

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

## Part 1: Steel flanges

The European Standard EN 1092-1:2007 has the status of a British Standard

ICS 23.040.60

# National foreword

This British Standard is the UK implementation of EN 1092-1:2007. It supersedes BS EN 1092-1:2002 which is withdrawn.

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

In BS EN 1092-1:2007, 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 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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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.

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 Management Centre or to any CEN member.

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

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## Contents

Page

|                                                                                                                                           |    |
|-------------------------------------------------------------------------------------------------------------------------------------------|----|
| Foreword.....                                                                                                                             | 4  |
| Introduction .....                                                                                                                        | 5  |
| 1 Scope .....                                                                                                                             | 6  |
| 2 Normative references .....                                                                                                              | 6  |
| 3 Terms and definitions .....                                                                                                             | 8  |
| 4 Designation .....                                                                                                                       | 9  |
| 4.1 General.....                                                                                                                          | 9  |
| 4.2 Standard designation .....                                                                                                            | 9  |
| 5 General requirements.....                                                                                                               | 10 |
| 5.1 Materials .....                                                                                                                       | 10 |
| 5.1.1 General.....                                                                                                                        | 10 |
| 5.1.2 Methods of manufacture related to base material.....                                                                                | 10 |
| 5.2 Repairs by welding .....                                                                                                              | 11 |
| 5.3 Bolting.....                                                                                                                          | 11 |
| 5.4 Gaskets .....                                                                                                                         | 11 |
| 5.5 Determination of p/t ratings .....                                                                                                    | 11 |
| 5.6 Dimensions.....                                                                                                                       | 12 |
| 5.6.1 Flanges and collars .....                                                                                                           | 12 |
| 5.6.2 Hubs.....                                                                                                                           | 12 |
| 5.6.3 Threaded flanges .....                                                                                                              | 13 |
| 5.6.4 Bolt holes.....                                                                                                                     | 13 |
| 5.6.5 Lapped joints.....                                                                                                                  | 13 |
| 5.6.6 Collar types .....                                                                                                                  | 13 |
| 5.7 Facings .....                                                                                                                         | 13 |
| 5.7.1 Types of facings.....                                                                                                               | 13 |
| 5.7.2 Jointing face finish .....                                                                                                          | 13 |
| 5.8 Surface finish of flanges and collars .....                                                                                           | 14 |
| 5.8.1 Surface finish .....                                                                                                                | 14 |
| 5.8.2 Spot facing or back facing of flanges.....                                                                                          | 15 |
| 5.9 Tolerances .....                                                                                                                      | 15 |
| 5.10 Marking .....                                                                                                                        | 15 |
| 5.10.1 General marking requirements.....                                                                                                  | 15 |
| 5.10.2 Stamping.....                                                                                                                      | 16 |
| 5.10.3 Declaration of compliance .....                                                                                                    | 16 |
| 5.11 Welding .....                                                                                                                        | 16 |
| 5.12 Inspection and testing.....                                                                                                          | 17 |
| 5.12.1 Inspection and testing of fusion welded joints .....                                                                               | 17 |
| 5.12.2 Inspection and testing of banded and electric welded flanges or collars from formed bars,<br>sectional steel or band material..... | 17 |
| 5.12.3 Inspection and testing of formed parts manufactured from base material other than forgings.....                                    | 18 |
| 5.12.4 Inspection and testing of other materials .....                                                                                    | 19 |
| 5.13 Certificates .....                                                                                                                   | 19 |
| Annex A (normative) Wall thickness and end preparation .....                                                                              | 66 |
| A.1 Weld-end preparation for flanges types 11 and 34 .....                                                                                | 66 |
| A.2 Weld-end preparation for type 35.....                                                                                                 | 69 |
| A.3 Weld end preparation for types 36 and 37 .....                                                                                        | 70 |
| Annex B (informative) Material groups .....                                                                                               | 71 |
| Annex C (informative) Approximate masses of flanges and collars.....                                                                      | 73 |
| Annex D (informative) Additional materials.....                                                                                           | 81 |
| Annex E (normative) Basis of flange calculation.....                                                                                      | 83 |
| E.1 General.....                                                                                                                          | 83 |
| E.2 Calculation method.....                                                                                                               | 83 |
| E.3 Basic rules for calculation of flange connection.....                                                                                 | 83 |

|                           |                                                                                                                           |            |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------|------------|
| E.3.1                     | General.....                                                                                                              | 83         |
| E.3.2                     | Flanges .....                                                                                                             | 83         |
| E.3.3                     | Pipes .....                                                                                                               | 84         |
| E.3.4                     | Bolting/Tightening .....                                                                                                  | 84         |
| E.3.5                     | Gasket .....                                                                                                              | 85         |
| <b>Annex F</b>            | <b>(normative) Determination of p/t-ratings .....</b>                                                                     | <b>86</b>  |
| F.1                       | General.....                                                                                                              | 86         |
| F.1.1                     | Reference temperature (RT) .....                                                                                          | 86         |
| F.1.2                     | Application limits and equations .....                                                                                    | 86         |
| F.2                       | Symbols, descriptions and units .....                                                                                     | 86         |
| F.2.1                     | General.....                                                                                                              | 86         |
| F.2.2                     | p/t-Ratings for materials with time independent nominal design stress .....                                               | 87         |
| F.2.3                     | p/t-Ratings for materials with time dependent nominal design stress .....                                                 | 87         |
| F.2.4                     | Reference value for thickness ( $v_R$ ).....                                                                              | 87         |
| F.2.5                     | Nominal design stresses and safety factors for mean creep rupture strength .....                                          | 87         |
| F.2.6                     | Flanges made from steel castings .....                                                                                    | 88         |
| F.2.7                     | Rounding of maximum allowable pressure at temperature .....                                                               | 88         |
| <b>Annex G</b>            | <b>(normative) p/t-ratings for a selection of EN materials .....</b>                                                      | <b>89</b>  |
| G.1                       | General.....                                                                                                              | 89         |
| G.1.1                     | p/t-ratings .....                                                                                                         | 89         |
| G.1.2                     | Basics of determination of p/t-ratings (see Annex F) .....                                                                | 89         |
| G.1.3                     | Application limits for creep range .....                                                                                  | 89         |
| G.2                       | Non-austenitic steels.....                                                                                                | 90         |
| G.2.1                     | General.....                                                                                                              | 90         |
| G.2.2                     | List of materials .....                                                                                                   | 91         |
| G.2.3                     | p/t-Ratings .....                                                                                                         | 92         |
| G.3                       | Austenitic and austenitic-ferritic steels .....                                                                           | 104        |
| G.3.1                     | General.....                                                                                                              | 104        |
| G.3.2                     | List of materials .....                                                                                                   | 104        |
| G.3.3                     | p/t-Ratings .....                                                                                                         | 105        |
| <b>Annex H</b>            | <b>(informative) Rings for tongue and groove flanges .....</b>                                                            | <b>112</b> |
| <b>Annex I</b>            | <b>(informative) Flanges with fixed inner diameter .....</b>                                                              | <b>113</b> |
| I.1                       | General.....                                                                                                              | 113        |
| I.2                       | Scope .....                                                                                                               | 113        |
| <b>Annex J</b>            | <b>(informative) Mating dimensions for flanges with higher DN .....</b>                                                   | <b>116</b> |
| <b>Annex ZA</b>           | <b>(normative) Relationship between this European Standard and the Essential Requirements of Directive 97/23/EC .....</b> | <b>118</b> |
| <b>Bibliography</b> ..... |                                                                                                                           | <b>120</b> |
| <b>National Annex NA</b>  | <b>(informative) to BS EN 1092-1:2007 .....</b>                                                                           | <b>122</b> |

## Foreword

This document (EN 1092-1:2007) 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 February 2008, and conflicting national standards shall be withdrawn at the latest by February 2008.

This document supersedes EN 1092-1:2001.

