

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

Part 1: Steel flanges

ICS 23.040.60

National foreword

This British Standard is the UK implementation of EN 1092-1:2007+A1:2013, incorporating corrigendum May 2014. It supersedes BS EN 1092-1:2007 which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by A1 A1.

The UK participation in its preparation was entrusted to Technical Committee PSE/15, Flanges.

In BS EN 1092-1:2007+A1:2013, the materials and material groups used in the manufacture of flanges are given in Table 9 and their corresponding Pressure/Temperature ratings are given in Annex G (normative). Additional materials that are widely in used in Europe are listed in Annex D (informative) but BS EN 1092-1:2007+A1:2013 contains no corresponding Pressure/Temperature information for these materials. National Annex NA (informative) contains guidance on Pressure/Temperature ratings for materials S235JR/1.0038 and ASME SA 105, which are predominantly used in the UK.

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

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.

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English Version

Flanges and their joints - Circular flanges for pipes, valves,
fittings and accessories, PN designated - Part 1: Steel flanges

Brides et leurs assemblages - Brides circulaires pour tubes,
appareils de robinetterie, raccords et accessoires,
désignées PN - Partie 1: Brides en acier

Flansche und ihre Verbindungen - Runde Flansche für
Rohre, Armaturen, Formstücke und Zubehörteile, nach PN
bezeichnet - Teil 1: Stahlflansche

This European Standard was approved by CEN on 23 June 2007 and includes Amendment 1 approved by CEN on 24 November 2012.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

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Foreword

This document (EN 1092-1:2007+A1:2013) 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 July 2013, and conflicting national standards shall be withdrawn at the latest by July 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes A1 EN 1092-1:2007 A1.

This document includes Amendment 1, approved by CEN on 2012-11-24.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1.

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 EU Directive 97/23/EC.

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

EN 1092 consists of the following four parts:

- *Part 1: Steel flanges;*
- *Part 2: Cast iron flanges;*
- *Part 3: Copper alloy flanges;*
- *Part 4: Aluminium alloy flanges.*

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

When the Technical Committee CEN/TC 74 commenced its work of producing this European Standard it took as its basis, the International Standard, ISO 7005-1, Steel flanges.

In taking this decision, CEN/TC 74, agreed that this standard would differ significantly from the ISO standard in respect of the following:

- a) whereas ISO 7005-1 included in its scope both the original DIN based flanges and also the original ANSI/ASME based flanges, EN 1092-1 contains only the PN based flanges. CEN/TC 74 has produced a separate series of standards, EN 1759-1, EN 1759-3 and EN 1759-4, dealing with the ANSI/ASME based flanges in their original Class designations;
- b) the opportunity was taken to revise some of the technical requirements applicable to the DIN origin flanges.

Consequently, whilst the mating dimensions, the flange and facing types and designations are compatible with those given in ISO 7005-1, it is important to take account of the following differences which exist in EN 1092-1:

- 1) the p/t ratings of this standard have been reduced in many cases by either limiting the lower temperature ratings which can no longer exceed the PN value, or by increasing the rate at which allowable pressures shall reduce with increase in temperature;
- 2) in addition to the range of PN 2,5 to PN 40 DIN origin flanges contained in the ISO standard, EN 1092-1 also includes flanges up to PN 400.

Major changes against edition 2001:

- i. flanges PN 160, PN 250, PN 320 and PN 400 have been introduced;
- ii. further methods of manufacture have been introduced;
- iii. welding conditions, inspection and testing have been introduced;
- iv. flange facing height f_1 changed back to former DN related dimensions;
- v. further collar types have been introduced;
- vi. materials have been updated;
- vii. new p/t-ratings are related to the flange material;
- viii. rings for tongue and groove flanges have been introduced;
- ix. the following flange types have been re-calculated according to the calculation method in EN 1591-1 with the basic rules as described in Annex E of this standard:
 - flanges type 11 for PN 2,5 to PN 400. Types 12 and 13 have been adjusted to the results for Type 11. As a result the thickness of some flanges above DN 500 had to be increased and the $\overline{A_1}$ wall thickness $\overline{A_1}$ had to be adjusted;
 - flanges type 05;
 - flanges type 01;
 - flanges type 02 with 32 resp. 33 up to DN 600 for PN 2,5 to PN 40;
 - flanges types 35, 36 and 37 for PN 10 to PN 40;
 - types 21 and 04 with 34 have not been re-calculated according to EN 1591-1.

1 Scope

This European Standard for a single series of flanges specifies requirements for circular steel flanges in PN designations PN 2,5 to PN 400 and nominal sizes from DN 10 to DN 4000.

This European Standard specifies the flange types and their facings, dimensions, tolerances, threading, bolt sizes, flange jointing face surface finish, marking, materials, pressure/ temperature ratings and approximate flange masses.

For the purpose of this European Standard, "flanges" include also lapped ends and collars.

This European Standard applies to flanges manufactured in accordance with the methods described in Table 1.

Non-gasketed pipe joints are outside the scope of this European Standard.

2 Normative references

[A1] The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. **[A1]**

[A1] EN 287-1:2011 **[A1]**, *Qualification test of welders — Fusion welding — Part 1: Steels*

[A1] *deleted text* **[A1]**

EN 571-1:1997, *Non destructive testing — Penetrant testing — Part 1: General principles*

EN 764-5:2002, *Pressure equipment — Part 5: Compliance and Inspection Documentation of Materials*

[A1] *deleted text* **[A1]**

EN 1333:2006, *Flanges and their joints — Pipework components — Definition and selection of PN*

EN 1418, *Welding personnel — Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials*

EN 1435:1997, *Non-destructive examination of welds — Radiographic examination of welded joints*

[A1] EN 1591-1:2001+A1:2009 **[A1]**, *Flanges and their joints — Design rules for gasketed circular flange connections — Part 1: Calculation method*

[A1] EN 1708-1:2010 **[A1]**, *Welding — Basic weld joint details in steel — Part 1: Pressurized components*

[A1] *deleted text* **[A1]**

EN 4014:2004, *Aerospace series — Inserts, thickwall, self-locking — Design standard*

[A1] EN 10028-2:2009 **[A1]**, *Flat products made of steels for pressure purposes — Part 2: Non-alloy and alloy steels with specified elevated temperature properties*

[A1] EN 10028-3:2009 **[A1]**, *Flat products made of steels for pressure purposes — Part 3: Weldable fine grain steels, normalized*

[A1] EN 10028-4:2009 **[A1]**, *Flat products made of steels for pressure purposes — Part 4: Nickel alloy steels with specified low temperature properties*

[A1] EN 10028-7:2007 **[A1]**, *Flat products made of steels for pressure purposes — Part 7: Stainless steels*

EN 10160:1999, *Ultrasonic testing of steel flat product of thickness equal or greater than 6 mm (reflection method)*

EN 10204:2004, *Metallic products — Types of inspection documents*

EN 10213-2:1995, *Technical delivery conditions for steel castings for pressure purposes — Part 2: Steel grades for use at room temperature and elevated temperatures*

EN 10213-3:1995, *Technical delivery conditions for steel castings for pressure purposes — Part 3: Steel grades for use at low temperatures*

EN 10213-4:1995, *Technical delivery conditions for steel castings for pressure purposes — Part 4: Austenitic and austenitic-ferritic steel grades*

EN 10216-2:2002+A2:2007 ^{A1}, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties*

EN 10216-3:2002, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 3: Alloy fine grain steel tubes*

EN 10216-4:2002, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 4: Non-alloy and alloy steel tubes with specified low temperature properties*

EN 10216-5:2004, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 5: Stainless steel tubes*

EN 10217-2:2002, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 2: Electric welded non-alloy and alloy steel tubes with specified elevated temperature properties*

EN 10217-3:2002, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 3: Alloy fine grain steel tubes*

EN 10217-7:2005, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 7: Stainless steel tubes*

EN 10220:2002, *Seamless and welded steel tubes — Dimensions and masses per unit length*

EN 10222-2:1999, *Steel forgings for pressure purposes — Part 2: Ferritic and martensitic steels with specified elevated temperature properties*

EN 10222-3:1998, *Steel forgings for pressure purposes — Part 3: Nickel steels with specified low temperature properties*

EN 10222-4:1998, *Steel forgings for pressure purposes — Part 4: Weldable fine grain steels with high proof strength*

EN 10222-5:1999, *Steel forgings for pressure purposes — Part 5: Martensitic, austenitic and austenitic-ferritic stainless steels*

EN 10226-3:2005, *Pipe threads where pressure tight joints are made on the threads — Part 3: Verification by means of limit gauges*

EN 10272:2007 ^{A1}, *Stainless steel bars for pressure purposes*

EN 10273:2007 ^{A1}, *Hot rolled weldable steel bars for pressure purposes with specified elevated temperature properties*

EN 12517-1:2006, *Non-destructive testing of welds — Part 1: Evaluation of welded joints in steel, nickel, titanium and their alloys by radiography — Acceptance levels*

EN 13445-3:2009, *Unfired pressure vessels — Part 3: Design* ^{A1}

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

EN ISO 1127:1996, *Stainless steel tubes — Dimensions, tolerances and conventional masses per unit length (ISO 1127:1992)*

Ⓐ₁ EN ISO 5817:2007, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections (ISO 5817:2003, corrected version:2005, including Technical Corrigendum 1:2006)* Ⓐ₁

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

EN ISO 9692-2:1998, *Welding and allied processes — Joint preparation — Part 2: Submerged arc welding of steels (ISO 9692-2:1998)*

Ⓐ₁ EN ISO 9712:2012, *Non-destructive testing — Qualification and certification of NDT personnel (ISO 9712:2012)* Ⓐ₁

Ⓐ₁ EN ISO 11666:2010, *Non-destructive testing of welds — Ultrasonic testing — Acceptance levels (ISO 11666:2010)* Ⓐ₁

EN ISO 15614-1:2004, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1:2004)*

EN ISO 15614-13:2005, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 13: Resistance butt and flash welding (ISO 15614-13:2005)*

Ⓐ₁ EN ISO 17637:2011, *Non-destructive testing of welds — Visual testing of fusion-welded joints (ISO 17637:2003)*

EN ISO 17638:2009, *Non-destructive testing of welds — Magnetic particle testing (ISO 17638:2003)*

EN ISO 17640:2010, *Non-destructive testing of welds — Ultrasonic testing — Techniques, testing levels, and assessment (ISO 17640:2010)*

EN ISO 23277:2009, *Non-destructive testing of welds — Penetrant testing of welds — Acceptance levels (ISO 23277:2006)*

EN ISO 23278:2009, *Non-destructive testing of welds — Magnetic particle testing of welds — Acceptance levels (ISO 23278:2006)* Ⓐ₁

ISO 7-1:1994, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 2768-1:1989, *General tolerances — Part 1: Tolerances for linear and angular dimensions without individual tolerance indications*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

DN

see EN ISO 6708

3.2

PN

see EN 1333

3.3

maximum allowable pressure, PS

maximum pressure for which the equipment is designed, as specified by the equipment manufacturer

3.4

maximum allowable temperature, TS

maximum temperature for which the equipment is designed, as specified by the equipment manufacturer

3.5

pressure equipment manufacturer

individual or organization that is responsible for the design, fabrication, testing, inspection, installation of pressure equipment and assemblies where relevant

[EN 764-3]

3.6

flange manufacturer

individual or organization that is responsible for the compliance of the flanges with the requirements of this European Standard

3.7

purchaser

person or organization that orders products in accordance with this European Standard. The purchaser is not necessarily, but may be, a manufacturer of pressure equipment in accordance with the EU Directive listed in Annex ZA. Where a purchaser has responsibilities under this EU Directive, this European Standard will provide a presumption of conformity with the essential requirements of the Directive so identified in Annex ZA

4 Designation

4.1 General

Table 6 specifies the flange types and collar types.

