevated temperature properties.*

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

EN 12420, *Copper and copper alloys — Forgings.*

EN 12449, *Copper and copper alloys — Seamless round tubes for general purposes.*

EN ISO 887, *Plain washers for metric bolts, screws and nuts for general purposes — General plan (ISO 887:2000).*

EN ISO 4287, *Geometrical Product Specification (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters (ISO 4287:1997).*

EN ISO 6708:1995, *Pipework components — Definition and selection of DN (nominal size) (ISO 6708:1995).*

3 Terms and definitions

For the purposes of this standard the following terms and definitions apply.

3.1

Class

alphanumeric designation used for reference purposes related to a combination of mechanical and dimensional characteristics of a component of a pipework system. It comprises the word Class followed by a dimensionless whole number

NOTE 1 The number following the word Class does not represent a measurable value and should not be used for calculation purposes except where specified in the relevant standard.

NOTE 2 The designation Class is not meaningful unless it is related to the relevant component standard number.

NOTE 3 It is intended that all components with the same Class and NPS (see below) designations have the same mating dimensions for compatible flange types.

3.2

DN

see EN ISO 6708:1995

3.3

NPS

alphanumeric designation of size for components of a pipework system, which is used for reference purposes. It comprises, for the purpose of Class designated flanges according to this standard, the letters NPS followed by a dimensionless number which is indirectly related to the physical size of the bore or outside diameter of the end connections

NOTE The number following the letters NPS does not represent a measurable value and should not be used for calculation purposes except where specified in the relevant standard. See EN ISO 6708.

4 Designation

4.1 General

The types of flanges and their reference numbers are given in Table 1 and the range of DN applicable to each flange type and to each Class shall be as given in Table 3.

NOTE 1 Flanges, which are identified and/or marked by NPS additionally or alternatively to DN, are deemed to comply with this standard.

NOTE 2 The relationship between DN and NPS is given for reference purposes in Tables 3, 4, 5 and 6.

4.2 Standard designation

Flanges and collars in accordance with this standard shall be designated by the following:

- a) Designation, e.g. flange or collar;
- b) Number of this standard, EN 1759-3;
- c) Number of flange type in accordance with Figure 1;
- d) Class designation, Class (the word Class may be omitted);
- e) Nominal size, DN (and/or NPS);
- f) Material number or symbol (see Tables 7 and 8) (for type 05C flanges it is necessary to specify both the material of the flange and the material of the cladding).

EXAMPLE 1 Designation of a plate flange type 01 in Class 150 and DN 600 (NPS 24) and in material symbol CuAl8Fe3:

Flange EN 1759-3/01/Class 150/DN 600/CW303G

or

Flange EN 1759-3/01/150/NPS 24/CW303G

EXAMPLE 2 Designation of a loose flange type 07 in Class 150 and DN 50 (NPS 2) and in material symbol S235JR:

Flange EN 1759-3/07/Class 150/DN 50/S235JR

or

Flange EN 1759-3/07/150/NPS 6/S235JR

EXAMPLE 3 Designation of a slip-on collar type 37 in Class 150 and DN 50 (NPS 2) and in material symbol CuZn20Al2As:

Collar EN 1759-3/37/Class 150/DN 50/CW702R

or

Collar EN 1759-3/37/150/NPS 2/CW702R

EXAMPLE 4 Designation of a blank flange type 05C with clad jointing face, in Class 300 and DN 150 (NPS 6) and in materials symbols, S235JR (for blank flange) and CuNi30Mn1Fe (for cladding):

Flange EN 1759-3/05C/Class 300/DN 150/S235JR-CW354H

or

Flange EN 1759-3/05C/300/NPS 6/S235JR-CW354H

4.3 Information to be supplied by the equipment manufacturer

For information to be supplied by the equipment manufacturer see annex A.

5 General requirements

5.1 Materials

Flanges and collars shall be manufactured from the materials specified in Tables 7 and 8 except for type 21 flanges where the flange manufacturer may use other materials by agreement with the equipment manufacturer.

The flange manufacturer shall provide means of identifying the material of the flange. An equipment manufacturer may require a certificate in accordance with EN 10204 which is suitable for the category of the equipment to which the flange is fitted.

NOTE If a protective coating such as zinc coating or painting is required on steel components, the equipment manufacturer should state this on the enquiry and/or order.

5.2 Repairs

5.2.1 Repairs by welding are permitted when there is a proven method and where not otherwise prohibited by the applicable material standard. All welding shall be carried out in accordance with a written procedure.

NOTE For approval of welding procedures, see EN 288-1. For approval of welders, see EN 287-1.

5.2.2 Any filler rod used for weld repairs shall be such as to produce a weld having characteristics at least equal to the parent metal. Flanges shall be heat treated after repair welding when the material standard requires such treatment.

5.3 Bolting

Flanges shall be suitable for use with the nominal size and number of bolts specified in Tables 4 and 5 as appropriate.

The bolting material shall be chosen by the equipment manufacturer according to the pressure, temperature, flange material and the selected gasket so that the flanged joint remains tight under the expected operating conditions.

NOTE 1 For information on bolting, see EN 1515-1 and EN 1515-2 and annexes B and C.

NOTE 2 For flange types 01, 05, 11, 12, 14 and 21, where copper alloy bolting is used, the recommended bolting materials are EN 12420 Alloy Nos. CW306G or CW307G for temperatures up to and including 120°C.

For flange types 04, 05C and 07, steel bolting should be used and reference should be made to EN 1515-1, EN 1515-2 and annex C.

5.4 Gaskets

The various gasket types, dimensions, design characteristics and material used are not within the scope of this standard. Dimensions of gaskets are given in the relevant parts of prEN 12560.

5.5 Pressure/temperature (p/T) ratings

5.5.1 General

The p/T ratings of the flanges manufactured from the materials specified in Tables 7 and 8 are given in Tables 9, 10 and 11.

The p/T ratings indicate the relationship between the maximum allowable pressure, PS and the maximum allowable temperature, TS.

Linear interpolation is permitted for intermediate temperatures.

NOTE 1 See EN 764 for terminology.