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 organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and 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 neck thickness 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

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

EN 287-1:2004, *Qualification test of welders — Fusion welding — Part 1: Steels*

EN 473:2000, *Non destructive testing — Qualification and certification of NDT personnel — General principles*

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*

EN 970:1997, *Non-destructive examination of fusion welds — Visual examination*

EN 1289:1998, *Non-destructive examination of welds — Penetrant testing of welds — Acceptance levels*

EN 1290:1998, *Non-destructive examination of welds — Magnetic particle examination of welds*

EN 1291:1998, *Non-destructive examination of welds — Magnetic particle testing of welds — Acceptance levels*

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*

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

EN 1708-1:1999, *Welding — Basic weld joint details in steel — Part 1: Pressurized components*

EN 1712:1997, *Non-destructive examination of welds — Ultrasonic examination of welded joints — Acceptance levels*

EN 1714:1997, *Non destructive examination of welds — Ultrasonic examination of welded joints*

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

EN 10028-2:2003, *Flat products made of steels for pressure purposes — Part 2: Non-alloy and alloy steels with specified elevated temperature properties*

- EN 10028-3:2003, *Flat products made of steels for pressure purposes — Part 3: Weldable fine grain steels, normalized*
- EN 10028-4:2003, *Flat products made of steels for pressure purposes — Part 4: Nickel alloy steels with specified low temperature properties*
- EN 10028-7:2000, *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, *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 10272:2000, *Stainless steel bars for pressure purposes*
- EN 10273:2000, *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 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)*

EN ISO 5817:2003, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections (ISO 5817:2003)*

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)*

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)*

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) and material and material standard (if necessary);
- 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, neck thickness 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.

NOTE 1 The materials given in Table 9 (see also Annex D) are tabulated in groups.

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 <sup>a</sup> | Casted | Made from flat products (plates) | Machined from rolled or forged bars and forged sectional steel | Bended and electric welded form bars, sectional steel or strip<br>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<br>≥ 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                              | yes                                                            | yes                                                                          | yes                                                    |
| 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                              | no                                                             | yes                                                                          | yes                                                    |

<sup>a</sup> Seamless rolled, pressed, forged.

<sup>b</sup> Only one radial weld is allowed under DN 1800.

<sup>c</sup> For welding see 5.11.

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

<sup>e</sup> 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 neck thickness 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 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  $7^\circ$  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

For collar types 33, 36 and 37 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** Flanges type 05 up to PN 40 and collars (except types 33, 36 and 37) shall have type A facing, other flanges shall have type B1 facings; unless type B2 facing is agreed between the purchaser and the supplier.

**Table 2 — Surface finish for jointing faces**

| Facing types                                                                                                                                                                                                                                                                                                                                                                                                                                    | Method of machining  | Radius of tool nose<br>mm | $R_a^a$<br>µm |      | $R_z^a$<br>µm |      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------------|---------------|------|---------------|------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                      | min.                      | min.          | max. | min.          | max. |
| A, B1 <sup>b</sup> , E, F                                                                                                                                                                                                                                                                                                                                                                                                                       | Turning <sup>c</sup> | 1,0                       | 3,2           | 12,5 | 12,5          | 50   |
| B2 <sup>b</sup> , C, D, G, H                                                                                                                                                                                                                                                                                                                                                                                                                    | Turning <sup>c</sup> | —                         | 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.                                                                                                                                                                                                                                                                                                               |                      |                           |               |      |               |      |
| <sup>a</sup> $R_a$ and $R_z$ are defined in EN ISO 4287.<br><sup>b</sup> Types B1 and B2 are raised face (type B) flanges with different specified surface roughness values.<br>B1 : Standard facing for all PN numbers.<br>B2 : Only if agreed between the purchaser and the flange manufacturer.<br><sup>c</sup> 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          | Rz max           | Ra max               | Rz max           |            |             |
| 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 <sup>a</sup> | 160 <sup>a</sup> | 25 <sup>a</sup>      | 160 <sup>a</sup> | b          | c           |
| 12 (Hubbed slip-on flange for welding)                                                                                                                        | 25 <sup>a</sup> | 160 <sup>a</sup> | 25 <sup>a</sup>      | 160 <sup>a</sup> | b          | c           |
| 13 (Hubbed threaded flange)                                                                                                                                   | 25 <sup>a</sup> | 160 <sup>a</sup> | See thread standard  |                  | b          | c           |
| 21 (Integral flange)                                                                                                                                          | 25 <sup>a</sup> | 160 <sup>a</sup> | 25 <sup>a</sup>      | 160 <sup>a</sup> |            | c           |
| 32 (Weld-on plate collar)                                                                                                                                     | 25              | 160              | 25                   | 160              |            |             |
| 33 (Lapped end pipe)                                                                                                                                          | 25              | 160              | 25                   | 160              |            |             |
| 34 (Weld-neck collar)                                                                                                                                         | 25 <sup>a</sup> | 160 <sup>a</sup> | 25 <sup>a</sup>      | 160 <sup>a</sup> |            |             |
| 35 (Welding neck)                                                                                                                                             | 25 <sup>a</sup> | 160 <sup>a</sup> | 25 <sup>a</sup>      | 160 <sup>a</sup> |            |             |
| 36 (Pressed collar with long neck)                                                                                                                            | 25 <sup>a</sup> | 160 <sup>a</sup> | 25 <sup>a</sup>      | 160 <sup>a</sup> |            |             |
| 37 (Pressed collar)                                                                                                                                           | 25 <sup>a</sup> | 160 <sup>a</sup> | 25 <sup>a</sup>      | 160 <sup>a</sup> |            |             |
| <sup>a</sup> Or up to PN 40 un-machined.<br><sup>b</sup> Bolt holes > PN 40 only drilled.<br><sup>c</sup> 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;
- PN designation, e.g. PN 40 (marking according to synoptic Table 7, other marking with lower PN number, for identical dimensions only, may be specified);

- f) wall thickness ( $S$ ), if not according to this European Standard;
- g) for EN materials — 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:

- i. flange/collar manufacturer's name or trade mark;
- ii. letters "EN";
- iii. PN designation e.g. PN 40;
- iv. either the name or the number or the grade of the material;
- v. cast number and/or suitable identification and/or identification number for the traceability of the cast.

### 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 EN 970 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 10<sup>th</sup> radial weld of rings shall have 100 % volumetric testing. Every 10<sup>th</sup> 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 10<sup>th</sup> flange shall have surface crack detection of welds (MT or PT).

**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 970                                                                           | EN ISO 5817:2003, 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 1714:1997, min. class B <sup>a</sup>                                          | EN 1712:1997, Acceptance level 2 + no planar imperfections accepted |
| Penetrant Testing (PT)                                                                         | EN 571-1:1997 + test parameter to EN 1289:1998<br>Table A.1 – Acceptance level 1 | EN 1289:1998, Acceptance level 1                                    |
| Magnetic Particle Testing (MT)                                                                 | EN 1290:1998 + test parameter to EN 1291:1998, Table A.1 – Acceptance level 1    | EN 1291:1998, Acceptance level 1                                    |
| <sup>a</sup> Thickness $t < 40$ mm class A is acceptable. By $t > 100$ mm class C is required. |                                                                                  |                                                                     |

NDT operators (Level 1) and supervisor (Level 2) shall be qualified and certified in accordance with EN 473.

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

- a) Welded joints shall be visually examined in accordance with EN 970 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 10160:1999, Table 3, acceptance criteria Class S<sub>2</sub> and EN 10160:1999, Table 5 Class E<sub>3</sub>.
- d) Flanges made of steels in Material Groups 1E0, 1E1, 2E0 and 3E1 are subjected by the flange manufacturer to ultrasonic testing or to radiographic testing with reference to Table 5 to the extend 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 are subjected 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 ≤ 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);

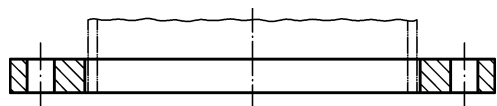
One set of test per cast, wall thickness range and heat treatment lot shall be performed for flanges and collars with  $PN \times DN > 1\,000$  bar and  $DN > 25$ . The tests shall be performed on test pieces from the component itself, or from test pieces placed together with the components in the heat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

#### **5.12.4 Inspection and testing of other materials**

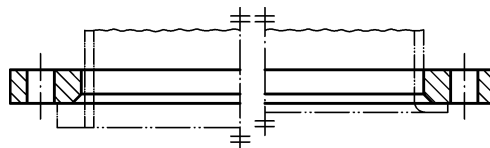
Flanges made of forgings, casts, bars, pressed and seamless rolled materials shall be inspected and tested by the material manufacturer in accordance with the appropriate material standard.

#### **5.13 Certificates**

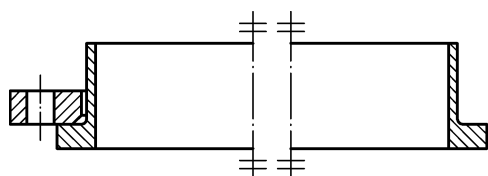
The flange manufacturer shall use respective procedures to ensure traceability of material and to avoid material exchange and shall be able to provide respective documentation for the base material used. Under consideration of EN 764-5, the purchaser of the flange may require a test certificate according 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.