Figures 1 and 2 show flange types and collar types with the relevant flange type numbers. Flanges shall be denoted with "flange type" and the "flange description". Collar components shall be denoted with collar type and the collar description.

Figure 3 shows flange facing types, which may be used with the flanges or components shown in Figures 1 and 2. Flange facings shall be denoted with "type" and the relevant symbol.

The range of DN, applicable to each flange type and collar and to each PN, shall be as given in Table 7, however not all dimensions are existing for each type.

4.2 Standard designation

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

- a) designation, e.g. flange, lapped end or collar;
- b) number of this European Standard, i.e. EN 1092-1;
- c) number of flange type or collar type in accordance with Figures 1 and 2;
- d) type of flange facing in accordance with Figure 3;
- e) DN (nominal size);
- f) bore diameter only if not according to this standard (for sizes greater than DN 600);

B_1 (only for types 01, 12 and 32);

B_2 (only for type 02);

B_3 (only for type 04);

- g) wall thickness S only if not according to this European Standard (only for types 11 and 34, 35, 36 and 37);
- h) bevelled wall thickness S_p if required (only for types 11 and 34 to 37, see Annex A);
- i) PN designation;
- j) for type 13 flanges type of thread (R_p or R_c);
- k) $\boxed{A_1}$ material and material standard (if necessary); $\boxed{A_1}$
- l) any heat treatment required;
- m) type of material certificate, if required (see 5.13).

EXAMPLE 1 Designation of a flange type 11 with facing type B2 of nominal size DN 200, $\boxed{A_1}$ wall thickness $\boxed{A_1}$ 9 mm, PN 100, made of material P245GH:

Flange EN 1092-1/11/B2/DN 200 × 9/PN 100/P245GH

EXAMPLE 2 Designation of a flange type 01 of nominal size DN 800, with bore diameter $B_1 = 818$ mm, PN 6, made of material P265GH:

Flange EN 1092-1/01/DN 800/818/PN 6/P265GH

EXAMPLE 3 Designation of a collar type 32 of nominal size DN 400, PN 10 and made of material P265GH:

Collar EN 1092-1/32/DN 400/PN 10/P265GH

EXAMPLE 4 Designation of a flange type 02 of nominal size DN 400, PN 10 and made of material 1.0425:

Flange EN 1092-1/02/DN 400/PN 10/1.0425

5 General requirements

5.1 Materials

5.1.1 General

Flanges and collars to be used in pressure equipment shall be manufactured from materials fulfilling the essential safety requirements of the Directive 97/23/EC. Materials specifications which meet the requirements for this European Standard are given in Table 9 (see also Annex D).

Collars type 35 to 37 shall only be manufactured of austenitic/austenitic ferritic steel.

The fabricated flange shall fulfil the mechanical properties of the material standard.

WARNING — The restrictions of the different material standards have to be followed.

$\boxed{A_1}$ NOTE 1 The materials given in Table 9 (see also Annex D) are tabulated in material groups containing materials of similar chemical/mechanical properties and corrosion resistance in order to facilitate an equivalent application of materials in a group depending on pressure, temperature and fluid. $\boxed{A_1}$

NOTE 2 The materials of ancillary components (for example rings according to Annex H) are not within the scope of this European Standard.

5.1.2 Methods of manufacture related to base material

Methods of manufacture see Table 1.

Table 1 — Methods of manufacture

Type of Flange and Collar	Forged ^a	Cast ^{A1}	Made from flat products (plates)	Machined from rolled or forged bars and forged sectional steel	^{A1} Bent ^{A1} and electric welded form bars, sectional steel or strip b, c, d, e	Pressed from welded or seamless pipes or flat products
01 (Plate flange for welding)	yes	no	yes	yes	yes	no
02 (Loose plate flange for Types 32—37)	yes	no	yes	yes	yes	no
04 (Loose plate flange for Type 34)	yes	no	yes	yes	yes	no
05 (Blind flange)	yes	no	yes	yes	no	no
11 (Weld-neck flange)	yes	no	no	yes	yes, for ≥ DN 700	no
12 (Hubbed slip-on flange for welding)	yes	no	no	yes	no	no
13 (Hubbed threaded flange)	yes	no	no	yes	no	no
21 (Integral flange)	yes	yes	no	yes	no	no
32 (Weld-on plate collar)	yes	no	yes	yes	yes	no
33 (Lapped end pipe)	yes	no	yes	^{A1} no ^{A1}	yes	^{A1} no ^{A1}
34 (Weld-neck collar)	yes	yes	no	yes	yes	no
35 (Welding neck)	yes	no	yes	yes	yes	no
36 (Pressed collar with long neck)	yes	no	no	no	yes	yes
37 (Pressed collar)	yes	no	yes	^{A1} yes ^{A1}	yes	^{A1} no ^{A1}

^a Seamless rolled, pressed, forged.

^b Only one radial weld is allowed under DN 1800. ^{A1} If using cut strips for manufacturing, the through thickness direction of the strip for type 11 and 34 has to be perpendicular to the flange centerline, for Type 01, 02, 04 and 32 in the direction of the flange centreline. ^{A1}

^c For welding see 5.11.

^d Welded flanges allowed only for an application up to 370 °C in conformance with EN 13480-3:2002, D.4.4.

^e In case flanges are made by cold forming of a base material e.g. flat product, some mechanical properties, like elongation after fracture (A) and impact energy (KV), will be impaired due to cold forming without subsequently heat treatment.

5.2 Repairs by welding

With the exception of weld repairs according to 5.11 repairs by welding are permitted only by written agreement of the purchaser.

Within the certificate for material or component relevant documents shall be noted, that approved welding procedure and welders qualification (see 5.11) have been applied.

5.3 Bolting

Flanges shall be suitable for use with the number and size of bolting as specified in Tables 10 to 21. The bolting shall be chosen by the equipment manufacturer according to the pressure, temperature, flange material and gasket so that the flanged joint remains tight under the expected operating conditions. For selection of bolting, see EN 1515-1, for combination of the materials of flanges and bolting see EN 1515-2, for information.

5.4 Gaskets

The various gasket types, dimensions, design characteristics and materials used are not within the scope of this European Standard. Dimensions of gaskets are given in the series of standards EN 1514.

5.5 Determination of p/t ratings

p/t ratings for flanges according to this standard shall be calculated in accordance with the rules given in Annex F.

p/t ratings for a selection of EN materials are given in Annex G.

5.6 Dimensions

5.6.1 Flanges and collars

The dimensions of flanges and collars shall be as given in Tables 8 and 10 to 22 according to the PN designation. Dimension $G_{\max}$ may be varied from the given value (see NOTE 1) which is a maximum limit. The wall thickness, S is a minimum value, selected according to pipe thickness T given in ISO 4200 (see NOTE 2). Outside diameter of neck (A) is selected according to EN 10220. The reduced wall thickness S_p is used in case of unequal S and T (type 34 see Table 12 to Table 15 and Annex A).

The following flange types have been re-calculated according to the calculation method in EN 1591-1 with the basic rules as described in Annex E of this European Standard:

- flanges type 11 for PN 2,5 to PN 400. Types 12 and 13 have been adjusted to the results for Type 11. As a result the thickness of some flanges above DN 500 had to be increased and the A_1 wall thickness A_1 had to be adjusted;
- flanges type 05;
- flanges type 01;
- flanges type 02 with 32 resp. 33 up to DN 600 for PN 2,5 to PN 40;
- flanges types 35, 36 and 37 for PN 10 to PN 40;
- types 21 and 04 with 34 have not been re-calculated according to EN 1591-1.

NOTE 1 The centre portion of the face of a flange type 05 need not be machined provided that the diameter of the un-machined portion does not exceed the recommended diameter for $G_{\max}$, given in Tables 10 to 21.

NOTE 2 When requested by the pressure equipment manufacturer/purchaser, wall thickness S , other than those given in this European Standard, may be supplied by agreement with the flange manufacturer, provided a calculation exists.

NOTE 3 A summary of the various types of flanges specified is given in Table 7 showing the nominal sizes applicable to each type and to each PN.

NOTE 4 Diameters N_1 , N_2 and N_3 of flange and collar types 11, 12, 13, 21 and 34 are the theoretical values permitting the use of ring spanners or the application of normal series plain washers without any additional machining, e.g. spot facing (see 5.8).

NOTE 5 The bore diameters of flanges type 21 are not specified in this standard, the effective bore diameters are usually given in the relevant component standard(s).

NOTE 6 Approximate masses of flanges and collars are given in Annex C.

NOTE 7 For flanges type 21 dimensions A , N_3 and R_1 are nominal values. These dimensions and their tolerances are included for guidance only.

NOTE 8 For the diameter of wall thickness S respectively beveled wall thickness S_p see Annex A. For flange type 34 refer to Tables 12 to 15.

5.6.2 Hubs

The hubs of flange types 12, 13 and 34 shall be either:

- a) parallel, or
- b) for manufacturing purposes, taper with an angle not exceeding 7° on the outside surface for forging or casting purposes.

Details of the weld end preparation for flanges type 11 and collar types 34 to 37 shall be as given in Annex A.

5.6.3 Threaded flanges

5.6.3.1 The threads of flanges type 13 shall be parallel (symbol R_p) or tapered (symbol R_c) in accordance with ISO 7-1. Gauging shall be in accordance with EN 10226-3.

NOTE Parallel threads will be supplied unless otherwise requested by the purchaser.

5.6.3.2 The thread shall be concentric with the axis of the flange and misalignments shall not exceed 5 mm per metre.

Flanges type 13 shall be manufactured without a parallel counterbore, but to protect the thread they shall be chamfered to the major diameter of the thread at the hubbed side of the flange at an angle between 30° and 50° to the axis of the thread. The chamfer shall be concentric with the thread and shall be included in the measurement of the thread length provided that the chamfer does not exceed one pitch in length.