NOTE 2 When type 21 flanges are supplied as part of another component (for example, a valve or pump) in a material other than those listed in Table 7, reference should be made to the relevant product or application standard for the appropriate p/T ratings.

NOTE 3 The p/T rating of a flange is not necessarily the p/T rating of the whole pipework system. Gasket materials can also impose a limitation of the p/T rating of a flanged joint and the gasket manufacturer should be consulted when selecting the material of the gasket.

5.5.2 p/T ratings of flanged joints

When two flanges in a flanged joint do not have the same p/T rating at any temperature, then the lower of the two flange p/T ratings at that temperature shall apply.

NOTE 1 For any p/T rating, the temperature shown is considered to be the same as that of the contained fluid. Use at a pressure corresponding to a temperature other than that of the contained fluid is the responsibility of the user.

NOTE 2 Application of the p/T ratings given in this standard to flange joints should take into consideration the risks of leakage due to forces and moments developed in the connecting pipework, see annex B.

NOTE 3 These notes on service considerations are not intended to be exhaustive.

5.6 Dimensions

5.6.1 Flanges

Dimensions of flanges shall be in accordance with the following tables and figures as appropriate:

- Class 150 flanges: Table 4 and Figure 2;
- Class 300 flanges: Table 5 and Figure 3.

NOTE 1 The bore sizes of type 21 flanges are usually equal to the nominal size of the pipe, valve or fitting of which they form a part and the actual bore sizes are usually given in the appropriate standard(s) for the pipe, valve or fitting.

NOTE 2 When type 07, 12 and 14 flanges are for use with soft soldering techniques only, then reference should be made to EN 1254-1 for socket depths.

NOTE 3 For type 34 collars and type 11 flanges the recommended weld preparation angle is $37,5 \pm 2,5^\circ$ when butt welding to pipe with thickness of 3 mm and greater.

5.6.2 Bolt holes

Bolt holes shall be equally spaced on the pitch circle diameter. In the case of type 21 flanges, the bolt holes shall be positioned such that they are symmetrical to the principle axes and such that no holes fall on these axes, i.e. positioned "off-centre", see Figures 2 and 3.

5.7 Flange facings

5.7.1 Types of facings

Types 01, 05, 11, 12, 14 and 21 flanges in copper alloy shall be provided with flat face.

NOTE 1 Flanges with flat face facings are suitable for bolting to flat face mating flanges using a full face gasket.

Types 04, 05C and 07 flanges have a raised face formed by the face of the collar or the cladding, for bolting to raised face mating flanges using an inside bolt circle gasket.

NOTE 2 The bolting of these flanges to a flat face iron or steel mating flange using full face or inside bolt circle gaskets is not precluded.

5.7.2 Jointing face finish

All flange jointing faces shall be machine finished and when compared by visual or tactile means with reference specimens, shall be in accordance with Table 2.

NOTE 1 It is not intended that instrument measurements are taken on the flange faces, and the R_a and R_z values as defined in EN ISO 4287 relate to the reference specimens.

NOTE 2 Other finishes may be agreed between the flange manufacturer and equipment manufacturer.

Table 2 — Surface finish of jointing faces

Method of machining	R_a^a μm		R_z^a μm	
	min.	max.	min.	max.
Turning ^b	3,2	12,5	12,5	50
^a R_a and R_z are defined in EN ISO 4287 ^b Turning covers any method of machining operation producing either serrated concentric or serrated spiral grooves.				
Machining processes other than turning are permissible provided that they give a surface finish in accordance with the R_a and R_z values specified.				

5.7.3 Rims

Rims of flanges and collars may be machined or un-machined.

5.7.4 Collars and loose flanges

Collars and loose flanges shall be machine finished, or have a surface equivalent to that obtained by machining on all locating diameters, bores and abutment faces. The abutment faces shall be flat and square to the bore axis.

5.8 Spot facing or back facing

Any spot facing or back facing required shall not reduce the flange thickness to less than the minimum specified.

When spot facing is used, the diameter shall be large enough to accommodate the outside diameter of the equivalent normal series of washers complying with EN ISO 887 for the bolt size being fitted.

When a flange is back faced, it is permissible for the fillet radius to be reduced but it shall not be eliminated entirely. The bearing surfaces for the bolting shall be parallel to the flange jointing face within the limits given in Table 6.

5.9 Tolerances

Tolerances on dimensions shall be as specified in Table 6.

5.10 Marking

5.10.1 Other than type 21 flanges

All flanges and collars shall be marked as follows:

- Number of this standard, i.e. EN 1759-3;
- Flange type number, e.g. 05;

- c) Class designation, e.g. Class 150 or 150;
- d) DN and/or NPS, e.g. DN 100 and/or NPS 4;
- e) Material designation. The alloy designation number given in Tables 7 and 8 shall be used, as appropriate;
- f) Flange manufacturer's name or trademark.

EXAMPLE 1 Copper alloy flanges:

EN 1759-3 — 12 — 150 — DN 300 (and/or NPS 12) — CW352H — XYZ.

EXAMPLE 2 Copper alloy collars:

EN 1759-3 — 37 — 300 — DN 50 (and/or NPS 2) — CC491K — XYZ.

EXAMPLE 3 Steel components:

EN 1759-3 — 07 — 300 — DN 50 (and/or NPS 2) — A105 — XYZ.