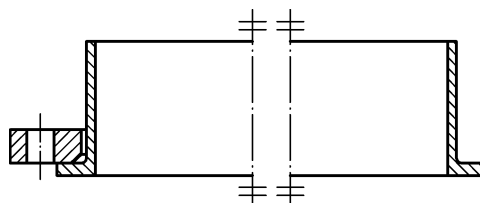
Type 01  
Plate flange for welding



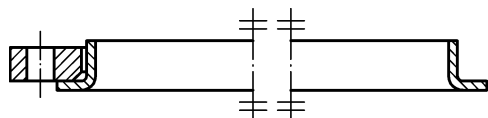
Type 02  
Loose plate flange with weld-on collar (see type 32) or  
lapped pipe end (see type 33)



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



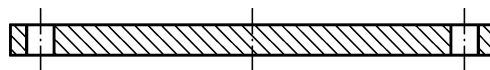
Type 02  
Loose plate flange  
with pressed collar with long neck (see type 36)



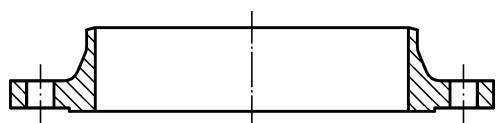
Type 02  
Loose plate flange  
with pressed collar (see type 37)



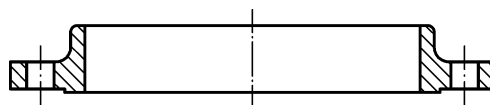
Type 04  
Loose plate flange with weld-neck collar (see type 34)



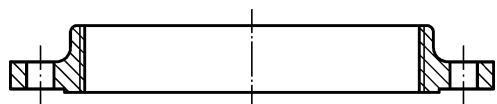
Type 05  
Blind flange



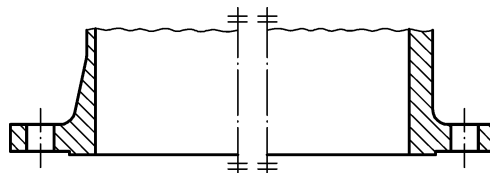
Type 11  
Weld-neck flange



Type 12  
Hubbed slip-on flange for welding



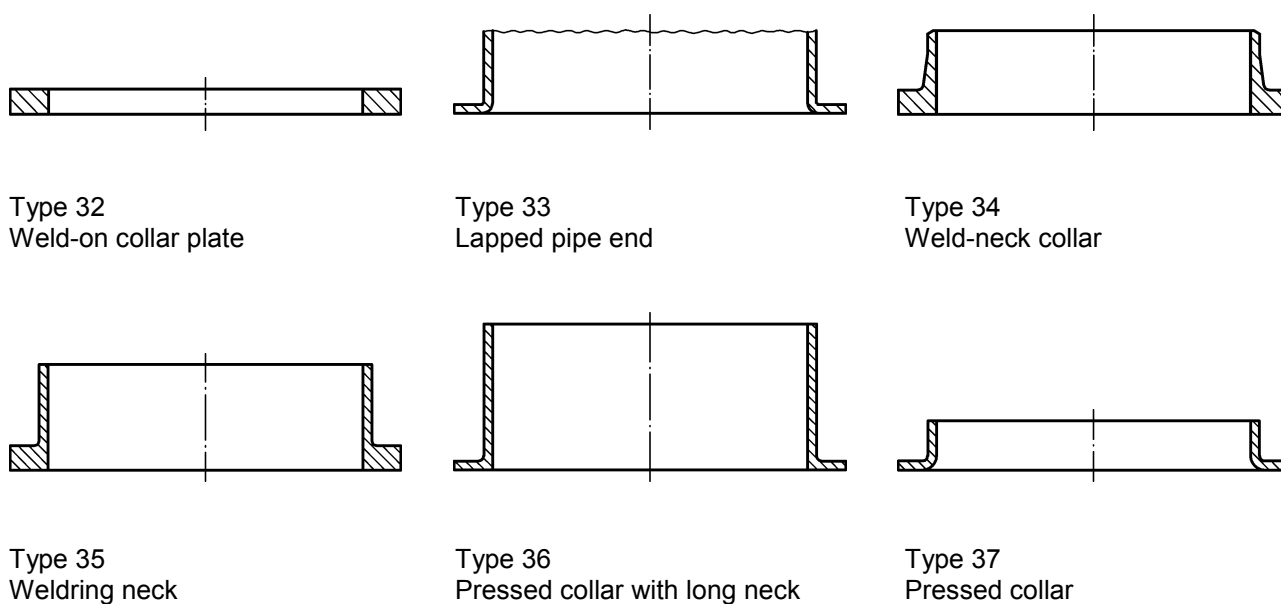
Type 13  
Hubbed threaded flange



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

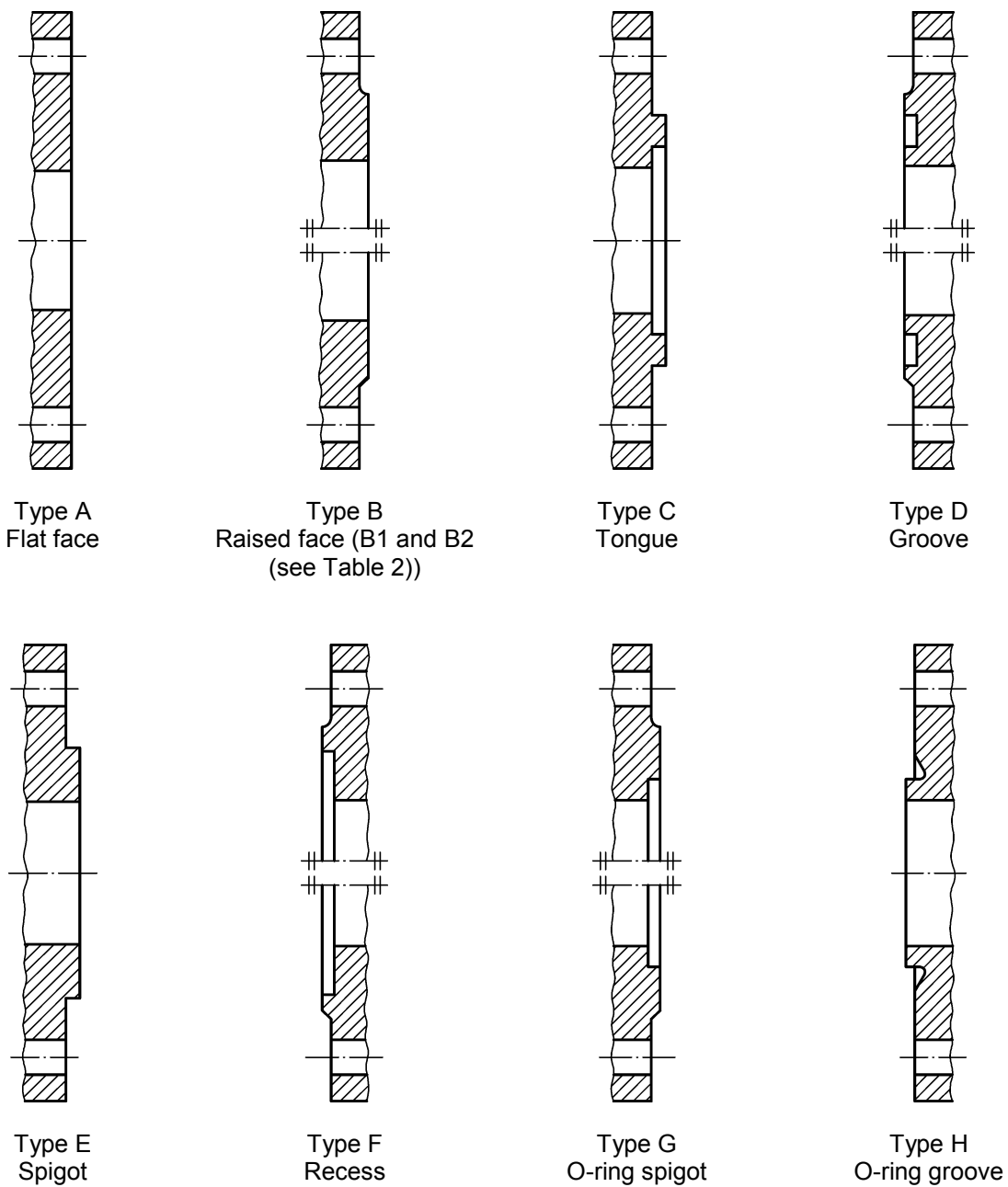


NOTE These sketches are diagrammatic only.

