



SLOVENSKI STANDARD

SIST EN 1092-1:2007+A1:2013

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Nadomešča:
SIST EN 1092-1:2007

Prirobnice in prirobnični spoji - Okrogle prirobnice za cevi, ventile, fittinge in pribor z oznako PN - 1. del: Jeklene prirobnice (vključno z dopolnilom A1)

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

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

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

Ta slovenski standard je istoveten z: EN 1092-1:2007+A1:2013

ICS:

23.040.60 Prirobnice, oglavki in spojni elementi Flanges, couplings and joints

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

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

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EN 1092-1:2007+A1:2013 (E)**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of an identical text or by endorsement, at the latest by July 2013, and conflicting national standards shall be withdrawn at the latest by July 2013.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.*

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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 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.

EN 1092-1:2007+A1:2013 (E)**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)*

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A1 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)* **A1**

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)*

A1 EN ISO 9712:2012, *Non-destructive testing — Qualification and certification of NDT personnel (ISO 9712:2012)* **A1**

A1 EN ISO 11666:2010, *Non-destructive testing of welds — Ultrasonic testing — Acceptance levels (ISO 11666:2010)* **A1**

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)*

A1 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)* **A1**

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**

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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);

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- 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

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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	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.

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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 unmachined portion does not exceed the recommended diameter for G_{\max} , given in Tables 10 to 21b-8675e4782435/sist-en-1092-1-2007a1-2013

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.