5.10.2 Method of marking

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

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

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

5.10.3 Omission of markings

If a flange is too small to enable all the markings required in 5.10.1 to be marked on the flange, then some of the markings are permitted to be omitted. The order in which the markings are omitted shall be as follows:

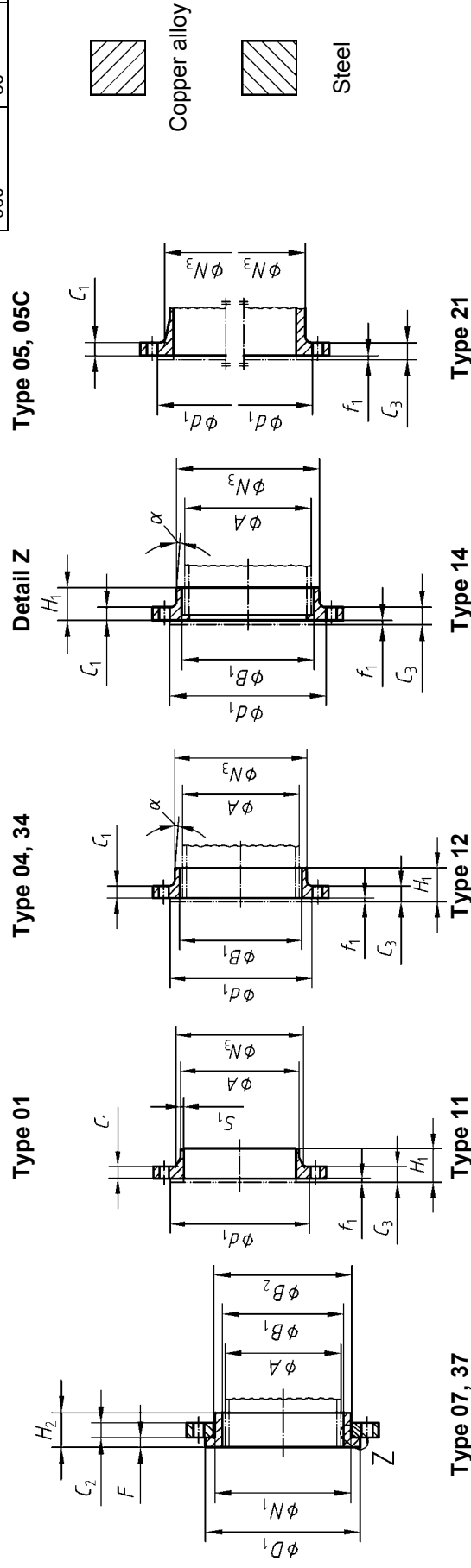
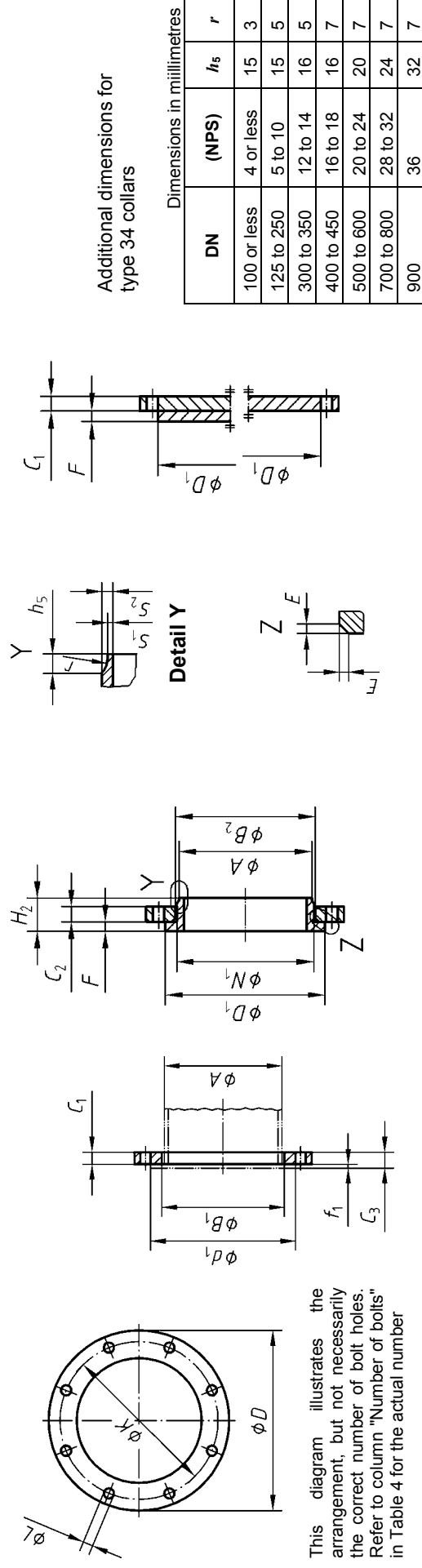
- a) Flange type number;
- b) DN (and/or NPS).

5.10.4 Declaration of compliance

The marking EN 1759-3, together with the flange manufacturer's name or trademark on or in relation to a product, represents a manufacturer's declaration of compliance, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of this standard.

Table 3 — Synoptic table for flange

Type number	Table number	Class	Nominal size																							
			(½)	(¾)	(1)	(1¼)	(1½)	(2)	(2½)	(3)	(4)	(5)	(6)	(8)	(10)	(12)	(14)	(16)	(18)	(20)	(24)	(28)	(32)	(36)		
			10	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500	600	700	800	900		
11	4	150	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
	4	150	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
04, 34	5	300	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
	4	150	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
05, 05C	5	300	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
	4	150	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
07, 37	5	300	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
	4	150	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
11	4	150	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
	5	300	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
12	4	150	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
	5	300	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
14	4	150	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
	5	300	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
21	4	150	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
	5	300	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
NOTE			The nominal sizes in which a flange of a particular type and Class may be ordered to this standard, are denoted by a dot.																							



NOTE 1 For type 12 and 14 flanges, all nominal sizes. $\alpha = 4^\circ$ max.

NOTE 2 Dimension N_3 is measured at the intersection of the projections of the hub draft angle and the back face of the flange.