Figure 2 — Collars types 32 to 37

Table 6 — Types of steel flanges and collars

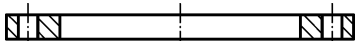
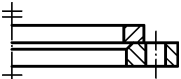
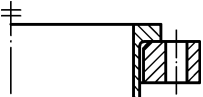
| Type No                                                                                                                           | Description                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| 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 <sup>a</sup>                                                                                                                   | Integral flange                                                     |
| 32 <sup>b</sup>                                                                                                                   | Weld-on plate collar                                                |
| 33 <sup>a, b</sup>                                                                                                                | Lapped pipe end                                                     |
| 34 <sup>b</sup>                                                                                                                   | Weld-neck collar                                                    |
| 35 <sup>b</sup>                                                                                                                   | Welding neck                                                        |
| 36 <sup>b</sup>                                                                                                                   | Pressed collar with long neck                                       |
| 37 <sup>b</sup>                                                                                                                   | Pressed collar                                                      |
| NOTE Type numbers have been made non-consecutive to permit possible future additions.                                             |                                                                     |
| <sup>a</sup> This is an integral part of a pressure equipment or a component.                                                     |                                                                     |
| <sup>b</sup> 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<br>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 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|--------------------------------------------------------------------------------------------------------|----------|----------------------------------|----|----|----|----|----|---------------------------------|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| <br>Type 01           | 2,5      | dimensions identical with PN 6   |    |    |    |    |    |                                 |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |       | 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     |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                        | 10       | dimensions identical with PN 40  |    |    |    |    |    | dimensions identical with PN 16 |    |    |     |     |     | 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     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                        | 25       | dimensions identical with PN 40  |    |    |    |    |    |                                 |    |    |     |     |     | 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   |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                        | 63       | dimensions identical with PN 100 |    |    |    |    |    | 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   |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <br>Types 02 and 32   | 2,5      | dimensions identical with PN 6   |    |    |    |    |    |                                 |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                        | 6        | 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   |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                        | 16       | dimensions identical with PN 40  |    |    |    |    |    | 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   |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                        | 40       | X                                | X  | X  | X  | X  | X  | X                               | X  | X  | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   | X   |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <br>Types 02 and 35 | 2,5      | dimensions identical with PN 6   |    |    |    |    |    |                                 |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                        | 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     |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                        | 10       | dimensions identical with PN 40  |    |    |    |    |    | dimensions identical with PN 16 |    |    |     |     |     | 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     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                        | 25       | dimensions identical with PN 40  |    |    |    |    |    | 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   |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

EN 1092-1:2007 (E)

Table 7 (continued)

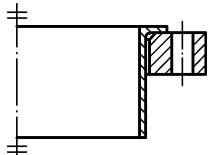
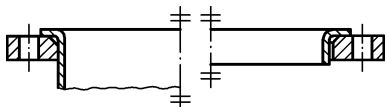
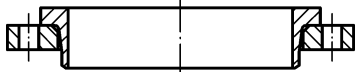
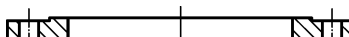
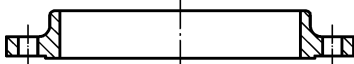
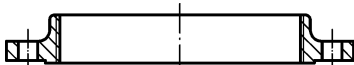
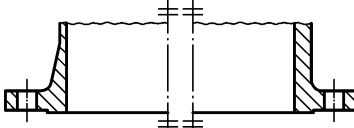
| Flange type or collar type                                                                              | DN<br>PN | 10                              | 15 | 20 | 25 | 32 | 40 | 50                              | 65 | 80 | 100 | 125 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 600 | 700 | 800 | 900 | 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 |  |  |  |  |  |  |  |
|---------------------------------------------------------------------------------------------------------|----------|---------------------------------|----|----|----|----|----|---------------------------------|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|--|--|--|--|--|--|
| <br>Type 02 and 36     | 2,5      | dimensions identical with PN 10 |    |    |    |    |    |                                 |    |    |     |     |     |     |     |     |     |     |     | X   | X   |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |
|                                                                                                         | 6        | dimensions identical with PN 10 |    |    |    |    |    |                                 |    |    |     |     |     |     |     |     |     |     |     | X   | X   |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |
|                                                                                                         | 10       | dimensions identical with PN 16 |    |    |    |    |    |                                 |    |    |     |     |     |     | X   | X   | X   | X   | X   |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |
|                                                                                                         | 16       | X                               | X  | X  | X  | X  | X  | X                               | X  | X  | X   | X   | X   | X   | X   | X   | X   | X   | X   |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |
| <br>Types 02 and 33/37 | 2,5      | dimensions identical with PN 10 |    |    |    |    |    |                                 |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |
|                                                                                                         | 6        | dimensions identical with PN 10 |    |    |    |    |    |                                 |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |
|                                                                                                         | 10       | 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   |     |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |
| <br>Types 04 and 34    | 10       | dimensions identical with PN 40 |    |    |    |    |    | dimensions identical with PN 16 |    |    |     |     |     | 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   |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |
|                                                                                                         | 25       | dimensions identical with PN 40 |    |    |    |    |    |                                 |    |    |     |     |     |     | 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   |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |  |  |  |

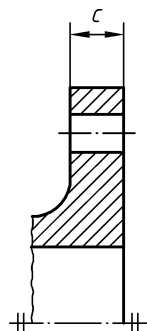
Table 7 (continued)

| Flange type or collar type                                                                     | DN<br>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 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|------------------------------------------------------------------------------------------------|----------|---------------------------------|----|----|----|----|----|---------------------------------|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| <br>Type 05   | 2,5      | dimensions identical with PN 6  |    |    |    |    |    |                                 |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 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     |       |       |       |       |       |       |       |       |       |       |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|                                                                                                | 10       | dimensions identical with PN 40 |    |    |    |    |    | dimensions identical with PN 16 |    |    |     |     |     | 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     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|                                                                                                | 25       | dimensions identical with PN 40 |    |    |    |    |    |                                 |    |    |     |     |     | 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   |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|                                                                                                | 63       | ←Use PN 100→                    |    |    |    |    |    | 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   |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| <br>Type 11 | 2,5      | dimensions identical with PN 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |

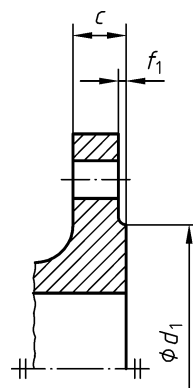
EN 1092-1:2007 (E)

Table 7 (concluded)

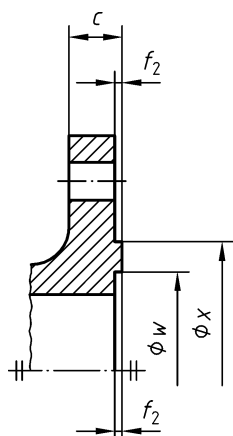
| Flange type or collar type                                                                     | DN<br>PN | 10                               | 15 | 20 | 25 | 32 | 40 | 50                              | 65 | 80 | 100 | 125 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 600 | 700 | 800 | 900 | 1 000 | 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 |   |   |   |   |   |   |   |
|------------------------------------------------------------------------------------------------|----------|----------------------------------|----|----|----|----|----|---------------------------------|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---|---|---|---|---|---|---|
| <br>Type 12   | 6        | 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   |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |   |   |   |   |   |   |   |
|                                                                                                | 16       | dimensions identical with PN 40  |    |    |    |    |    | 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   |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |   |   |   |   |   |   |   |
|                                                                                                | 40       | 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   |     |     |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |   |   |   |   |   |   |   |
|                                                                                                | 100      | X                                | X  | X  | X  | X  | X  | X                               | X  | X  | X   | X   | X   |     |     |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |   |   |   |   |   |   |   |
| <br>Type 13   | 6        | 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   |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |   |   |   |   |   |   |   |
|                                                                                                | 16       | dimensions identical with PN 40  |    |    |    |    |    | 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   |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |   |   |   |   |   |   |   |
|                                                                                                | 40       | 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   |     |     |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |   |   |   |   |   |   |   |
|                                                                                                | 100      | X                                | X  | X  | X  | X  | X  | X                               | X  | X  | X   | X   | X   |     |     |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |   |   |   |   |   |   |   |
| <br>Type 21 | 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     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |   |   |   |   |   |   |   |
|                                                                                                | 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     | 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     | 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 | 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   |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |   |   |   |   |   |   |   |
|                                                                                                | 63       | dimensions identical with PN 100 |    |    |    |    |    | 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   |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |   |   |   |   |   |   |   |
|                                                                                                | 160      | 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   |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |   |   |   |   |   |   |   |
|                                                                                                | 320      | 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   |     |     |     |     |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |   |   |   |   |   |   |   |