5.6.4 Bolt holes

Bolt holes shall be equally spaced on the pitch circle diameter. In the case of flanges type 21 they shall be positioned such that they are symmetrical to the principal axes and such that no holes fall on these axes i.e. positioned "off-centre", see Figures 5 to 16.

5.6.5 Lapped joints

The dimensions of lapped joints to be used with flanges, type 02, are specified in Tables 8 and 10 to 14.

5.6.6 Collar types

A₁ For collar types 33, **A₁** the thickness of the lapped end at the facing shall be not less than the specified wall thickness of the pipe used.

The dimensions of collar types 35, 36 and 37 to be used with flanges type 02 are given in Tables 10 to 14. Type 33 thickness shall be at least the same as for type 37 (see Annex A.3).

5.7 Facings

5.7.1 Types of facings

The types of facings shall be as given in Figure 3 and their dimensions shall be as given in Figure 4 and Table 8.

For facings types B, D, F and G, the transition from the edge of the raised face to the flange shall be:

- a) radius, or
- b) chamfer

at the choice of the flange manufacturer.

5.7.2 Jointing face finish

5.7.2.1 All flange and collar jointing faces, except types 33, 36 and 37, shall be machine finished and shall have a surface finish in accordance with the values given in Table 2 when compared with reference specimens by visual or tactile means.

NOTE It is not intended that instrument measurements be taken on the faces themselves; the R_a and R_z values as defined in EN ISO 4287 relate to the reference specimens.

5.7.2.2 For flanges and collars (except types 33, 36 and 37) with facing types A, B1, E and F, turning shall be carried out with a round nosed tool in accordance with Table 2.

5.7.2.3  If not otherwise agreed between the purchaser and the supplier type 01 and type 05 up to PN 40 and collars (except types 33, 36 and 37) shall have type A facing, other flanges shall have standard facing type B1 for all PN numbers. 

Table 2 — Surface finish for jointing faces

Facing types	Method of machining	 Radius of round nosed tool  mm	R_a^a µm		R_z^a µm	
		min.	min.	max.	min.	max.
A, B1 ^b , E, F	Turning ^c	1,0	3,2	12,5	12,5	50
B2 ^b , C, D, G, H	Turning ^c	—	0,8	3,2	3,2	12,5
NOTE For certain applications, e.g. low temperature gases, it may be necessary to stipulate closer control to the surface finish.						
^a R_a and R_z are defined in EN ISO 4287. ^b Types B1 and B2 are raised face (type B) flanges with different specified surface roughness values. B1 : Standard facing for all PN numbers. B2 : Only if agreed between the purchaser and the flange manufacturer. ^c The term 'turning' includes any method of machine operation producing either serrated concentric or serrated spiral grooves.						

5.8 Surface finish of flanges and collars

5.8.1 Surface finish

The surface finish of flanges and collars shall be according to Table 3. The given surface roughness values apply to as-delivered condition, unless otherwise specified by the purchaser.

Table 3 — Surface finish

Flange type	Outer diameter		Centre bore diameter		Bolt holes	Spot facing
	Ra max [A ₁] µm (A ₁)	Rz max [A ₁] µm (A ₁)	Ra max [A ₁] µm (A ₁)	Rz max [A ₁] µm (A ₁)		
01 (Plate flange for welding)	25	160	25	160	b	c
02 (Loose plate flange for Types 32—37)	25	160	25	160	b	
04 (Loose plate flange for Type 34)	25	160	25	160	b	
05 (Blind flange)	25	160	n.a.		b	c
11 (Weld-neck flange)	25 ^a	160 ^a	25 ^a	160 ^a	b	c
12 (Hubbed slip-on flange for welding)	25 ^a	160 ^a	25 ^a	160 ^a	b	c
13 (Hubbed threaded flange)	25 ^a	160 ^a	See thread standard		b	c
21 (Integral flange)	25 ^a	160 ^a	25 ^a	160 ^a		c
32 (Weld-on plate collar)	25	160	25	160		
33 (Lapped end pipe)	25 [A ₁] ^a (A ₁)	160	25 [A ₁] ^a (A ₁)	160		
34 (Weld-neck collar)	25 ^a	160 ^a	25 ^a	160 ^a		
35 (Welding neck)	25 ^a	160 ^a	25 ^a	160 ^a		
36 (Pressed collar with long neck)	25 ^a	160 ^a	25 ^a	160 ^a		
37 (Pressed collar)	25 ^a	160 ^a	25 ^a	160 ^a		
^a Or up to PN 40 un-machined. ^b Bolt holes > PN 40 only drilled. ^c Chip machining spot facing for PN ≥ 63 (see 5.8.2).						

5.8.2 Spot facing or back facing of flanges

Any spot facing or back facing shall not reduce the flange thickness to less than the flange thickness specified. When spot facing is used, the diameter shall be large enough to accommodate the outside diameter of the equivalent normal series of washers in accordance with EN ISO 887 for the bolt size being fitted. The bearing surfaces for the bolting shall be parallel to the flange face within the limits given in Table 22. When a flange is back faced a minimum fillet radius, R_2 (see Figure 17) in accordance with Table 23 shall be maintained.

5.9 Tolerances

Tolerances on dimensions of flanges and collars shall be as given in Table 22.

General tolerances for dimensions without given tolerance: According to ISO 2768-1 — c.

5.10 Marking

5.10.1 General marking requirements

All flanges, lapped ends and collars, other than type 21 flanges, should be marked as follows:

- flange/collar manufacturer's name or trade mark, e.g. XXX;
- number of this European Standard, i.e. EN 1092-1;
- flange/collar type number;
- DN, e.g. DN 150;

- e) PN designation, e.g. PN 40 (marking according to synoptic Table 7, other marking with lower PN number, $\boxed{A_1}$ by identical dimensions $\langle A_1 \rangle$ only, may be specified);
- f) wall thickness (S), if not according to this European Standard;
- g) $\boxed{A_1}$ ~~deleted text~~ $\langle A_1 \rangle$ either the name or the number or the grade of the material, e.g. P245GH;
- h) heat number of melt and/or suitable identification, such as code number, for the traceability e.g. A2345, when test certification is required.

EXAMPLE XXX/EN 1092-1/11/DN 150/PN 40/P265GH/A2345

- i) additional marking (M) for flanges according to Annex I:

EXAMPLE XXX/EN 1092-1/34M/...

If a part is too small to enable all the markings required then the minimum marking required shall be:

- $\boxed{A_1}$ — $\langle A_1 \rangle$ flange/collar manufacturer's name or trade mark;
- $\boxed{A_1}$ — $\langle A_1 \rangle$ letters "EN";
- $\boxed{A_1}$ — $\langle A_1 \rangle$ PN designation e.g. PN 40;
- $\boxed{A_1}$ — $\langle A_1 \rangle$ either the name or the number or the grade of the material;
- $\boxed{A_1}$ — heat number of melt and/or suitable identification, such as code number, for the traceability. $\langle A_1 \rangle$

5.10.2 Stamping

Marking has to be visible and durable. Where hard stampings are used, the marking shall be positioned on the outer rim of the parts.

NOTE It should be ensured that hard stamping markings are not liable to cause cracks in the flange material.

5.10.3 Declaration of compliance

The marking EN 1092-1, together with the flange manufacturer's name or trademark on or in relation to a product, represents the flange manufacturer's declaration of compliance to this European Standard, i.e. a claim by or on behalf of the flange manufacturer that the product meets the requirements of this European Standard.

5.11 Welding

When producing flanges or collars by fusion welding or flanges or collars formed by bending from sections, bar steel or flat products and flash-butt welded the following criteria are valid:

- welding process/procedures shall be qualified and certified in accordance with EN ISO 15614-1 and EN ISO 15614-13;

NOTE Existing valid welding procedures for arc welding of steels i.e. in accordance with EN 288-3 may be used (see introduction to EN ISO 15614-1:2004).

- welders and/or welding operators shall be qualified in accordance with EN 287-1 and/or EN 1418.

All welds shall have full penetration.

Local repair of weld seam with filler metal is permitted, provided that the repair procedure/welders are qualified in accordance with the relevant part of the above mentioned standards.

If heat treatment is required, the repair welding shall be carried out prior to that.

5.12 Inspection and testing

5.12.1 Inspection and testing of fusion welded joints

- a) Welded joints shall be visually examined in accordance with A_1 EN ISO 17637 A_1 before any other NDT is performed.
- b) The area to be examined shall include the weld metal and the heat affected zones.
- c) The required surface examination shall be performed on all the surfaces.
- d) Any type of NDT shall be performed after any forming or heat treatment operation. Where a material is not sensitive to PWHT cracking (e.g. material groups 1.1 and 8.1 (see CEN ISO/TR 15608)), NDT may be performed before PWHT.
- e) In case of austenitic base or filler material, the method for surface testing shall be PT.
- f) Welded pipe as base material shall conform to the relevant product (pipe) standard (see Table 9).
- g) All other longitudinal welds of necks shall have 100 % volumetric (RT/UT) testing.
- h) For type 35 only: Every 10th radial weld of rings shall have 100 % volumetric testing. Every 10th ring weld shall have surface crack detection (MT or PT) except in material groups 1.1, 1.2 or 8.1.
- i) For type 35 only: Welding of neck to ring, every 10th flange shall have surface crack detection of welds (MT or PT).

A_1 Table 4 — NDT methods, techniques, characterisation and acceptance criteria for fusion welded flanges or collars

NDT Methods (abbreviations)	Techniques	Acceptance Criteria
Visual inspection (VT)	EN ISO 17637	EN ISO 5817:2007, surface imperfections, Acceptance level B
Radiography (RT)	EN 1435:1997, class B	EN 12517-1:2006, Acceptance level 2 and Table 6.6.4-1
Ultrasonic Testing(UT)	EN ISO 17640:2010, min. class B ^a	EN ISO 11666:2010, Acceptance level 2 + no planar imperfections accepted
Penetrant Testing (PT)	EN 571-1:1997 + test parameter to EN ISO 23277:2009 Table A.1 – Acceptance level 1	EN ISO 23277:2009, Acceptance level 1
Magnetic Particle Testing (MT)	EN ISO 17638:2009 + test parameter to EN ISO 23278:2009, Table A.1 – Acceptance level 1	EN ISO 23278:2009, Acceptance level 1

^a Thickness $t < 40$ mm class A is acceptable. By $t > 100$ mm class C is required.

A_1

NDT operators (Level 1) and supervisor (Level 2) shall be qualified and certified in accordance with A_1 EN ISO 9712 A_1 .