Figure 2 — Dimensions of Class 150 flanges (see Table 4)

Table 4 — Dimensions of Class 150 flanges (see Figure 2)

Dimensions in millimetres except nominal size of bolts in inch

Nominal size	Mating dimensions				Flange thickness			Hub diameter		Neck diameter (min.)		Collar diameter		Length through hub of collar				Cladding thickness		Collar thickness		Collar or cladding diameter		Bore of flange or collar	Bore of flange	Chamfer				
	Tube outside diameter	Outside diameter of flange	Pitch circle diameter	Bolt hole diameter	Bolts		Nom. size	C ₂	C ₁	N ₃	N ₁	H ₁	H ₂	H ₂	H ₁	H ₂	H ₁	F	S ₁ min.	S ₂ min.	D ₁	B ₁	B ₂							
					Number	Number																								
																											D	K	L	
DN	(NPS)	Flange types																							E					
All types																														
10 ^a	(½)	16.0	89	60.3	15.9	4	½	11.1	8	8	8	21	30	18.0	21	35	16	48	5.0	5	5	1.0	2.0	40	16.07	19	23	2		
20	(¾)	25.0	98	69.8	15.9	4	½	12.7	8	8	9	31	38	27.0	31	24	16	52	5.0	5	5	1.0	2.5	53	25.08	28	33	2		
25	(1)	30.0	108	79.4	15.9	4	½	14.3	9	9	10	36	49	32.0	36	24	18	56	5.0	5	5	1.5	2.5	60	30.08	33	38	3		
32	(1¼)	38.0	117	88.9	15.9	4	½	15.4	10	10	10	45	59	40.0	45	26	40	18	57	5.0	5	5	1.5	2.5	70	38.08	41	47	3	
40	(1½)	44.5	127	98.4	15.9	4	½	17.5	11	11	11	51	65	46.5	51	26	45	19	62	5.0	5	5	1.5	2.5	80	44.60	48	53	3	
50	(2)	57.0	152	120.6	19.0	4	¾	19.0	13	13	13	67	78	59.0	67	28	45	19	64	6.0	6	5	1.5	2.5	99	57.23	62	69	3	
65	(2½)	76.1	178	139.7	19.0	4	¾	23.8	20	20	14	85	90	78.0	87	32	45	19	70	6.0	6	5	2.0	3.0	120	76.33	81	89	3	
80	(3)	88.9	190	152.4	19.0	4	¾	24.0	—	20	20	16	103	108	91.0	—	34	50	—	70	7.0	—	5	2.5	3.5	130	89.18	94	—	3
100	(4)	108.0	229	190.5	19.0	8	¾	24.0	—	20	20	17	134	135	110.0	—	40	50	—	76	7.0	—	5	2.5	3.5	158	108.38	113	—	3
125	(5)	133.0	254	215.9	22.2	8	¾	24.4	—	22	22	19	159	164	135.5	—	44	50	—	89	7.0	—	5	2.5	3.5	188	133.63	138	—	4
150	(6)	159.0	279	241.3	22.2	8	¾	25.5	—	22	22	21	183	192	161.5	—	44	50	—	89	9.0	—	5	2.5	3.5	212	159.63	164	—	4
200	(8)	219.1	343	298.4	22.2	8	¾	29.0	—	26	26	24	238	246	222.0	—	46	50	—	102	9.0	—	5	3.5	5.0	268	220.03	225	—	5
250	(10)	267.0	406	362.0	25.4	12	7⁄8	30.5	—	—	28	25	287	305	269.0	—	48	50	—	102	9.0	—	5	4.0	5.5	320	268.13	278	—	5
250	(10)	273.0	406	362.0	25.4	12	7⁄8	30.5	—	—	28	25	287	305	275.0	—	48	50	—	102	9.0	—	5	4.0	5.5	320	274.13	278	—	7
300	(12)	323.9	483	431.8	25.4	12	7⁄8	32.0	—	—	40	27	344	365	327.0	—	66	50	—	114	11.0	—	5	5.0	6.5	370	325.03	330	—	7
350	(14)	368.0	533	476.2	28.6	12	1	35.0	—	—	41	—	395	—	371.0	—	67	50	—	127	11.0	—	5	5.5	7.0	430	369.13	374	—	7
400	(16)	419.0	597	539.8	28.6	16	1	37.0	—	—	45	—	446	—	422.0	—	73	50	—	127	12.0	—	5	6.0	7.5	482	420.13	426	—	7
450	(18)	457.2	635	577.8	31.8	16	1½	40.0	—	—	48	—	508	—	460.0	—	77	50	—	140	12.0	—	5	7.0	8.5	530	458.33	465	—	7
500	(20)	508.0	698	635.0	31.8	20	1½	45.0	—	—	49	—	559	—	511.0	—	80	50	—	144	12.0	—	5	7.5	9.0	585	509.13	517	—	7
600	(24)	610.0	813	749.3	34.9	20	1¾	48.0	—	—	50	—	665	—	613.0	—	86	60	—	152	14.0	—	5	9.0	10.5	685	611.13	618	—	9
700	(28)	711.0	927	863.6	34.9	28	1¾	72.0	—	—	52	—	775	—	719.0	—	94	60	—	152	19.0	—	5	10.5	14.5	800	712.13	727	—	9
800	(32)	813.0	1060	977.9	41.3	28	1½	81.0	—	—	56	—	879	—	821.0	—	98	60	—	154	20.5	—	5	12.0	16.0	905	814.13	829	—	9
900	(36)	914.0	1168	1086.0	41.3	32	1½	90.5	—	—	60	—	988	—	921.0	—	105	60	—	157	22.0	—	5	13.5	17.5	1000	915.13	921	—	9

a For the copper and copper alloy tube industry the normal designation for NPS 1/2 is DN 10 but for ferrous tubes the normal designation is DN 15.