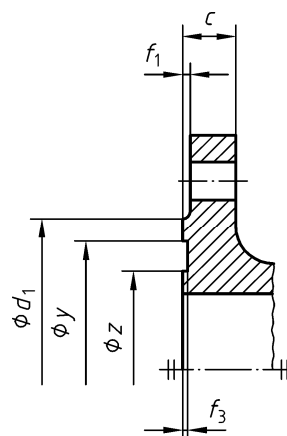
Type A: Flat face



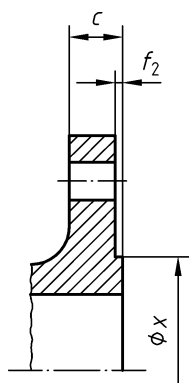
Type B: Raised face (B1 and B2)



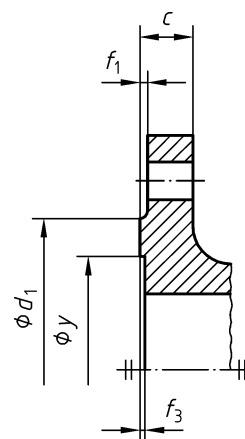
Type C: Tongue



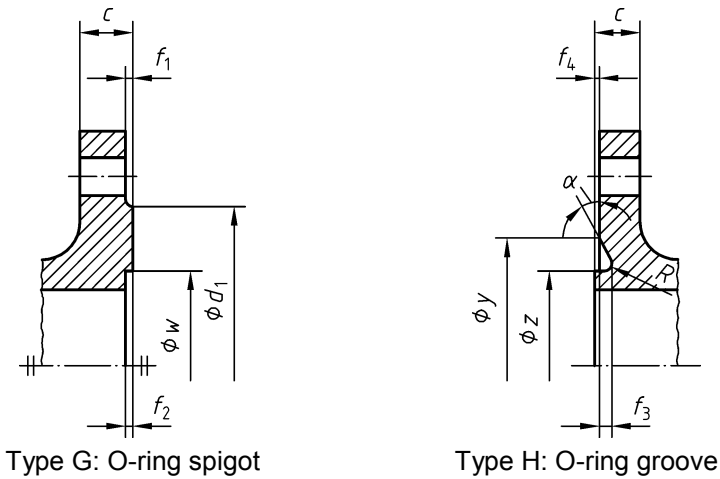
Type D: Groove



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 <sup>a</sup> | PN 6 <sup>a</sup> | 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     | 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    | —                | 2,5 |
| 15    | 40                  | 40                | 45    | 45    | 45    | 45    | 45    | 45     | 45     | 45     | 45     | 45     |       |       |       |       | 29    | 39  | 40  | 28    | —                |     |
| 20    | 50                  | 50                | 58    | 58    | 58    | 58    | 58    | 58     | 58     | 58     | 58     | 58     |       |       |       |       | 36    | 50  | 51  | 35    | 41°              |     |
| 25    | 60                  | 60                | 68    | 68    | 68    | 68    | 68    | 68     | 68     | 68     | 68     | 68     |       |       |       |       | 43    | 57  | 58  | 42    |                  |     |
| 32    | 70                  | 70                | 78    | 78    | 78    | 78    | 78    | 78     | 78     | 78     | 78     | 78     |       |       |       |       | 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    |       |       |       |       | 106   | 120 | 121 | 105   |                  |     |
| 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    | —      | 292   | 312   | 313   | 291   | 27°   |     |     |       |                  |     |
| 300   | 365                 | 365               | 370   | 378   | 395   | 410   | 410   | 410    | 410    | —      | —      | —      | 343   | 363   | 364   | 342   |       |     |     |       |                  |     |
| 350   | 415                 | 415               | 430   | 438   | 450   | 465   | 465   | 465    | —      | —      | —      | —      | 395   | 421   | 422   | 394   |       |     |     |       |                  |     |
| 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   | —      | —      | —      | —      | —      | 751   | 777   | 778   | 750   |       |     |     |       |                  |     |
| 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   |       | 28° |     |       |                  |     |
| 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 | —     | —      | —      | —      | —      | —      | 1 462 | 1 492 | 1 494 | 1 460 |       |     |     |       |                  |     |
| 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 | —     | —     | —     | —     | —      | —      | —      | —      | —      | —     | —     | —     | —     |       |     |     |       |                  |     |
| 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             | —     | —     | —     | —     | —     | —      | —      | —      | —      | —      | —     | —     | —     | —     |       |     |     |       |                  |     |
| 3 600 | 3 720               | 3 790             | —     | —     | —     | —     | —     | —      | —      | —      | —      | —      | —     | —     | —     | —     |       |     |     |       |                  |     |
| 3 800 | 3 920               | —                 | —     | —     | —     | —     | —     | —      | —      | —      | —      | —      | —     | —     | —     | —     |       |     |     |       |                  |     |
| 4 000 | 4 120               | —                 | —     | —     | —     | —     | —     | —      | —      | —      | —      | —      | —     | —     | —     | —     |       |     |     |       |                  |     |

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

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

## EN 1092-1:2007 (E)

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          |
|       | —                 | —          | —               | 10CrMo9-10    | EN 10028-2 | 1.7380          | —             | —          | —               | 10CrMo9-10    | EN 10273 | 1.7380          |
| 6E1   | X16CrMo5-1<br>+NT | EN 10222-2 | 1.7366          | —             | —          | —               | GX15CrMo5     | EN 10213-2 | 1.7365          | —             | —        | —               |
| 7E0   | —                 | —          | —               | P275NL1       | EN 10028-3 | 1.0488          | G17Mn5        | EN 10213-3 | 1.1131          | —             | —        | —               |
|       | —                 | —          | —               | P275NL2       | EN 10028-3 | 1.1104          | G20Mn5        | EN 10213-3 | 1.6220          | —             | —        | —               |
| 7E1   | —                 | —          | —               | P355NL1       | EN 10028-3 | 1.0566          | —             | —          | —               | —             | —        | —               |
|       | —                 | —          | —               | P355NL2       | EN 10028-3 | 1.1106          | —             | —          | —               | —             | —        | —               |
| 7E2   | 15NiMn6           | EN 10222-3 | 1.6228          | 15NiMn6       | EN 10028-4 | 1.6228          | G9Ni10        | EN 10213-3 | 1.5636          | —             | —        | —               |
|       | —                 | —          | —               | 11MnNi5-3     | EN 10028-4 | 1.6212          | —             | —          | —               | —             | —        | —               |
|       | 13MnNi6-3         | EN 10222-3 | 1.6217          | 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          | —             | —        | —               |
|       | X12Ni5            | EN 10222-3 | 1.5680          | X12Ni5        | EN 10028-4 | 1.5680          | —             | —          | —               | —             | —        | —               |
|       | X8Ni9             | EN 10222-3 | 1.5662          | X8Ni9         | EN 10028-4 | 1.5662          | —             | —          | —               | —             | —        | —               |
| 8E0   | —                 | —          | —               | —             | —          | —               | —             | —          | —               | —             | —        | —               |
| 8E2   | P285NH            | EN 10222-4 | 1.0477          | P275NH        | EN 10028-3 | 1.0487          | —             | —          | —               | P275NH        | EN 10273 | 1.0487          |
|       | P285QH            | EN 10222-4 | 1.0478          | —             | —          | —               | —             | —          | —               | —             | —        | —               |
| 8E3   | P355NH            | EN 10222-4 | 1.0565          | P355N         | EN 10028-3 | 1.0562          | —             | —          | —               | P355NH        | EN 10273 | 1.0565          |
|       | P355QH1           | EN 10222-4 | 1.0571          | P355NH        | EN 10028-3 | 1.0565          | —             | —          | —               | P355QH        | EN 10273 | 1.8867          |
| 9E0   | X20CrMoV11-1      | EN 10222-2 | 1.4922          | —             | —          | —               | GX23CrMoV12-1 | EN 10213-2 | 1.4931          | —             | —        | —               |
| 9E1   | X10CrMoVNb9-1     | EN 10222-2 | 1.4903          | 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          |
|       | —                 | —          | —               | X2CrNi19-11   | EN 10028-7 | 1.4306          | —             | —          | —               | X2CrNi19-11   | EN 10272 | 1.4306          |
| 10E0  | —                 | —          | —               | X1CrNi25-21   | EN 10028-7 | 1.4335          | —             | —          | —               | —             | —        | —               |
| 10E1  | X2CrNiN18-10      | EN 10222-5 | 1.4311          | X2CrNiN18-10  | EN 10028-7 | 1.4311          | —             | —          | —               | X2CrNiN18-10  | 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          |
|       | 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          |
|       | X1NiCrMoCu25-20-5 | 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          |
|       | —                 | —          | —               | X6CrNiMoNb17-12-2  | EN 10028-7 | 1.4580          | GX5CrNiMoNb19-11-2   | EN 10213-4 | 1.4581          | X6CrNiMoNb17-12-2  | EN 10272   | 1.4580          |
| 16E0  | —                 | —          | —               | —                  | —          | —               | 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          | —                  | —          | —               |