5.12.2 Inspection and testing of A_1 bent A_1 and electric welded flanges or collars from formed bars, sectional steel or band material

- a) Welded joints shall be visually examined in accordance with A_1 EN ISO 17637 A_1 before any other NDT is performed. Acceptance criteria in accordance with EN ISO 5817 surface imperfections level C.
- b) The area to be examined shall include the weld metal and the heat affected zones.
- c) All base material for these flanges, such as plates or flat products shall be inspected ultrasonically according to EN 10160. Scope of test according to EN 10160:199, Table 3, acceptance criteria Class S₁ and EN 10160:1999, Table 5 Class E₃.

- d) Flanges made of steels in Material Groups 1E0, 1E1, 2E0 and 3E1 A_1 shall be subjected A_1 by the flange manufacturer to ultrasonic testing or to radiographic testing with reference to Table 5 to the extent defined in Table 5. As a rule, flanges that are produced by continuous welding with the same machine setting are grouped together to form a test batch.
- e) Finished flanges of all other material groups A_1 shall be subjected A_1 by the flange manufacturer to ultrasonic inspection or to radiographic inspection in the weld zone according to Table 5 on each flange.
- f) Flanges with unit weights > 300 kg shall be inspected ultrasonically or radiographically according to Table 5 in all material groups.
- g) All welds shall be tested by the flange manufacturer for the presence of surface cracks with a suitable method as Penetrant Testing for austenitic base or filler material and Magnetic Particle Testing for Ferritic material according to Table 5. The following materials constitute exceptions: P 235 GH, P 265 GH and P 250 GH.
- h) The non-destructive testing shall be carried out after completion of possible post-weld heat treatment (PWHT). Where a material is not sensitive to PWHT cracking e.g. material groups 1.1 and 8.1 (see CEN ISO/TR 15608), NDT may be performed before PWHT.

Table 5 — Scope of non-destructive testing for flanges or collars formed by bending and electric welded formed bars, sectional steel or band material

Number of flanges per test unit	Scope of non-destructive testing	Minimum of:
≥ 1 to ≤ 20	100 %	—
> 20 to ≤ 50	50 %	20 flanges
> 50 to ≤ 200	25 %	25 flanges
> 200 to $\leq 1\,000$	15 %	50 flanges
$> 1\,000$	10 %	150 flanges

5.12.3 Inspection and testing of formed parts manufactured from base material other than forgings

5.12.3.1 Non-destructive testing

The testing of formed parts shall include on each component or batch of identical components (dependent on the material and size of flange), if appropriate:

- wall thickness measurements;
- dimensional checks
- hardness tests (e.g. carbon and low alloy steels);
- ultrasonic testing for internal imperfections in longitudinal and transversal direction (e.g. for thickness above 8 mm);
- examination for surface or near surface imperfections (MT or PT).

Material, heat treatment conditions, heat treatment lot, degree of deformation shall be considered in the definition of the batch (see e.g. EN 10253 standards).

5.12.3.2 Destructive testing for heat treated or hot formed components

Testing shall be performed to verify the heat treatment of the formed parts, and shall include the tests required by the base material specification, e.g.:

- tensile test;

- notch impact test;
- micrographs (e.g. 9 % or 12 % Cr steels);

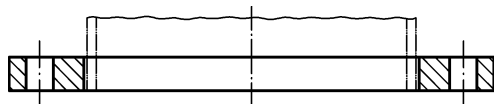
One set of test per cast, wall thickness range and heat treatment lot shall be performed for flanges and collars with $PN \times DN > 1\,000$ bar and $DN > 25$. The tests shall be performed on test pieces from the component itself, or from test pieces placed together with the components in the heat treatment furnaces. The test results shall fulfil the mechanical properties of the material standard.

5.12.4 Inspection and testing of other materials

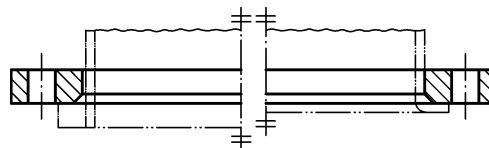
Flanges made of forgings, casts, bars, pressed and seamless rolled materials shall be inspected and tested by the material manufacturer in accordance with the appropriate material standard.

5.13 Certificates

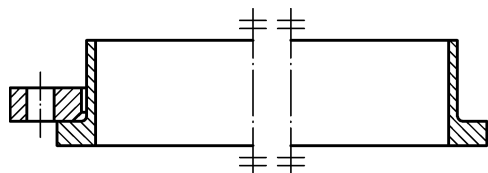
The flange manufacturer shall use respective procedures to ensure traceability of material and to avoid material exchange and shall be able to provide respective documentation for the base material used. Under consideration of EN 764-5, the purchaser of the flange may require a test certificate according to EN 10204:2004 (2.1, 3.1 or 3.2), applicable for the respective category. The rules of Directive 97/23/EC and the product specification, which includes the technical delivery conditions, shall be applied. If an inspection certificate 3.1 is required, the quality system of the material manufacturer must fulfil the ESRs in the third paragraph of section 4.3 of Annex I of Directive 97/23/EC.



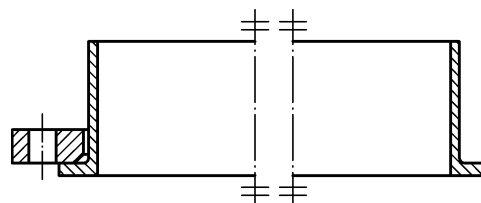
Type 01
Plate flange for welding



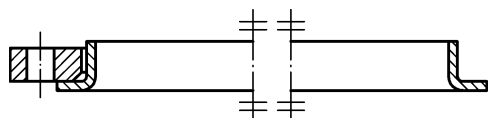
Type 02
Loose plate flange with weld-on collar (see type 32) or
lapped pipe end (see type 33)



Type 02
Loose plate flange with weld ring neck
(see type 35)



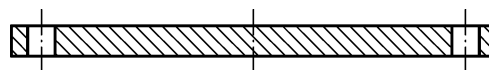
Type 02
Loose plate flange
with pressed collar with long neck (see type 36)



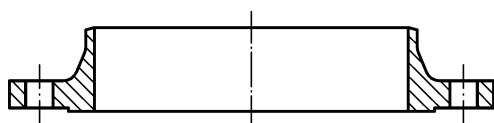
Type 02
Loose plate flange
with pressed collar (see type 37)



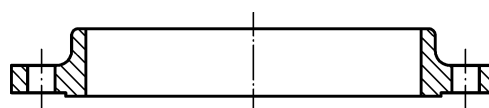
Type 04
Loose plate flange with weld-neck collar (see type 34)



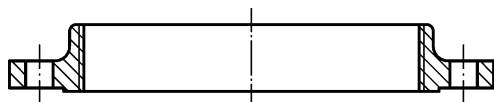
Type 05
Blind flange



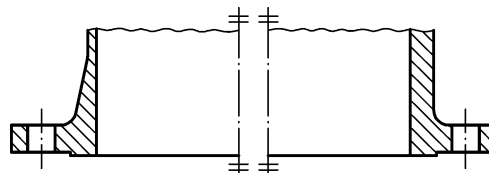
Type 11
Weld-neck flange



Type 12
Hubbed slip-on flange for welding



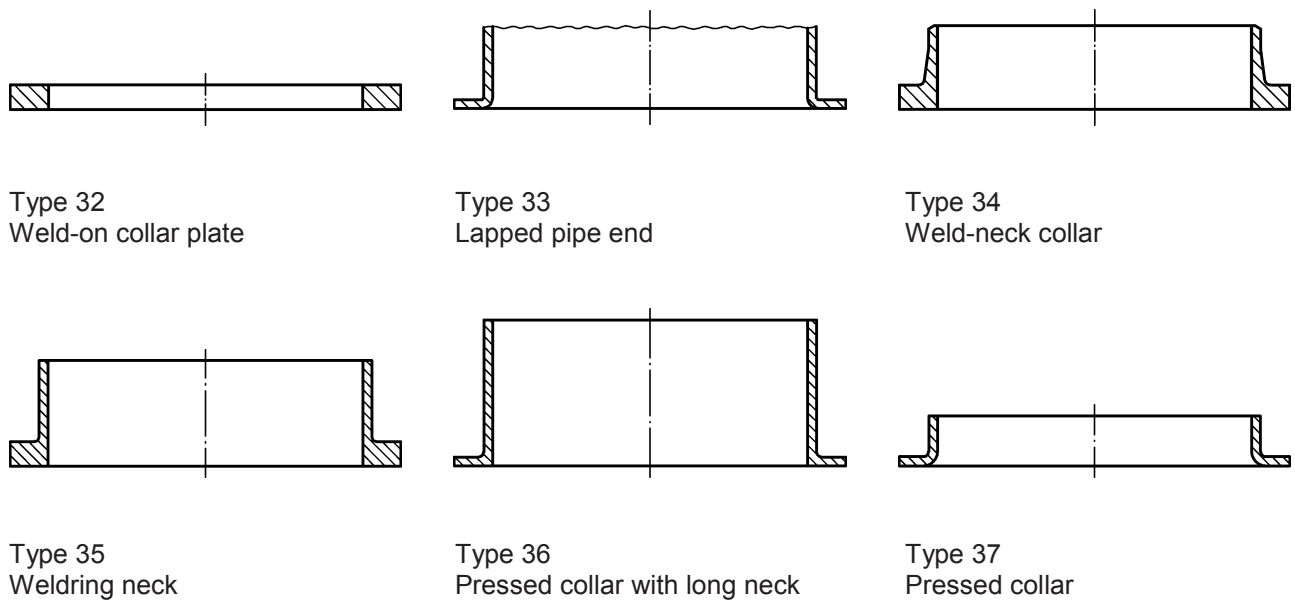
Type 13
Hubbed threaded flange



Type 21
Integral flange

NOTE These sketches are diagrammatic only, in particular no detail is shown for the mating surfaces (see Figure 3).