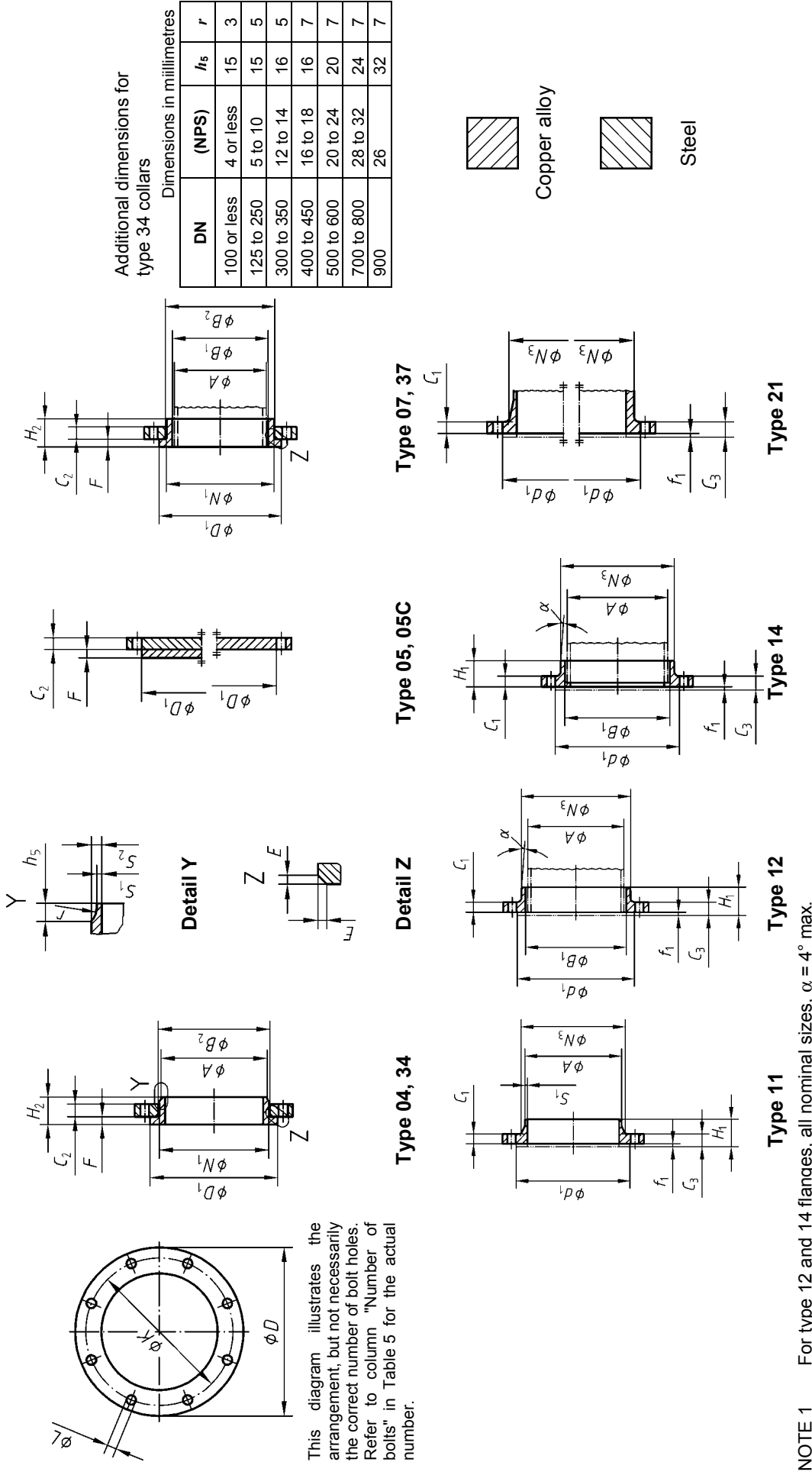


Figure 3 — Dimensions of Class 300 flanges (see Table 5)

Dimensions in millimetres except nominal size of bolts in inch

^a For the copper and copper alloy tube industry the normal designation for NPS 1/2 is DN 10 but for ferrous tubes the normal designation is DN 15.

Table 6 — Tolerances

Dimensions and tolerances in millimetres

Symbol	Feature	Flange type		Nominal size – DN (NPS)																
				(2)	(2½)	(3)	(4)	(5)	(6)	(8)	(10)	(12)	(14)	(16)	(18)	(20)	(24)	(28)	(32)	(36)
				50	65	80	100	125	150	200	250	300	350	400	450	500	600	700	800	900
				Tolerances																
B ₁	Bore diameter	01	+ 0,05 0	+ 0,01 0																
		07																		
		12 ^a 14 ^a		+ 0,01 0				+ 0,25 0				+ 3 0								
B ₂	Bore diameter	04	+ 1 0		+ 1,5 0				+ 2 0				+ 4 0							
		07	+ 1 0																	
H ₁	Length through hub of flange	11; 12; 14	+ 1,5 0				+ 2,5 0										+ 3,5 0			
H ₂		04	± 1,5	± 2																
		07	+ 1,5 0																	
N ₁	Hub, neck or collar diameter	34	± 0,5	± 1				± 1,5		± 2										
37		± 2						± 3				± 4								
N ₃		11; 12; 14		± 2				± 3				± 4								
		21		+ 1,5 0	+ 2,5 0				+ 3,5 0				+ 5 0				+ 10 0			
D	Outside diameter of flange	All types	machined	± 1				± 1,5		± 2		± 2								
			un-machined	± 2				± 2		± 3		± 5								
C ₁ , C ₂	Flange thickness	C ₁ : 01; 11; 12; 14; 21 C ₂ : 04; 05; 07	C ₁ , C ₂ [25				25 < C ₁ , C ₂ [50				50 < C ₁ , C ₂ [75				C ₁ , C ₂ > 75					
			+ 3,5 0				+ 5 0				+ 7,5 0				+ 10 0					
D ₁	Collar or cladding diameter	34; 37	± 1		± 2															
		05C	+ 1 0	+ 2 0				+ 3 0												
F	Facing height	34	+ 0,50				± 1						± 1,5							
		05C	± 0,3						± 0,6											
		37	+ 1 0	+ 2 0				+ 3 0												
K	Pitch circle diameter ^c	All types	Bolt diameter				14 to 24				25 to 39									
			Tolerance				± 0,9				± 1,4									
	Centre to centre ^c	All types	Tolerance				± 0,45				± 0,7									
			DN (NPS)				[100 (4)				> 100 (4)									
L	Bolt hole diameter	All types	Hole diameter				[20				μ 22									
			Tolerance				+ 0,8 0				+ 1,3 0									

NOTE Miscellaneous radii and chamfers should be regarded as maximum unless otherwise specified.

^a The wider tolerances for DN 250 to DN 500 types 12 and 14 flanges are intended for attachment by fusion welding.^b Concentricity given is between K and any machined diameter. This tolerance does not apply if a suitable machined diameter does not exist.^c Tolerances on the pitch circle diameter and centre-to-centre of adjacent bolt holes are based on the difference between the bolt and the bolt hole diameter and thus in conjunction cannot exceed the clearance together with any tolerances on the diameter of the bolt hole.