## EN 1092-1:2007 (E)

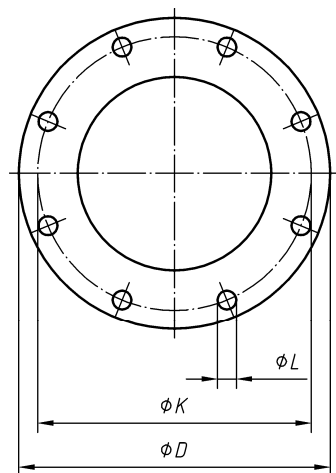
Table 9 (continued)

| 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   | X11CrMo5-1+NT1 | 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  | X2CrNiN18-10   | EN 10216-5 | 1.4311          | X2CrNiN18-10  | 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)

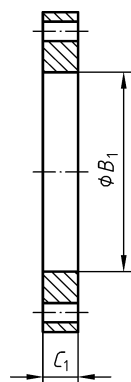
| Group | Seamless tubes     |            |                 | Welded tubes       |            |                 |
|-------|--------------------|------------|-----------------|--------------------|------------|-----------------|
|       | Material name      | Standard   | Material number | Material name      | 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          |
|       | —                  | —          | —               | X2CrNiMoN18-15-4   | 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          |
| 15E0  | 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          |

EN 1092-1:2007 (E)

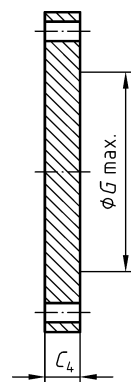


This diagram illustrates the arrangement but not necessarily the correct number of bolt holes.

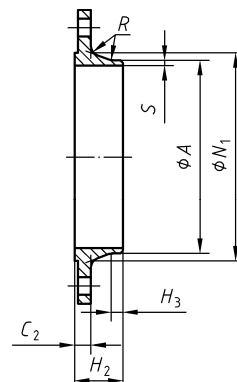
Refer to the column "Bolting Number" in Table 10 for actual number.



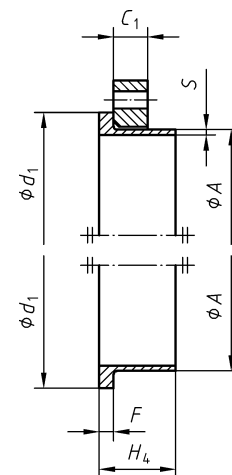
Type 01



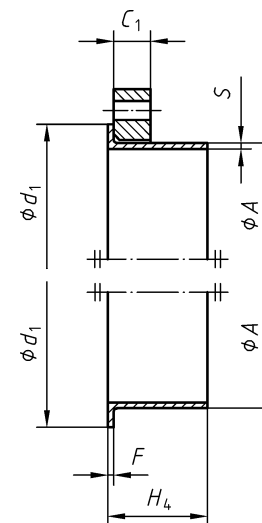
Type 05



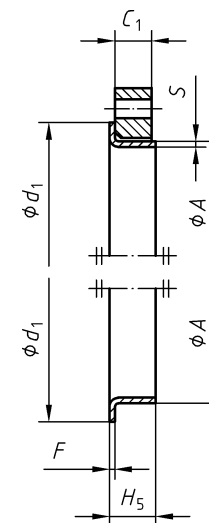
Type 11



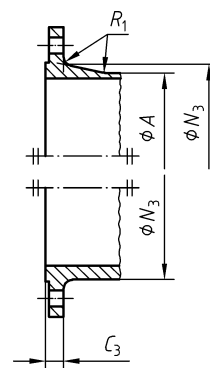
Type 02 and 35



Type 02 and 36



Type 02 and 37



Type 21

NOTE 1 Dimension  $N_1$  is measured at the intersection of the hub draft angle and the back face of the flange.

NOTE 2 For dimension  $G_{\text{max}}$ , refer to NOTE 1 of 5.6.1.