Figure 1 — Flange types

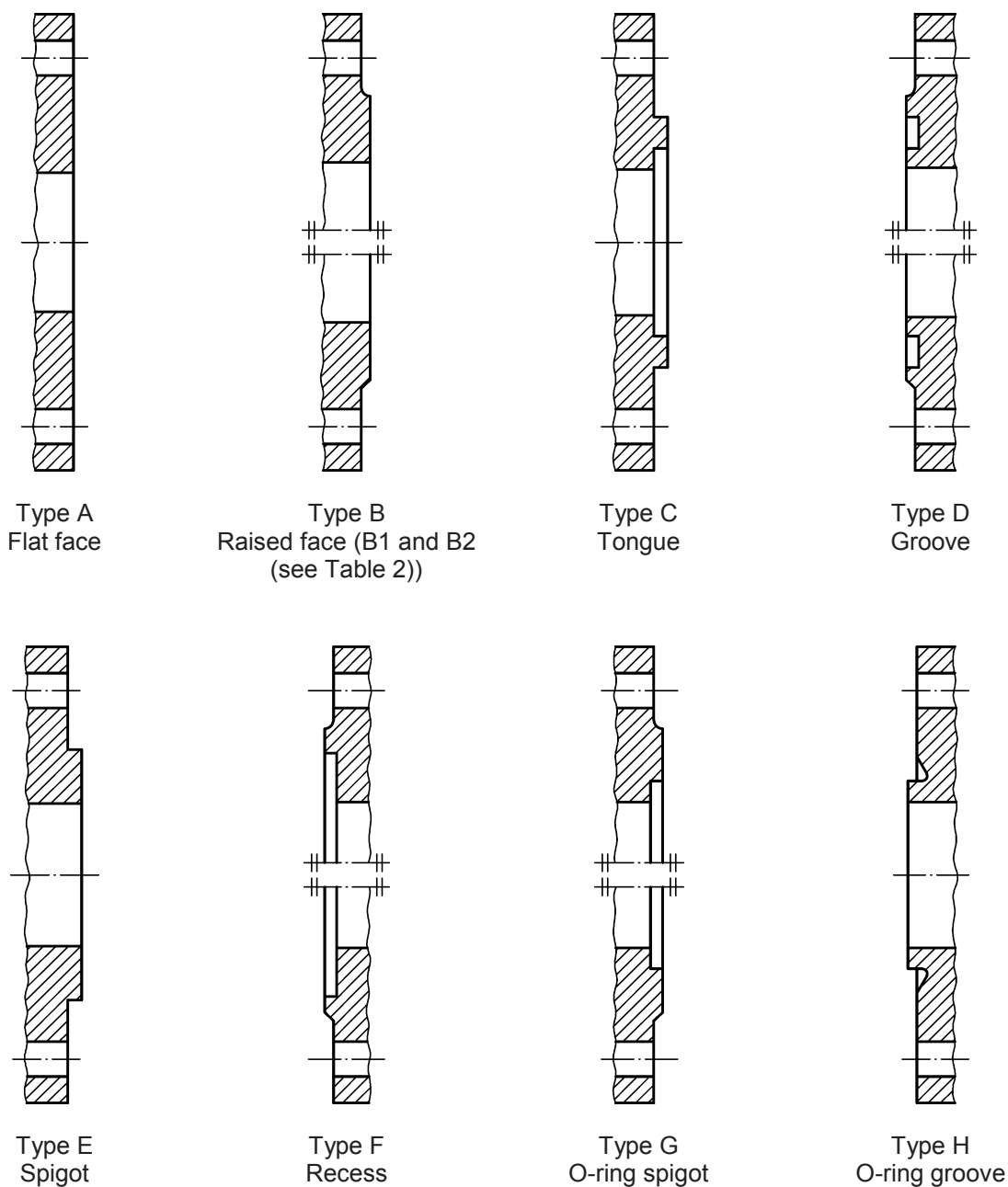


NOTE These sketches are diagrammatic only.

Figure 2 — Collars types 32 to 37

Table 6 — Types of steel flanges and collars

Type No	Description
01	Plate flange for welding
02	Loose plate flange with weld-on plate collar or for lapped pipe end
04	Loose plate flange with weld-neck collar
05	Blind flange
11	Weld-neck flange
12	Hubbed slip-on flange for welding
13	Hubbed threaded flange
21 ^a	Integral flange
32 ^b	Weld-on plate collar
33 ^{a, b}	Lapped pipe end
34 ^b	Weld-neck collar
35 ^b	Weldring neck
36 ^b	Pressed collar with long neck
37 ^b	Pressed collar
NOTE Type numbers have been made non-consecutive to permit possible future additions.	
^a This is an integral part of a pressure equipment or a component.	
^b Type numbers 32, 33, 35, 36 and 37 are for use with type 02 flanges and type number 34 for use with type 04 flanges.	



NOTE 1 The transition from the edge of the raised face to the flange face may be by radius or chamfer for types B, D, F and G only (see 5.7.1).

NOTE 2 B1 and B2 are raised face (type B) for different applications (see 5.7.2.2, 5.7.2.3 and Table 2).

NOTE 3 For the dimensions of flange facings, see Figure 4 and Table 8.

Figure 3 — Flange facing types

Table 7 — Synoptic table

Flange type or collar type	DN PN	10	15	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500	600	700	800	900	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 600	2 800	3 000	3 200	3 400	3 600	3 800	4 000																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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Table 7 (continued)

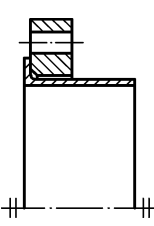
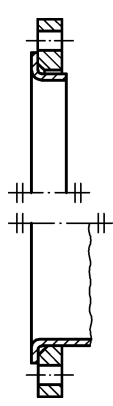
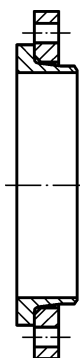
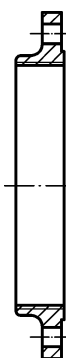
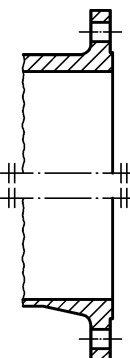
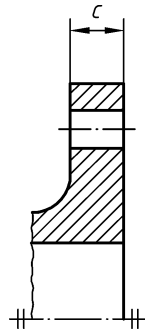
Flange type or collar type	DN PN	10	15	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500	600	700	800	900	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 600	2 800	3 000	3 200	3 400	3 600	3 800	4 000		
		Type 02 and 36																																								
	2,5	A17 use only for this flange and collar combination A17																					X																			
	6	A17 use only for this flange and collar combination A17																					X																			
	10	dimensions identical with PN 16											X	X	X	X																										
	16	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																							
	2,5	A17 use only for this flange and collar combination A17																																								
	6	A17 use only for this flange and collar combination A17																																								
	10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																							
	16	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																							
	10	dimensions identical with PN 40											dimensions identical with PN 16										X	X	X	X	X	X														
	16	dimensions identical with PN 40											X	X	X	X	X	X	X	X	X	X	X	X	X	X	X															
	25	dimensions identical with PN 40											dimensions identical with PN 40										X	X	X	X	X	X	X	X	X											
	40	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		

Table 7 (continued)

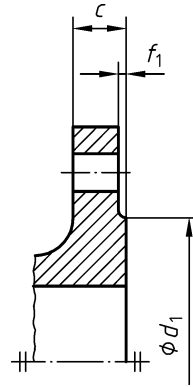
Flange type or collar type		DN	Dimensions in mm																																													
PN			10	15	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500	600	700	800	900	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 600	2 800	3 000	3 200	3 400	3 600	3 800	4 000							
 Type 05	2,5																										X																					
	6		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
	10		dimensions identical with PN 40										dimensions identical with PN 16			X	X	X	X	X	X	X	X	X	X	X	X																					
	16		dimensions identical with PN 40													X	X	X	X	X	X	X	X	X	X	X	X																					
	25		dimensions identical with PN 40													X	X	X	X	X	X	X	X	X	X	X																						
	40		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																						
	63		← Use PN 100 →	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																						
	100		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																							
	2,5																																															
	6		X	X	X	X	X	X	X	X	X	X	dimensions identical with PN 16			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
10		dimensions identical with PN 40													X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
16		dimensions identical with PN 40													X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
25		dimensions identical with PN 40													X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
40		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
63		dimensions identical with PN 100													X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
100		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
160		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
250		dimensions identical with PN 320																																														
320		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
400		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

Table 7 (concluded)

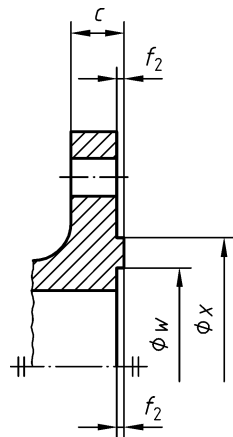
Flange type or collar type	DN PN	Nominal pressure (PN)																																												
		10	15	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500	600	700	800	900	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 600	2 800	3 000	3 200	3 400	3 600	3 800	4 000						
 Type 12	6	X	X	X	X	X	X	X	X	X	X	X	X	X	X																															
	10	dimensions identical with PN 40										dimensions identical with PN 16										X	X	X	X	X	X																			
	16	dimensions identical with PN 40					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																			
	25	dimensions identical with PN 40					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																			
	40	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																				
	63	dimensions identical with PN 100					X	X	X	X	X	X	X	X																																
	100	X	X	X	X	X	X	X	X	X	X	X	X	X																																
	6	X	X	X	X	X	X	X	X	X	X	X	X	X	X																															
	10	dimensions identical with PN 40					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																				
	16	dimensions identical with PN 40					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																	
 Type 13	25	dimensions identical with PN 40					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																					
	40	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																		
	63	dimensions identical with PN 100					X	X	X	X	X	X	X	X																																
	100	X	X	X	X	X	X	X	X	X	X	X	X	X																																
	2.5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																				
	6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																	
	10	dimensions identical with PN 40					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																
	16	dimensions identical with PN 40					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X															
	25	dimensions identical with PN 40					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X															
	40	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																
 Type 21	63	dimensions identical with PN 100					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																	
	100	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																	
	160	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																	
	250	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																
	320	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X															
	400	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X														
											dimensions identical with PN 40																																			



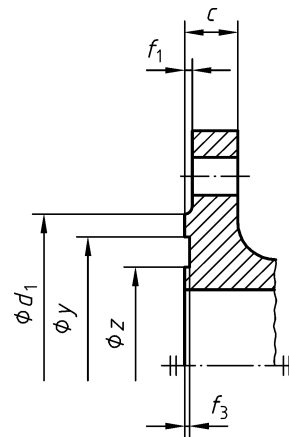
Type A: Flat face



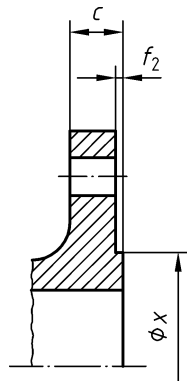
Type B: Raised face (B1 and B2)



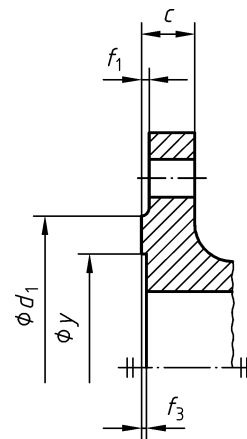
Type C: Tongue



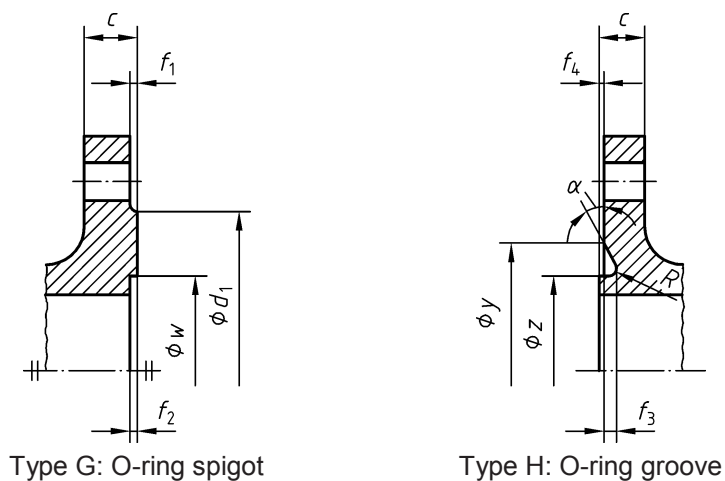
Type D: $\boxed{A_1}$ Groove a continuous line above the groove $\boxed{A_1}$



Type E: Spigot



Type F: Recess



- NOTE 1 Dimension C includes the raised face thickness.
NOTE 2 Cross section diameter of the O-ring is $2 \times R$.