Table 7 — Copper alloy materials

Copper alloy material				Flange or collar types ^c					
Product form	Standard	Alloy designation		12, 14, 37	01, 12, 14, 37	01, 11, 12, 14, 34, 37	05	05C	21
		Symbol	Number	Method of attachment					
				Soft solder (slip-on) ^a	Silver brazing (slip-on) ^a	Fusion welding (slip-on or weld neck)			
Casting	EN 1982	CuSn5Pb5Zn5-C	CC491K	•	•	—	•	—	•
		CuSn7Pb3Zn2-C	CC492K	•	•	—	•	—	•
		CuSn6Zn4Pb2-C	CC498K	•	•	—	•	—	•
		CuA110Fe2-C	CC331G	—	—	•	—	—	•
		CuA110Ni5Fe5-C	CC333G	—	—	•	—	—	•
Forging or plate	EN 12420 EN 1652	CuZn20A12Ass	CW702R	—	•	•	•	•	—
		CuA18Fe3	CW303G	—	—	•	•	•	—
		CuA110Fe3Mn2	CW306G	—	—	•	•	•	—
		CuA110Ni5Fe4	CW307G	—	—	•	•	•	—
		CuNi10Fe1Mn	CW352H	—	•	• ^b	•	•	—
		CuNi30Mn1Fe	CW354H	—	•	•	•	•	—

^a Applicable to attachment to copper tubes to EN 12449 and appropriate to sizes DN 50 and smaller.

^b For certain seawater applications it is common practice to use the alloy CuNi10Fe1,6Mn for type 34 collars.

^c The symbol "•" indicates the common material/flange type combinations.

Table 8 — Steel grades

Steel grade			Flange types ^b
Product form	Standard	Designation	04, 07, 05C
Plate	EN 10028-2	P265GH	•
	EN 10028-2	P295GH	•
Forging	EN 10222-2	P245GH ^a	•

^a For the purposes of this standard, steel in accordance with ASTM A105 has material properties not inferior to P245GH and is therefore fully suitable for flange applications.

^b The symbol "•" indicates the common material/flange combinations.

Table 9 — Pressure/temperature ratings for general application^{a, b, e}

Class	Maximum allowable temperature, TS in °C								
	– 10 to 66	100	120	150	180	200 ^c	220	250	260 ^d
	Maximum allowable pressure, PS in bar ^f								
150	15,5	14,6	13,9	13,3	12,4	11,8	11,3	10,7	10,3
300	34,5	32,3	31,1	29,3	27,4	26,2	24,9	23,1	22,4

^a Ratings have been adopted from ISO 7005-3:1988 Table 10.

^b Ratings are for flanges/collars manufactured in the materials given in Tables 7 and 8, except for alloy numbers CC333G and CW354H (see Table 10), and in all sizes except those sizes covered by Table 11.

^c Flanges/collars in alloy number CW702R are limited to a maximum allowable temperature of 200°C.

^d Flanges/collars in alloy number CW307G may be used at temperatures up to and including 350°C at the maximum allowable pressure specified for 260°C.

^e Flanges/collars in types 12, 14 and 37 and in sizes DN 50 (NPS 2) and smaller in both Class 150 and Class 300, when used in conjunction with copper tubes to EN 12449 and attached by soft solder, shall be limited to the following maximum allowable temperatures and/or pressures:

6 bar at 110°C;
10 bar at 66°C;
16 bar at 30°C.

^f 1 bar = 100 kPa.

Table 10 — Pressure/temperature ratings for alloy numbers CC333G and CW354H^{a, b}

Class	Maximum allowable temperature, TS in °C												
	– 10 to 66	100	120	150	180	200 ^c	220	250	260	280	300	320	350
	Maximum allowable pressure, PS in bar ^d												
150	15,5	15,0	14,5	14,0	13,7	13,5	13,0	12,7	12,5	12,0	11,5	11,0	10,3
300	34,5	33,0	32,5	30,5	29,0	28,5	27,5	26,5	26,0	25,0	24,5	23,5	22,4

^a Ratings have been adopted from ISO 7005-3:1988 Table 10a.

^b Ratings are for flanges/collars manufactured in alloy numbers CC333G and CW354H in all sizes, except those sizes covered by Table 11.

^c Flanges/collars in types 12, 14 and 37 in both Class 150 and Class 300 when attached by silver brazing, shall be limited to a maximum allowable temperature of 200°C.

^d 1 bar = 100 kPa.

Table 11 — Pressure/temperature ratings for large size flanges^{a, b}

Class	Maximum allowable temperature, TS in °C	
	– 10 to 100	120
	Maximum allowable pressure, PS in bar ^c	
150	14	13,9
300	20	19,8
^a Ratings have been adopted from ISO 7005-3:1988 Table 10b. ^b Ratings are for flanges/collars manufactured in the materials given in Tables 7 and 8 and in sizes: DN 350 (NPS14) and larger for Class 150 ; DN 250 (NPS10) and larger for Class 300. ^c 1 bar = 100 kPa.		

Annex A

(informative)

Information to be supplied by the equipment manufacturer

In addition to the standard designation specified in 4.2, the following additional information should be supplied by the equipment manufacturer in the enquiry and/or order, where appropriate:

- a) whether loose plate flange in steel (types 04 or 07) and blank flanges in steel (type 05C) are required to have any protective coating (e.g. zinc coating, painting), subject to agreement between the equipment manufacturer and flange manufacturer (see 5.1);
- b) whether types 07, 12 and 14 flanges are for use with soft soldering techniques (see 5.6.1);
- c) whether flanges are to be supplied un-drilled, or drilled to non-standard requirements (see 5.6.2);
- d) whether surface finish is required different from that specified in 5.7.2;
- e) whether flange rims are to be machined or un-machined (see 5.7.3).

Annex B (informative)

Application and installation

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

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

B.3 Flanges may be required to be pressure tested after attachment of a pipe or other equipment or when forming an integral part of such equipment. The test pressure is then dependent on the requirements of the appropriate standard or code of practice in accordance with which the equipment has been fabricated or manufactured. Any test pressure should not exceed 1,5 times the allowable pressure at 20 °C, rounded up to the next whole bar increment.