Figure 5 — Dimensions of PN 2,5 flanges

Table 10 — Dimensions of PN 2,5 flanges

Dimensions in millimetres

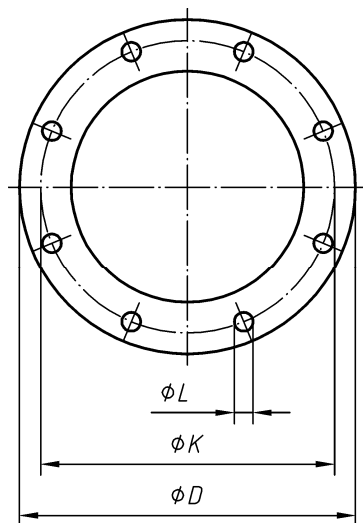
| DN                 | Mating dimensions |                         |                       |         |                     | Outside diameter of neck | Bore diameters        |                       | Flange thickness      |                       |                       |                       | Collar thickness |     |       |     | Diameter of shoulder    | Length                |                       |                       |                       |                       | Neck diameters        |                       | Corner radii | Wall thickness (see 5.6.1) |
|--------------------|-------------------|-------------------------|-----------------------|---------|---------------------|--------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------|-----|-------|-----|-------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|--------------|----------------------------|
|                    | Outside diameter  | Diameter of bolt circle | Diameter of bolt hole | Bolting |                     |                          |                       |                       |                       |                       |                       |                       |                  |     |       |     |                         |                       |                       |                       |                       |                       |                       |                       |              |                            |
|                    |                   |                         |                       | Number  | Size                |                          |                       |                       |                       |                       |                       |                       |                  |     |       |     |                         |                       |                       |                       |                       |                       |                       |                       |              |                            |
|                    | <i>D</i>          | <i>K</i>                | <i>L</i>              | Number  | Size                | <i>A</i>                 | <i>B</i> <sub>1</sub> | <i>B</i> <sub>2</sub> | <i>C</i> <sub>1</sub> | <i>C</i> <sub>2</sub> | <i>C</i> <sub>3</sub> | <i>C</i> <sub>4</sub> | <i>F</i>         |     |       |     | <i>G</i> <sub>max</sub> | <i>H</i> <sub>2</sub> | <i>H</i> <sub>3</sub> | <i>H</i> <sub>4</sub> | <i>H</i> <sub>5</sub> | <i>N</i> <sub>1</sub> | <i>N</i> <sub>3</sub> | <i>R</i> <sub>1</sub> | <i>S</i>     |                            |
| Flange type        |                   |                         |                       |         |                     |                          |                       |                       |                       |                       |                       |                       |                  |     |       |     |                         |                       |                       |                       |                       |                       |                       |                       |              |                            |
| 01, 02, 05, 11, 21 |                   |                         |                       |         | 11<br>21<br>35 — 37 | 01<br>32                 | 02                    | 01<br>02              | 11<br>21              | 05                    | 32                    | 35                    | 36               | 37  | 05    | 11  | 11                      | 35                    | 36                    | 37                    | 11                    | 21                    | 11<br>13              | 11, 35<br>to<br>37    |              |                            |
| 10                 | 75                | 50                      | 11                    | 4       | M10                 | 17,2                     | 18,0                  | 21                    | 12                    | 12                    | 12                    | 10                    | 5                | 2   | 2,5   | —   | 28                      | 6                     | 28                    | 35                    | 7                     | 26                    | 20                    | 4                     | See Annex A  |                            |
| 15                 | 80                | 55                      | 11                    | 4       | M10                 | 21,3                     | 22,0                  | 25                    | 12                    | 12                    | 12                    | 10                    | 5                | 2   | 2,5   | —   | 30                      | 6                     | 30                    | 38                    | 7                     | 30                    | 26                    | 4                     |              |                            |
| 20                 | 90                | 65                      | 11                    | 4       | M10                 | 26,9                     | 27,5                  | 31                    | 14                    | 14                    | 14                    | 10                    | 6                | 2,5 | 3     | —   | 32                      | 6                     | 32                    | 40                    | 8                     | 38                    | 34                    | 4                     |              |                            |
| 25                 | 100               | 75                      | 11                    | 4       | M10                 | 33,7                     | 34,5                  | 38                    | 14                    | 14                    | 14                    | 10                    | 7                | 2,5 | 3     | —   | 35                      | 6                     | 35                    | 40                    | 10                    | 42                    | 44                    | 4                     |              |                            |
| 32                 | 120               | 90                      | 14                    | 4       | M12                 | 42,4                     | 43,5                  | 46                    | 16                    | 14                    | 14                    | 10                    | 8                | 3   | 3     | —   | 35                      | 6                     | 35                    | 42                    | 12                    | 55                    | 54                    | 6                     |              |                            |
| 40                 | 130               | 100                     | 14                    | 4       | M12                 | 48,3                     | 49,5                  | 53                    | 16                    | 14                    | 14                    | 10                    | 8                | 3   | 3     | —   | 38                      | 7                     | 38                    | 45                    | 15                    | 62                    | 64                    | 6                     |              |                            |
| 50                 | 140               | 110                     | 14                    | 4       | M12                 | 60,3                     | 61,5                  | 65                    | 16                    | 14                    | 14                    | 12                    | 8                | 3   | 3     | —   | 38                      | 8                     | 38                    | 45                    | 20                    | 74                    | 74                    | 6                     |              |                            |
| 65                 | 160               | 130                     | 14                    | 4       | M12                 | 76,1                     | 77,5                  | 81                    | 16                    | 14                    | 14                    | 12                    | 8                | 3   | 3     | 55  | 38                      | 9                     | 38                    | 45                    | 20                    | 88                    | 94                    | 6                     |              |                            |
| 80                 | 190               | 150                     | 18                    | 4       | M16                 | 88,9                     | 90,5                  | 94                    | 18                    | 16                    | 16                    | 12                    | 10               | 3   | 4     | 70  | 42                      | 10                    | 42                    | 50                    | 25                    | 102                   | 110                   | 8                     |              |                            |
| 100                | 210               | 170                     | 18                    | 4       | M16                 | 114,3                    | 116,0                 | 120                   | 18                    | 16                    | 16                    | 14                    | 10               | 4   | 4     | 90  | 45                      | 10                    | 45                    | 52                    | 25                    | 130                   | 130                   | 8                     |              |                            |
| 125                | 240               | 200                     | 18                    | 8       | M16                 | 139,7                    | 141,5                 | 145                   | 20                    | 18                    | 18                    | 14                    | 10               | 4   | 4     | 115 | 48                      | 10                    | 48                    | 55                    | 25                    | 155                   | 160                   | 8                     |              |                            |
| 150                | 265               | 225                     | 18                    | 8       | M16                 | 168,3                    | 170,5                 | 174                   | 20                    | 18                    | 18                    | 14                    | 10               | 5   | 4     | 140 | 48                      | 12                    | 48                    | 55                    | 25                    | 184                   | 182                   | 10                    |              |                            |
| 200                | 320               | 280                     | 18                    | 8       | M16                 | 219,1                    | 221,5                 | 226                   | 22                    | 20                    | 20                    | 16                    | 11               | 5   | 5     | 190 | 55                      | 15                    | 55                    | 62                    | 30                    | 236                   | 238                   | 10                    |              |                            |
| 250                | 375               | 335                     | 18                    | 12      | M16                 | 273,0                    | 276,5                 | 281                   | 24                    | 22                    | 22                    | 18                    | 12               | 8   | —     | 235 | 60                      | 15                    | 60                    | 68                    | —                     | 290                   | 284                   | 12                    |              |                            |
| 300                | 440               | 395                     | 22                    | 12      | M20                 | 323,9                    | 327,5                 | 333                   | 24                    | 22                    | 22                    | 18                    | 12               | 8   | —     | 285 | 62                      | 15                    | 62                    | 68                    | —                     | 342                   | 342                   | 12                    |              |                            |
| 350                | 490               | 445                     | 22                    | 12      | M20                 | 355,6                    | 359,5                 | 365                   | 26                    | 22                    | 22                    | 18                    | 13               | 8   | —     | 330 | 62                      | 15                    | 62                    | 68                    | —                     | 385                   | 392                   | 12                    |              |                            |
| 400                | 540               | 495                     | 22                    | 16      | M20                 | 406,4                    | 411,0                 | 416                   | 28                    | 22                    | 22                    | 20                    | 14               | 8   | —     | 380 | 65                      | 15                    | 65                    | 72                    | —                     | 438                   | 442                   | 12                    |              |                            |
| 450                | 595               | 550                     | 22                    | 16      | M20                 | 457,0                    | 462,0                 | 467                   | 30                    | 22                    | 24                    | 20                    | 15               | 8   | —     | 425 | 65                      | 15                    | 65                    | 72                    | —                     | 492                   | 494                   | 12                    |              |                            |
| 500                | 645               | 600                     | 22                    | 20      | M20                 | 508,0                    | 513,5                 | 519                   | 30                    | 24                    | 24                    | 22                    | 16               | 8   | —     | 475 | 68                      | 15                    | 68                    | 75                    | —                     | 538                   | 544                   | 12                    |              |                            |
| 600                | 755               | 705                     | 26                    | 20      | M24                 | 610,0                    | 616,5                 | 622                   | 32                    | 30                    | 30                    | 22                    | 16               | —   | —     | 575 | 70                      | 16                    | 70                    | —                     | —                     | 640                   | 642                   | 12                    |              |                            |
| 700                | 860               | 810                     | 26                    | 24      | M24                 | 711,0                    | a                     | 721                   | 40                    | 30                    | 40                    | —                     | 16               | —   | —     | 670 | 76                      | 16                    | 70                    | —                     | —                     | 740                   | 746                   | 12                    |              |                            |
| 800                | 975               | 920                     | 30                    | 24      | M27                 | 813,0                    |                       | 824                   | 44                    | 30                    | 44                    | —                     | 16               | —   | —     | 770 | 76                      | 16                    | 70                    | —                     | —                     | 842                   | 850                   | 12                    |              |                            |
| 900                | 1 075             | 1 020                   | 30                    | 24      | M27                 | 914,0                    |                       | 926                   | 48                    | 30                    | 48                    | —                     | 16               | —   | —     | 860 | 74                      | 16                    | 70                    | —                     | —                     | 942                   | 950                   | 12                    |              |                            |
| 1 000              | 1 175             | 1 120                   | 30                    | 28      | M27                 | 1 016,0                  |                       | 1 028                 | 52                    | 30                    | 52                    | —                     | 18               | —   | —     | 960 | 74                      | 16                    | 70                    | —                     | —                     | 1 045                 | 1 050                 | 16                    |              |                            |
| 1 200              | 1 375             | 1 320                   | 30                    | 32      | M27                 | 1 219                    | 1 234                 | 60                    | 32                    | 50                    | —                     | 20                    | —                | —   | 1 160 | 94  | 16                      | 90                    | —                     | —                     | 1 245                 | —                     | 16                    |                       |              |                            |

## EN 1092-1:2007 (E)

Table 10 (continued)