Figure 4 — Flange facing (dimensions see Tables 6 and 8 to 19)

Table 8 — Flange facing dimensions

DN	d_1												f_1	f_2	f_3	f_4	w^b	x	y	z^b	$\alpha \approx$	R
	PN 2,5 a	PN 6 a	PN 10	PN 16	PN 25	PN 40	PN 63	PN 100	PN 160	PN 250	PN 320	PN 400	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
10	35	35	40	40	40	40	40	40	40	40	40	40	2	4,5	4,0	2,0	24	34	35	23	—	
15	40	40	45	45	45	45	45	45	45	45	45	45	2	4,5	4,0	2,0	29	39	40	28	—	
20	50	50	58	58	58	58	58	58	De- leted text $\langle A \rangle$	De- leted text $\langle A \rangle$	De- leted text $\langle A \rangle$	De- leted text $\langle A \rangle$					36	50	51	35	—	
25	60	60	68	68	68	68	68	68	De- leted text $\langle A \rangle$	De- leted text $\langle A \rangle$	De- leted text $\langle A \rangle$	De- leted text $\langle A \rangle$	3	5,0	4,5	2,5	43	57	58	42	41°	2,5
32	70	70	78	78	78	78	78	78	De- leted text $\langle A \rangle$	De- leted text $\langle A \rangle$	De- leted text $\langle A \rangle$	De- leted text $\langle A \rangle$					51	65	66	50		
40	80	80	88	88	88	88	88	88	88	88	88	88					61	75	76	60		
50	90	90	102	102	102	102	102	102	102	102	102	102					73	87	88	72		
65	110	110	122	122	122	122	122	122	122	122	122	122					95	109	110	94		
80	128	128	138	138	138	138	138	138	138	138	138	138	4	5,0	4,5	2,5	106	120	121	105	32°	3
100	148	148	158	158	162	162	162	162	162	162	162	162					129	149	150	128		
125	178	178	188	188	188	188	188	188	188	188	188	188					155	175	176	154		
150	202	202	212	212	218	218	218	218	218	218	218	218					183	203	204	182		
200	258	258	268	268	278	285	285	285	285	285	285	285					239	259	260	238		
250	312	312	320	320	335	345	345	345	345	345	345	345	5	5,5	5,0	3,0	292	312	313	291	27°	3,5
300	365	365	370	378	395	410	410	410	410	410	410	410					343	363	364	342		
350	415	415	430	438	450	465	465	465	—	—	—	—	5	6,5	6,0	4,0	395	421	422	394	28°	4
400	465	465	482	490	505	535	535	535	—	—	—	—					447	473	474	446		
450	520	520	532	550	555	560	560	560	—	—	—	—					497	523	524	496		
500	570	570	585	610	615	615	615	615	—	—	—	—					549	575	576	548		
600	670	670	685	725	720	735	735	—	—	—	—	—					649	675	676	648		
700	775	775	800	795	820	840	840	—	—	—	—	—	5	6,5	6,0	4,0	751	777	778	750	28°	4
800	880	880	905	900	930	960	960	—	—	—	—	—					856	882	883	855		
900	980	980	1 005	1 000	1 030	1 070	1 070	—	—	—	—	—					961	987	988	960		
1 000	1 080	1 080	1 110	1 115	1 140	1 180	1 180	—	—	—	—	—					1 062	1 092	1 094	1 060		
1 200	1 280	1 295	1 330	1 330	1 350	1 380	1 380	—	—	—	—	—					1 262	1 292	1 294	1 260		
1 400	1 480	1 510	1 535	1 530	1 560	1 600	—	—	—	—	—	—	5	6,5	6,0	4,0	1 462	1 492	1 494	1 460	28°	4
1 600	1 690	1 710	1 760	1 750	1 780	1 815	—	—	—	—	—	—					1 662	1 692	1 694	1 660		
1 800	1 890	1 920	1 960	1 950	1 985	—	—	—	—	—	—	—					1 862	1 892	1 894	1 860		
2 000	2 090	2 125	2 170	2 150	2 210	—	—	—	—	—	—	—					2 062	2 092	2 094	2 060		
2 200	2 295	2 335	2 370	—	—	—	—	—	—	—	—	—					—	—	—	—		
2 400	2 495	2 545	2 570	—	—	—	—	—	—	—	—	—	5	6,5	6,0	4,0	—	—	—	—	28°	4
2 600	2 695	2 750	2 780	—	—	—	—	—	—	—	—	—					—	—	—	—		
2 800	2 910	2 960	3 000	—	—	—	—	—	—	—	—	—					—	—	—	—		
3 000	3 110	3 160	3 210	—	—	—	—	—	—	—	—	—					—	—	—	—		
3 200	3 310	3 370	—	—	—	—	—	—	—	—	—	—					—	—	—	—		
3 400	3 510	3 580	—	—	—	—	—	—	—	—	—	—	5	6,5	6,0	4,0	—	—	—	—	28°	4
3 600	3 720	3 790	—	—	—	—	—	—	—	—	—	—					—	—	—	—		
3 800	3 920	—	—	—	—	—	—	—	—	—	—	—					—	—	—	—		
4 000	4 120	—	—	—	—	—	—	—	—	—	—	—					—	—	—	—		

a Flange facing types C, D, E, F, G and H according to Figure 4 are not used for PN 2,5 and 6.

b Flange facing types G and H according to Figure 4 are only used for PN 10 to PN 40.

Table 9 — Material selection for the manufacturing of flanges

Group	Forgings			Flat products			Castings			Bars		
	Material name	Standard	Material number	Material name	Standard	Material number	Material name	Standard	Material number	Material name	Standard	Material number
2E0	—	—	—	—	—	—	GP240GR	EN 10213-2	1.0621	—	—	—
3E0	—	—	—	P235GH	EN 10028-2	1.0345	GP240GH	EN 10213-2	1.0619	P235GH	EN 10273	1.0345
3E0	—	—	—	—	—	—	—	—	—	P250GH	EN 10273	1.0460
3E0	P245GH	EN 10222-2	1.0352	P265GH	EN 10028-2	1.0425	GP280GH	EN 10213-2	1.0625	P265GH	EN 10273	1.0425
3E1	P280GH	EN 10222-2	1.0426	P295GH	EN 10028-2	1.0481	—	—	—	P295GH	EN 10273	1.0481
4E0	16Mo3	EN 10222-2	1.5415	16Mo3	EN 10028-2	1.5415	G20Mo5	EN 10213-2	1.5419	16Mo3	EN 10273	1.5415
5E0	13CrMo4-5	EN 10222-2	1.7335	13CrMo4-5	EN 10028-2	1.7335	G17CrMo5-5	EN 10213-2	1.7357	13CrMo4-5	EN 10273	1.7335
6E0	11CrMo9-10	EN 10222-2	1.7383	12CrMo9-10	EN 10028-2	1.7375	G17CrMo9-10	EN 10213-2	1.7379	11CrMo9-10	EN 10273	1.7383
6E1	X16CrMo5-1 +NT	EN 10222-2	1.7366	10CrMo9-10	EN 10028-2	1.7380	—	—	—	10CrMo9-10	EN 10273	1.7380
7E0	—	—	—	P275NL1	EN 10028-3	1.0488	GX15CrMo5	EN 10213-2	1.7365	—	—	—
7E1	—	—	—	P275NL2	EN 10028-3	1.1104	G17Mn5	EN 10213-3	1.1131	—	—	—
7E1	—	—	—	P355NL1	EN 10028-3	1.0566	G20Mn5	EN 10213-3	1.6220	—	—	—
7E2	15NiMn6	EN 10222-3	1.6228	P355NL2	EN 10028-3	1.1106	—	—	—	—	—	—
7E2	—	—	—	15NiMn6	EN 10028-4	1.6228	G9Ni10	EN 10213-3	1.5636	—	—	—
7E2	13MnNi6-3	EN 10222-3	1.6217	11MnNi5-3	EN 10028-4	1.6212	—	—	—	—	—	—
7E2	—	—	—	13MnNi6-3	EN 10028-4	1.6217	—	—	—	—	—	—
7E3	12Ni14	EN 10222-3	1.5637	12Ni14	EN 10028-4	1.5637	G9Ni14	EN 10213-3	1.5638	—	—	—
7E3	X12Ni5	EN 10222-3	1.5680	12Ni14	EN 10028-4	1.5680	—	—	—	—	—	—
7E3	X8Ni9	EN 10222-3	1.5662	X12 Ni 5 (A)	EN 10028-4	1.5662	—	—	—	—	—	—
8E0	—	—	—	X8Ni9	EN 10028-4	1.5662	—	—	—	—	—	—
8E2	P285NH	EN 10222-4	1.0477	—	—	—	—	—	—	P275NH	EN 10273	1.0487
8E2	P285QH	EN 10222-4	1.0478	P275NH	EN 10028-3	1.0487	—	—	—	—	—	—
8E3	P355NH	EN 10222-4	1.0565	—	—	—	—	—	—	—	—	—
8E3	P355QH1	EN 10222-4	1.0571	P355N	EN 10028-3	1.0562	—	—	—	P355NH	EN 10273	1.0565
9E0	X20CrMoV11-1	EN 10222-2	1.4922	P355NH	EN 10028-3	1.0565	—	—	—	P355QH	EN 10273	1.8867
9E1	X10CrMoVNb9-1	EN 10222-2	1.4903	—	—	—	GX23CrMoV12-1	EN 10213-2	1.4931	—	—	—
9E1	—	—	—	X10CrMoVNb9-1	EN 10028-2	1.4903	—	—	—	—	—	—
10E0	X2CrNi18-9	EN 10222-5	1.4307	X2CrNi18-9	EN 10028-7	1.4307	GX2CrNi19-11	EN 10213-4	1.4309	X2CrNi18-9	EN 10272	1.4307
10E0	—	—	—	X2CrNi19-11	EN 10028-7	1.4306	—	—	—	X2CrNi19-11	EN 10272	1.4306
10E0	—	—	—	X1CrNi25-21	EN 10028-7	1.4335	—	—	—	—	—	—
10E1	X2CrNi18-10	EN 10222-5	1.4311	X2CrNi18-10	EN 10028-7	1.4311	—	—	—	X2CrNi18-10	EN 10272	1.4311
11E0	X5CrNi18-10	EN 10222-5	1.4301	X5CrNi18-10	EN 10028-7	1.4301	GX5CrNi19-10	EN 10213-4	1.4308	X5CrNi18-10	EN 10272	1.4301
11E0	X6CrNi18-10	EN 10222-5	1.4948	X6CrNi18-10	EN 10028-7	1.4948	—	—	—	—	—	—