Annex C (informative)

Use of metric bolting in lieu of imperial bolting

C.1 General

Whilst not recommended, if users prefer or require to use metric bolting in lieu of the imperial bolting given in Tables 4 and 5, C.3 gives the comparable metric bolt sizes that have been agreed in the preparation of ISO 7005. The guidance notes on gasket assembly given in C.2 should be carefully observed (see Tables C.1 and C.2).

C.2 Gaskets

WARNING: Users should note that the centring of an inside bolt circle gasket in an assembled flange joint will be affected when using metric bolting. In bolt sizes up to and including 1½, the metric comparable sizes tend to be larger in diameter, whilst above this size they tend to be smaller. It is essential therefore that great care be taken to ensure that gaskets are centred properly.

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

C.3 Comparable nominal bolt sizes

If metric bolting is to be used, the comparable imperial and metric nominal bolt sizes are as given in Table C.1.

Table C.1 — Nominal bolt sizes

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

C.4 Imperial/metric bolt comparisons

To enable users to ascertain precisely the differences in the two systems, Table C.2 is given for reference.

Table C.2 — Imperial/metric bolt comparisons

All dimensions in millimetres

Bolt diameter			Bolt hole diameter	Clearances
Imperial	Metric	Difference	Imperial	Metric bolt in an imperial hole
12,70	14,00	+ 1,30	15,88	1,88
15,88	16,00	+ 0,12	19,05	3,05
19,05	20,00	+ 0,95	22,23	2,23
22,23	24,00	+ 1,77	25,40	1,40
25,40	27,00	+ 1,60	28,58	1,58
28,58	30,00	+ 1,42	31,75	1,75
31,75	33,00	+ 1,25	34,93	1,93
38,10	39,00	+ 0,90	41,28	2,28

Annex D (informative)

Approximate masses of flanges and collars

Tables D.1 and D.2 give calculated masses of flanges and collars which may be used for guidance only.

These calculated masses are based on nominal dimensions given in Tables 4 and 5 and on mass densities of $8,90 \text{ g/cm}^3$ for copper alloy materials and $7,80 \text{ g/cm}^3$ for steel materials.

The equipment manufacturer should consult the flange manufacturer to obtain actual masses, which may vary from the calculated masses due to dimensional variations within the permitted tolerances given in Table 6.

Table D.1 — Masses of Class 150 flanges and collars

Nominal size		Mass (kg)																							
		Type																							
01		11		14		34		04		34/04		05C		05C		05		37		07		37/07			
				12		Copper		Steel		Total		Copper		Steel		Total				Copper		Steel		Total	
DN	NPS																								
10	½	0,37	0,41	0,39	0,05	0,45	0,50	0,06	0,47	0,53	0,54	0,06	0,43	0,49											
20	¾	0,45	0,51	0,48	0,09	0,61	0,70	0,10	0,67	0,77	0,76	0,10	0,58	0,69											
25	1	0,61	0,71	0,65	0,12	0,84	0,95	0,13	0,93	1,06	1,06	0,13	0,81	0,94											
32	1¼	0,78	0,93	0,85	0,15	1,04	1,19	0,17	1,20	1,37	1,36	0,17	0,99	1,16											
40	1½	1,00	1,14	1,04	0,19	1,37	1,57	0,22	1,62	1,84	1,85	0,19	1,32	1,51											
50	2	1,67	1,97	1,80	0,32	2,07	2,39	0,34	2,52	2,86	2,88	0,38	1,97	2,35											
65	2½	3,41	3,84	3,53	0,45	3,45	3,90	0,50	4,41	4,91	5,03	0,52	3,25	3,77											
80	3	3,73	4,45	3,99	0,58	3,80	4,37	0,59	5,10	5,69	5,81	—	—	—											
100	4	5,29	6,79	6,15	0,82	5,41	6,23	0,87	7,29	8,16	8,31	—	—	—											
125	5	6,57	8,74	7,71	1,07	6,21	7,27	1,24	9,05	10,29	10,33	—	—	—											
150	6	7,45	9,87	8,68	1,47	7,34	8,81	1,57	11,54	13,11	13,17	—	—	—											
200	8	11,87	15,35	13,02	1,96	11,21	13,16	2,51	20,20	22,71	23,05	—	—	—											
250 ^a	10 ^a	—	15,16	18,14	2,64	14,91	17,55	3,58	29,35	32,93	33,49	—	—	—											
250 ^b	10 ^b	—	14,06	17,05	2,45	14,91	17,36	3,58	29,35	32,93	33,49	—	—	—											
300	12	—	17,50	35,83	3,44	22,87	26,31	4,78	44,22	49,00	50,45	—	—	—											
350	14	—	12,12	43,15	5,05	28,82	33,87	6,46	58,81	65,27	67,10	—	—	—											
400	16	—	14,15	56,86	6,31	36,68	42,99	8,12	77,82	85,94	88,79	—	—	—											
450	18	—	29,01	69,11	8,05	41,86	49,91	9,82	94,84	104,66	108,22	—	—	—											
500	20	—	33,68	82,71	9,46	55,05	64,51	11,96	128,73	140,70	146,89	—	—	—											
600	24	—	—	109,26	13,74	74,89	88,63	16,40	187,20	203,60	213,60	—	—	—											
700	28	—	—	143,07	22,63	130,87	153,49	22,37	363,99	386,36	415,32	—	—	—											
800	32	—	—	194,17	28,98	193,14	222,12	28,63	534,16	562,79	609,50	—	—	—											
900	36	—	—	241,95	33,69	256,20	289,89	34,95	726,47	761,42	828,92	—	—	—											
^a For flanges to suit 267 mm O.D. tube.																									
^b For flanges to suit 273 mm O.D. tube.																									

Table D.2 — Masses of Class 300 flanges and collars

Nominal size		Mass (kg)													
		Type													
DN	NPS	11		14	34	04	34/04	05C	05C	05C	05		37	07	37/07
		12		Copper	Steel	Total	Copper	Steel	Total	Copper	Steel	Total	Copper	Steel	Total
10	½	0,53	0,50	0,06	0,68	0,74	0,06	0,71	0,77	0,81	0,06	0,81	0,06	0,66	0,73
20	¾	0,98	0,92	0,11	1,12	1,24	0,12	1,20	1,32	1,37	0,12	1,37	0,12	1,09	1,21
25	1	1,11	1,05	0,15	1,38	1,53	0,16	1,49	1,66	1,70	0,17	1,70	0,17	1,34	1,50
32	1¼	1,40	1,31	0,19	1,74	1,93	0,21	1,94	2,15	2,21	0,22	2,21	0,22	1,68	1,90
40	1½	1,99	1,88	0,28	2,58	2,86	0,27	2,88	3,15	3,28	0,28	3,28	0,28	2,52	2,80
50	2	2,27	2,04	0,36	2,82	3,19	0,36	3,35	3,72	3,83	0,44	3,83	0,44	2,70	3,14
65	2½	5,14	4,38	0,49	4,00	4,49	0,52	5,02	5,54	5,73	0,59	5,73	0,59	3,79	4,37
80	3	6,63	5,83	0,68	5,56	6,25	0,67	7,13	7,80	8,14	—	8,14	—	—	—
100	4	10,76	9,56	0,86	9,37	10,23	0,87	11,87	12,75	13,55	—	13,55	—	—	—
125	5	12,72	11,16	1,11	11,76	12,87	1,24	15,84	17,08	18,08	—	18,08	—	—	—
150	6	16,75	14,92	1,58	15,48	17,06	1,57	21,58	23,15	24,62	—	24,62	—	—	—
200	8	23,89	20,36	2,11	22,07	24,18	2,51	34,94	37,45	39,86	—	39,86	—	—	—
250 ^a	10 ^a	35,62	30,64	2,91	31,39	34,31	3,58	54,12	57,70	61,75	—	61,75	—	—	—
250 ^b	10 ^b	33,99	29,32	2,73	31,39	34,13	3,58	54,12	57,70	61,75	—	61,75	—	—	—
300	12	56,40	48,28	3,89	45,73	49,62	4,78	79,75	84,54	91,00	—	91,00	—	—	—
350	14	82,81	70,23	9,18	59,86	69,05	8,05	106,13	114,19	121,10	—	121,10	—	—	—
400	16	106,90	90,92	7,18	75,41	82,58	8,12	139,33	147,45	158,98	—	158,98	—	—	—
450	18	141,87	118,73	8,84	96,39	105,22	9,82	176,53	186,34	201,42	—	201,42	—	—	—
500	20	172,59	144,73	10,69	118,30	128,99	11,96	222,28	234,24	253,62	—	253,62	—	—	—
600	24	243,46	213,59	15,76	176,91	192,67	16,40	340,69	357,09	388,73	—	388,73	—	—	—

^a For flanges to suit 267 mm O.D. tube.

^b For flanges to suit 273 mm O.D. tube.

Annex ZA (informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 97/23/EC

This European standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association (EFTA) to provide a means of conforming to Essential Requirements of the New Approach Directive 97/23/EC (Pressure Equipment Directive, PED).

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in table ZA confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations

Table ZA — Correspondence between this European Standard and Directive 97/23/EC

Clause(s)/sub-clause(s) of this EN	Essential requirements (ERs) of Directive 97/23/EC	Qualifying remarks/Notes
5.1	Materials: Materials for pressure equipment to be suitable during lifetime.	4
	Materials for pressurised parts to have appropriate properties for all operating and test conditions: — to be sufficiently ductile and tough.	4.1 (a)
5.5	Design	2
	To be designed to ensure safety throughout intended life — to incorporate appropriate safety coefficients.	2.1
	To be designed for adequate strength.	2.2
	To be designed for loadings appropriate to its intended use.	2.2.1
	To be designed for appropriate strength based on a calculation method.	2.2.2
	Requirements to be met by applying one of the following methods — design by formula.	2.2.3 (a)
	Design calculations to establish the resistance of equipment, in particular: — account to be taken of combinations of temperature and pressure; — maximum stresses and peak stresses to be within safe limits.	2.2.3 (b)
5.1 5.10.1 (f)	Traceability Identification of the material making up the component.	3.1.5

WARNING: Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

EN 287-1, *Approval testing of welders — Fusion welding — Part 1: Steels*

EN 288-1, *Specification and qualification of welding procedures for metallic materials — Part 1: General rules for fusion welding*

EN 764, *Pressure equipment — Terminology and symbols — Pressure, temperature, volume*

EN 1254-1, *Copper and copper alloys — Plumbing fittings — Part 1: Fittings with ends for capillary soldering or capillary brazing to copper tubes*

EN 1515-1, *Flanges and their joints — Bolting — Part 1: Selection of bolting*

EN 1515-2, *Flanges and their joints — Bolting — Part 2: Classification of bolt materials for steel flanges, PN designated*

EN 10204, *Metallic products — Types of inspection documents*

EN 12560-1, *Flanges and their joints — Gaskets for Class-designated flanges — Part 1: Non-metallic flat gaskets with or without inserts*

EN 12560-2, *Flanges and their joints — Gaskets for Class-designated flanges — Part 2: Spiral wound gaskets for use with steel flanges*

EN 12560-3, *Flanges and their joints — Gaskets for Class-designated flanges — Part 3: Non-metallic PTFE envelope gaskets*

EN 12560-4, *Flanges and their joints — Gaskets for Class-designated flanges — Part 4: Corrugated, flat or grooved metallic and filled metallic gaskets for use with steel flanges*

EN 12560-5, *Flanges and their joints — Gaskets for Class-designated flanges — Part 5: Metallic ring joint gaskets for use with steel flanges*

prEN 12560-6, *Flanges and their joints — Gaskets for Class-designated flanges — Part 6: Covered serrated metal gaskets for use with steel flanges*

prEN 12560-7, *Flanges and their joints — Gaskets for Class-designated flanges — Part 7: Covered metal jacketed gaskets for use with steel flanges*

ISO 7005-3:1998, *Metallic flanges — Part 3: Copper alloy and composite flanges*

ANSI B16.24, *Bronze pipe flanges and flanged fittings*

ANSI/ASTM A105, *Forgings, carbon steel, for piping components*

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