Table 9 (continued)

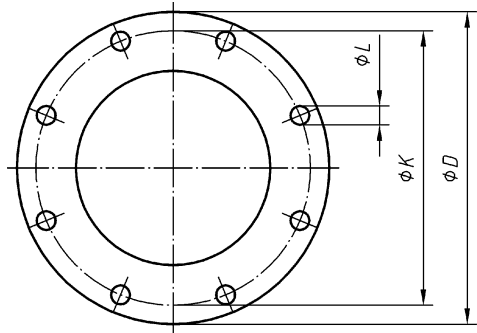
Group	Forgings			Flat products			Castings			Bars		
	Material name	Standard	Material number	Material name	Standard	Material number	Material name	Standard	Material number	Material name	Standard	Material number
12E0	X6CrNiTi18-10	EN 10222-5	1.4541	X6CrNiTi18-10	EN 10028-7	1.4541	—	—	—	X6CrNiTi18-10	EN 10272	1.4541
	X6CrNiNb18-10	EN 10222-5	1.4550	X6CrNiNb18-10	EN 10028-7	1.4550	GX5CrNiNb19-11	EN 10213-4	1.4552	X6CrNiNb18-10	EN 10272	1.4550
	X6CrNiTiB18-10	EN 10222-5	1.4941	X6CrNiTiB18-10	EN 10028-7	1.4941	—	—	—	—	—	—
13E0	X2CrNiMo17-12-2	EN 10222-5	1.4404	X2CrNiMo17-12-2	EN 10028-7	1.4404	GX2CrNiMo19-11-2	EN 10213-4	1.4409	X2CrNiMo17-12-2	EN 10272	1.4404
	X2CrNiMo17-12-3	EN 10222-5	1.4432	X2CrNiMo17-12-3	EN 10028-7	1.4432	—	—	—	X2CrNiMo17-12-3	EN 10272	1.4432
	X2CrNiMo18-14-3	EN 10222-5	1.4435	X2CrNiMo18-14-3	EN 10028-7	1.4435	—	—	—	X2CrNiMo18-14-3	EN 10272	1.4435
	X1NiCrMoCu25-5-20-5	EN 10222-5	1.4539	X1NiCrMoCu25-20-5	EN 10028-7	1.4539	GX2NiCrMo28-20-2	EN 10213-4	1.4458	X1NiCrMoCu25-20-5	EN 10272	1.4539
	—	—	—	X1NiCrMoCu31-27-4	EN 10028-7	1.4563	—	—	—	X1NiCrMoCu31-27-4	EN 10272	1.4563
13E1	X2CrNiMoN17-11-2	EN 10222-5	1.4406	X2CrNiMoN17-11-2	EN 10028-7	1.4406	—	—	—	X2CrNiMoN17-11-2	EN 10028-7	1.4406
13E1	X2CrNiMoN17-13-3	EN 10222-5	1.4429	X2CrNiMoN17-13-3	EN 10028-7	1.4429	—	—	—	X2CrNiMoN17-13-3	EN 10028-7	1.4429
13E1	—	—	—	X2CrNiMoN17-13-5	EN 10028-7	1.4439	—	—	—	X2CrNiMoN17-13-5	EN 10028-7	1.4439
13E1	—	—	—	X1NiCrMoCuN25-20-7	EN 10028-7	1.4529	—	—	—	X1NiCrMoCuN25-20-7	EN 10028-7	1.4529
13E1	—	—	—	X1CrNiMoCuN20-18-7	EN 10028-7	1.4547	—	—	—	X1CrNiMoCuN20-18-7	EN 10272	1.4547
14E0	X5CrNiMo17-12-2	EN 10222-5	1.4401	X5CrNiMo17-12-2	EN 10028-7	1.4401	GX5CrNiMo19-11-2	EN 10213-4	1.4408	X5CrNiMo17-12-2	EN 10272	1.4401
14E0	X3CrNiMo17-13-3	EN 10222-5	1.4436	X3CrNiMo17-13-3	EN 10028-7	1.4436	—	—	—	X3CrNiMo17-13-3	EN 10272	1.4436
15E0	X6CrNiMoTi17-12-2	EN 10222-5	1.4571	X6CrNiMoTi17-12-2	EN 10028-7	1.4571	—	—	—	X6CrNiMoTi17-12-2	EN 10272	1.4571
16E0	—	—	—	X6CrNiMoNb17-12-2	EN 10028-7	1.4580	GX5CrNiMoNb19-11-2	EN 10213-4	1.4581	X6CrNiMoNb17-12-2	EN 10272	1.4580
	—	—	—	—	—	—	GX2CrNiMoCuN25-6-3-3	EN 10213-4	1.4517	—	—	—
	—	—	—	X2CrNiN23-4	EN 10028-7	1.4362	—	—	—	X2CrNiN23-4	EN 10272	1.4362
	X2CrNiMoN22-5-3	EN 10222-5	1.4462	X2CrNiMoN22-5-3	EN 10028-7	1.4462	GX2CrNiMoN22-5-3	EN 10213-4	1.4470	X2CrNiMoN22-5-3	EN 10272	1.4462
	X2CrNiMoN25-7-4	EN 10222-5	1.4410	X2CrNiMoN25-7-4	EN 10028-7	1.4410	—	—	—	X2CrNiMoN25-7-4	EN 10272	1.4410
	—	—	—	—	—	—	GX2CrNiMoN26-7-4	EN 10213-4	1.4469	—	—	—

Table 9 (continued)

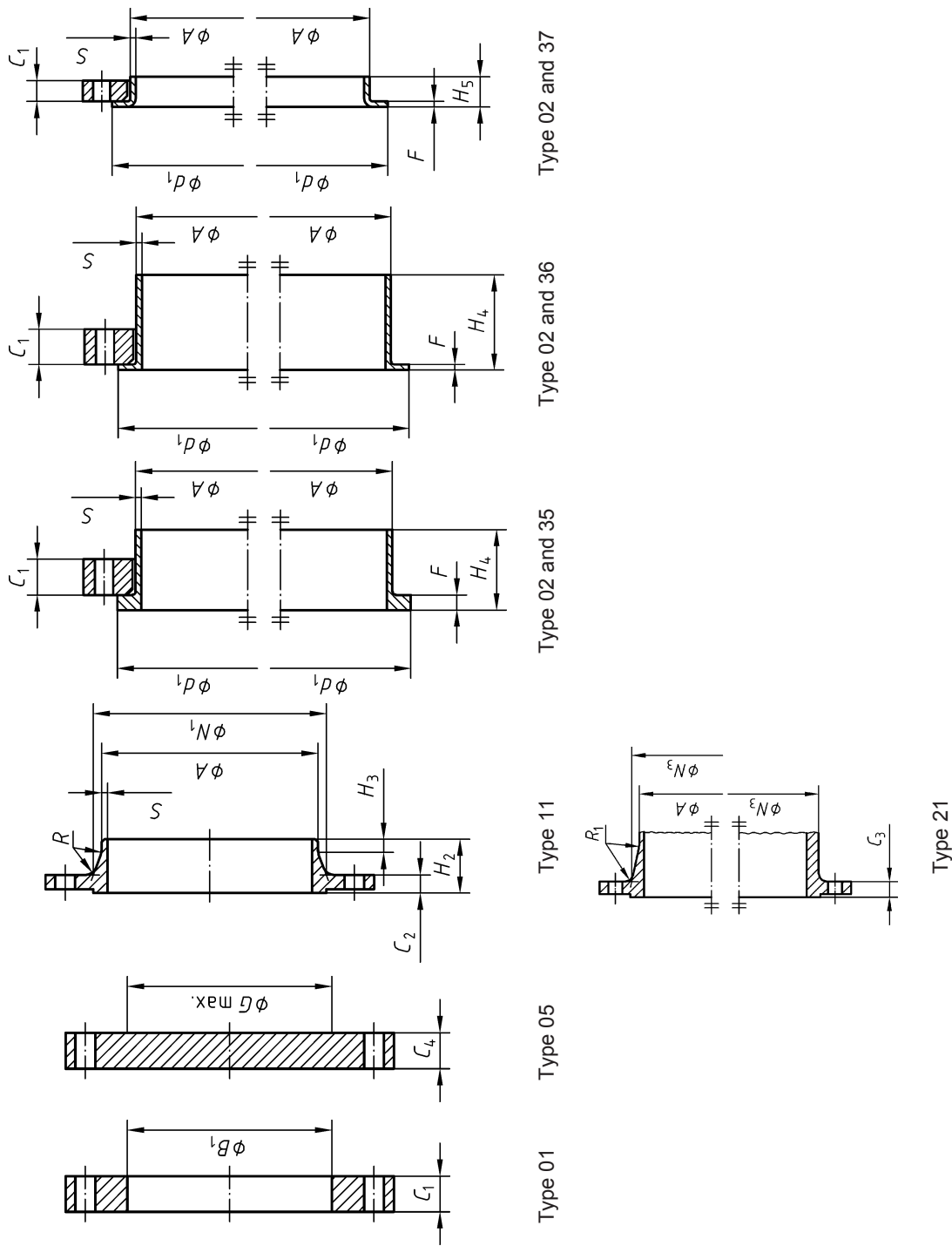
Group	Seamless tubes			Welded tubes		
	Material name	Standard	Material number	Material name	Standard	Material number
2E0	—	—	—	—	—	—
3E0	P195GH	EN 10216-2	1.0348	P195GH	EN 10217-2	1.0348
	P235GH	EN 10216-2	1.0345	P235GH	EN 10217-2	1.0345
3E1	P265GH	EN 10216-2	1.0425	P265GH	EN 10217-2	1.0425
4E0	16Mo3	EN 10216-2	1.5415	16Mo3	EN 10217-2	1.5415
5E0	13CrMo4-5	EN 10216-2	1.7335	—	—	—
6E0	10CrMo9-10	EN 10216-2	1.7380	—	—	—
6E0	11CrMo9-10	EN 10216-2	1.7383	—	—	—
6E1	14X11CrMo5+NT1 (A)	EN 10216-2	1.7362+NT1	—	—	—
7E0	P275NL1	EN 10216-3	1.0488	P275NL1	EN 10217-3	1.0488
	P275NL2	EN 10216-3	1.1104	P275NL2	EN 10217-3	1.1104
7E1	P355NL1	EN 10216-3	1.0566	P355NL1	EN 10217-3	1.0566
	P355NL2	EN 10216-3	1.1106	P355NL2	EN 10217-3	1.1106
7E2	12Ni14	EN 10216-4	1.5637	—	—	—
	X10Ni9	EN 10216-4	1.5682	—	—	—
7E3	13MnNi6-3	EN 10216-4	1.6217	—	—	—
8E0	P275NL1	EN 10216-3	1.0488	P275NL1	EN 10217-3	1.0488
8E0	P275NL2	EN 10216-3	1.1104	P275NL2	EN 10217-3	1.1104
8E2	—	—	—	—	—	—
8E3	P355NH	EN 10216-3	1.0565	P355NH	EN 10217-3	1.0565
9E0	X20CrMoV11-1	EN 10216-2	1.4922	—	—	—
9E1	X10CrMoVNb9-1	EN 10216-2	1.4903	—	—	—
10E0	X2CrNi18-9	EN 10216-5	1.4307	X2CrNi18-9	EN 10217-7	1.4307
	X2CrNi19-11	EN 10216-5	1.4306	X2CrNi19-11	EN 10217-7	1.4306
	X1CrNi25-21	EN 10216-5	1.4335	—	—	—
10E1	X2CrNi18-10	EN 10216-5	1.4311	X2CrNi18-10	EN 10217-7	1.4311
11E0	X5CrNi18-10	EN 10216-5	1.4301	X5CrNi18-10	EN 10217-7	1.4301
11E0	X6CrNi18-10	EN 10216-5	1.4948	—	—	—
12E0	X6CrNiTi18-10	EN 10216-5	1.4541	X6CrNiTi18-10	EN 10217-7	1.4541
	X6CrNiNb18-10	EN 10216-5	1.4550	X6CrNiNb18-10	EN 10217-7	1.4550
	X7CrNiTi18-10	EN 10216-5	1.4940	—	—	—
	X7CrNiTiB18-10	EN 10216-5	1.4941	—	—	—
	X7CrNiNb18-10	EN 10216-5	1.4912	—	—	—
	X8CrNiNb16-13	EN 10216-5	1.4961	—	—	—

Table 9 (concluded)

Group	Seamless tubes			Welded tubes		
	Material name	Standard	Material number	Material name	Standard	Material number
13E0	X2CrNiMo17-12-2	EN 10216-5	1.4404	X2CrNiMo17-12-2	EN 10217-7	1.4404
	—	—	—	X2CrNiMo17-12-3	EN 10217-7	1.4432
	X2CrNiMo18-14-3	EN 10216-5	1.4435	X2CrNiMo18-14-3	EN 10217-7	1.4435
	X1NiCrMoCu25-20-5	EN 10216-5	1.4539	X1NiCrMoCu25-20-5	EN 10217-7	1.4539
	X1NiCrMoCu31-27-4	EN 10216-5	1.4563	X1NiCrMoCu31-27-4	EN 10217-7	1.4563
	—	—	—	X2CrNiMo18-15-4	EN 10217-7	1.4438
13E1	X6CrNiMo17-13-2	EN 10216-5	1.4918	—	—	—
	X2CrNiMoN17-13-3	EN 10216-5	1.4429	X2CrNiMoN17-13-3	EN 10217-7	1.4429
	X2CrNiMoN17-13-5	EN 10216-5	1.4439	X2CrNiMoN17-13-5	EN 10217-7	1.4439
	X1CrNiMoN25-22-2	EN 10216-5	1.4466	—	—	—
	X1CrNiMoCuN20-18-7	EN 10216-5	1.4547	X1CrNiMoCuN20-18-7	EN 10217-7	1.4547
	X1NiCrMoCuN25-20-7	EN 10216-5	1.4529	X1NiCrMoCuN25-20-7	EN 10217-7	1.4529
14E0	X5CrNiMo17-12-2	EN 10216-5	1.4401	X5CrNiMo17-12-2	EN 10217-7	1.4401
	X3CrNiMo17-13-3	EN 10216-5	1.4436	X3CrNiMo17-13-3	EN 10217-7	1.4436
	X6CrNiMoTi17-12-2	EN 10216-5	1.4571	X6CrNiMoTi17-12-2	EN 10217-7	1.4571
	X6CrNiMoNb17-12-2	EN 10216-5	1.4580	—	—	—
16E0	X2CrNiMoS18-5-3	EN 10216-5	1.4424	—	—	—
	X2CrNiMoN22-5-3	EN 10216-5	1.4462	X2CrNiMoN22-5-3	EN 10217-7	1.4462
	X2CrNiN23-4	EN 10216-5	1.4362	X2CrNiN23-4	EN 10217-7	1.4362
	X2CrNiMoN25-7-4	EN 10216-5	1.4410	X2CrNiMoN25-7-4	EN 10217-7	1.4410
	X2CrNiMoCuN25-6-3	EN 10216-5	1.4507	—	—	—
	X2CrNiMoCuWN25-7-4	EN 10216-5	1.4501	X2CrNiMoCuWN25-7-4	EN 10217-7	1.4501



This diagram illustrates the arrangement but not necessarily the correct number of bolt holes.
Refer to the column "Bolting Number" in Table 10 for actual number.



Type 21

Dimension N_1 is measured at the intersection of the hub draft angle and the back face of the flange.
For dimension G_{max} , refer to NOTE 1 of 5.6.1.

Figure 5 — Dimensions of PN 2,5 flanges

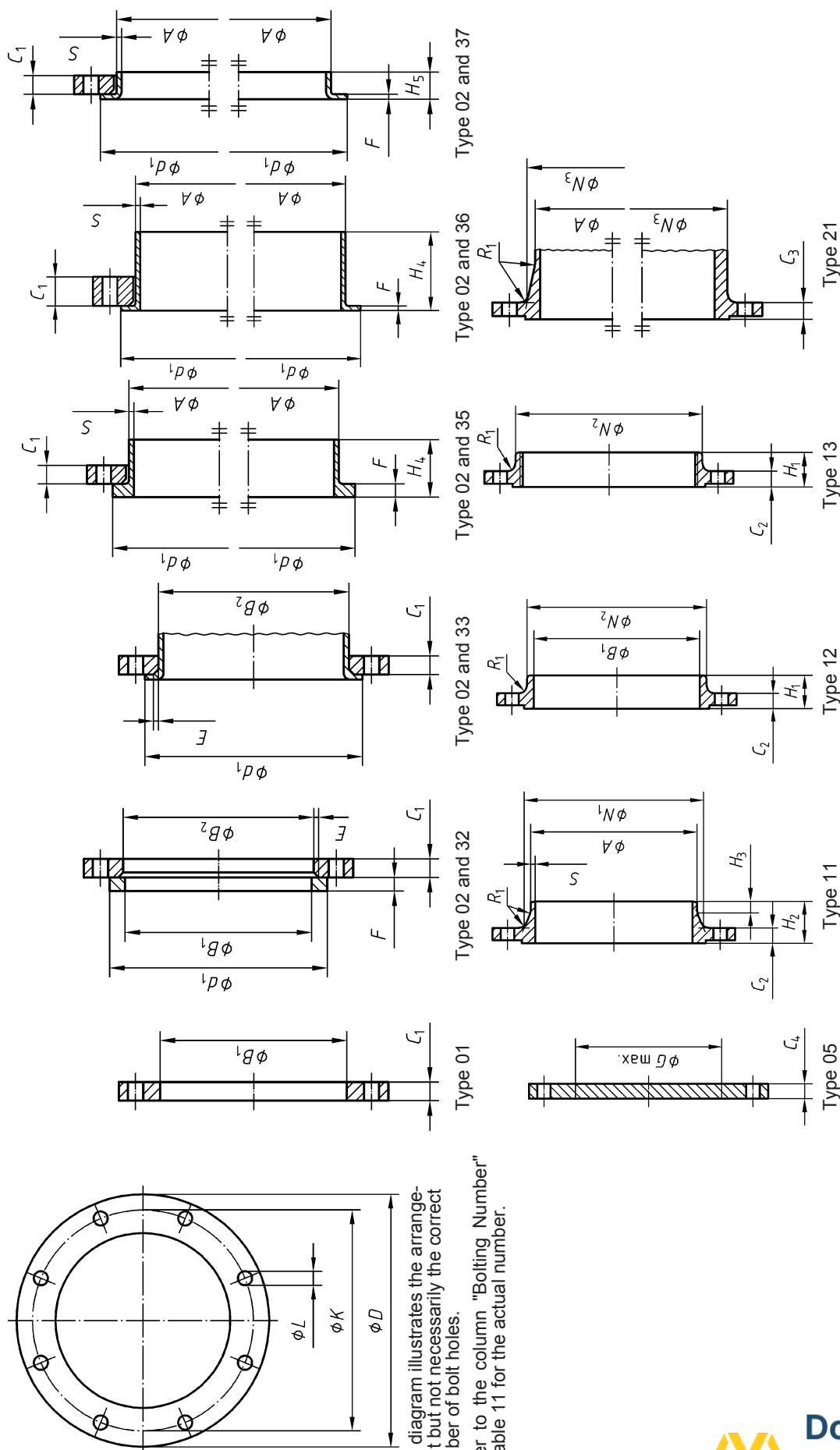
Dimensions in millimetres

See Annex A

Table 10 (continued)

Dimensions in millimetres

DN	Mating dimensions				Outside diameter of neck	Bore diameters				Flange thickness				Collar thickness				Facing diameter (A ₁)	Length					Neck diameters			Corner radii	Wall thickness (see 5.6.1)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
	Outside diameter	Diameter of bolt circle	Diameter of bolt hole	Bolting																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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Dimensions N_1 , N_2 and N_3 are measured at the intersection of the hub draft angle and the back face of the flange.

For dimension d_1 , see Table 8.

For dimensions G_{max} refer to NOTE 1 of 5.6.1.

Type 33: lapped pipe end without determination of thickness and height.

Figure 6 — Dimensions of PN 6 flanges