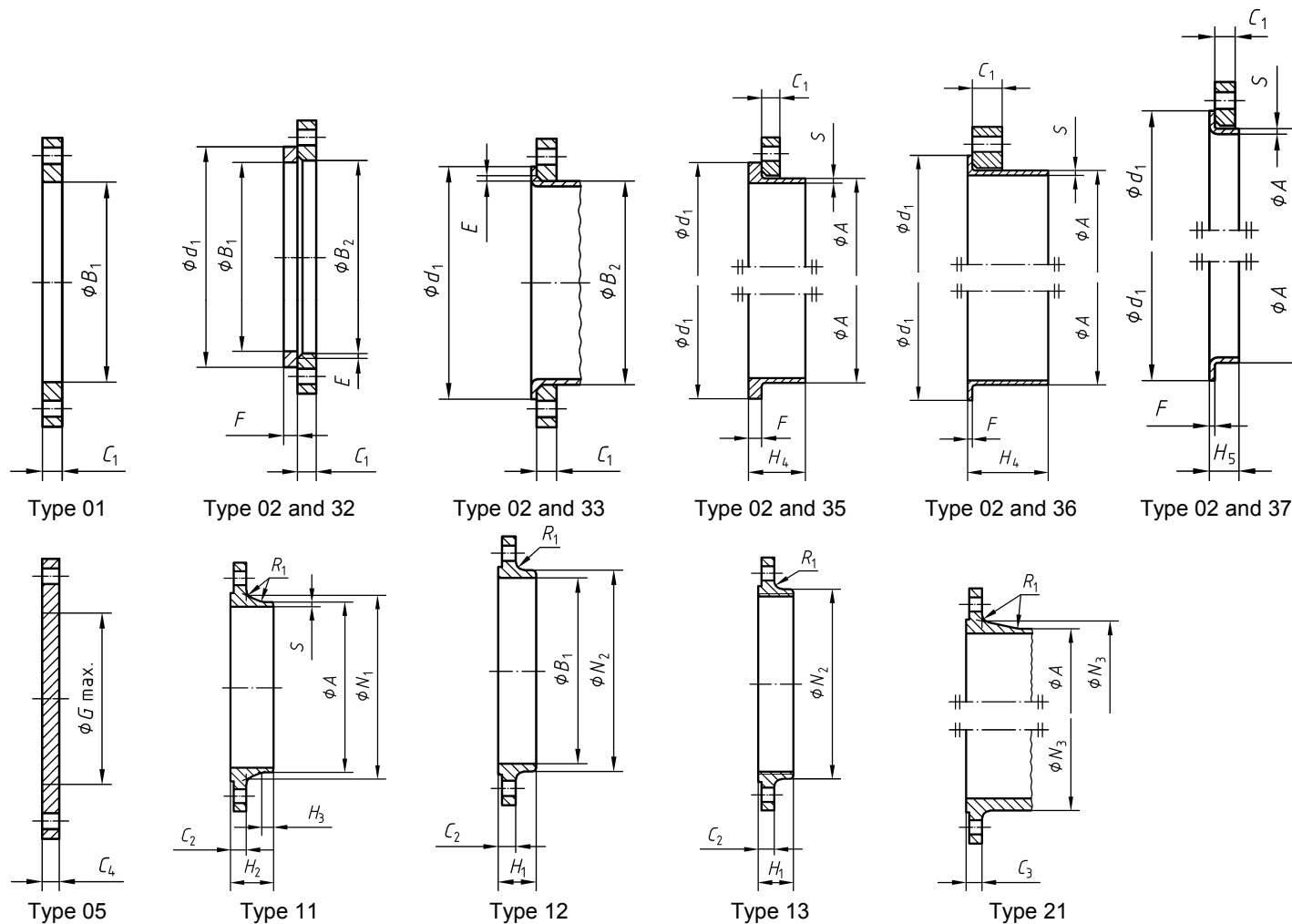
Dimensions in millimetres

| DN                                  | Mating dimensions   |                               |                             |         |      | Outside dia-<br>meter of neck | Bore<br>diameters     |                       | Flange thickness      |                       |                       |                       | Collar thickness |                         |                       | Diameter of<br>shoulder | Length                |                       |                       |                       |                       | Neck diameters |    | Corner<br>radii | Wall thickness<br>(see 5.6.1) |
|-------------------------------------|---------------------|-------------------------------|-----------------------------|---------|------|-------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------|-------------------------|-----------------------|-------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------|----|-----------------|-------------------------------|
|                                     | Outside<br>diameter | Diameter<br>of bolt<br>circle | Diameter<br>of bolt<br>hole | Bolting |      |                               |                       |                       |                       |                       |                       |                       |                  |                         |                       |                         |                       |                       |                       |                       |                       |                |    |                 |                               |
|                                     |                     |                               |                             |         |      |                               |                       |                       |                       |                       |                       |                       |                  |                         |                       |                         |                       |                       |                       |                       |                       |                |    |                 |                               |
|                                     | <i>D</i>            | <i>K</i>                      | <i>L</i>                    | Number  | Size | <i>A</i>                      | <i>B</i> <sub>1</sub> | <i>B</i> <sub>2</sub> | <i>C</i> <sub>1</sub> | <i>C</i> <sub>2</sub> | <i>C</i> <sub>3</sub> | <i>C</i> <sub>4</sub> | <i>F</i>         | <i>G</i> <sub>max</sub> | <i>H</i> <sub>2</sub> | <i>H</i> <sub>3</sub>   | <i>H</i> <sub>4</sub> | <i>H</i> <sub>5</sub> | <i>N</i> <sub>1</sub> | <i>N</i> <sub>3</sub> | <i>R</i> <sub>1</sub> | <i>S</i>       |    |                 |                               |
|                                     | Flange type         |                               |                             |         |      |                               |                       |                       |                       |                       |                       |                       |                  |                         |                       |                         |                       |                       |                       |                       |                       |                |    |                 |                               |
| 01, 02, 05, 11, 21                  |                     |                               |                             |         |      | 11<br>21<br>35 — 37           | 01<br>32              | 02                    | 01<br>02              | 11<br>21              | 05                    | 32                    | 35               | 36                      | 37                    | 05                      | 11                    | 11                    | 35                    | 36                    | 37                    | 11             | 21 | 11              | 11, 35<br>to<br>37            |
| 1 400                               | 1 575               | 1 520                         | 30                          | 36      | M27  | 1 422                         | a                     | —                     | —                     | 38                    | —                     | —                     | —                | —                       | —                     | 1 346                   | 96                    | 16                    | —                     | —                     | —                     | 1 445          | —  | 16              | See Annex A                   |
| 1 600                               | 1 790               | 1 730                         | 30                          | 40      | M27  | 1 626                         |                       | —                     | —                     | 46                    | —                     | —                     | —                | —                       | —                     | 1 546                   | 102                   | 20                    | —                     | —                     | —                     | 1 645          | —  | 16              |                               |
| 1 800                               | 1 990               | 1 930                         | 30                          | 44      | M27  | 1 829                         |                       | —                     | —                     | 46                    | —                     | —                     | —                | —                       | —                     | 1 746                   | 110                   | 20                    | —                     | —                     | —                     | 1 845          | —  | 16              |                               |
| 2 000                               | 2 190               | 2 130                         | 30                          | 48      | M27  | 2 032                         |                       | —                     | —                     | 50                    | —                     | —                     | —                | —                       | —                     | 1 950                   | 122                   | 22                    | —                     | —                     | —                     | 2 045          | —  | 16              |                               |
| 2 200                               | 2 405               | 2 340                         | 33                          | 52      | M30  | 2 235                         | —                     | —                     | 56                    | —                     | —                     | —                     | —                | —                       | —                     | 129                     | 25                    | —                     | —                     | —                     | 2 248                 | —              | 18 |                 |                               |
| 2 400                               | 2 605               | 2 540                         | 33                          | 56      | M30  | 2 438                         | —                     | —                     | 62                    | —                     | —                     | —                     | —                | —                       | —                     | 143                     | 25                    | —                     | —                     | —                     | 2 448                 | —              | 18 |                 |                               |
| 2 600                               | 2 805               | 2 740                         | 33                          | 60      | M30  | 2 620                         | —                     | —                     | 64                    | —                     | —                     | —                     | —                | —                       | —                     | 148                     | 25                    | —                     | —                     | —                     | 2 648                 | —              | 18 |                 |                               |
| 2 800                               | 3 030               | 2 960                         | 36                          | 64      | M33  | 2 820                         | —                     | —                     | 74                    | —                     | —                     | —                     | —                | —                       | —                     | 161                     | 25                    | —                     | —                     | —                     | 2 848                 | —              | 18 |                 |                               |
| 3 000                               | 3 230               | 3 160                         | 36                          | 68      | M33  | 3 020                         | —                     | —                     | 80                    | —                     | —                     | —                     | —                | —                       | —                     | 170                     | 25                    | —                     | —                     | —                     | 3 050                 | —              | 18 |                 |                               |
| 3 200                               | 3 430               | 3 360                         | 36                          | 72      | M33  | 3 220                         | —                     | —                     | 84                    | —                     | —                     | —                     | —                | —                       | —                     | 180                     | 25                    | —                     | —                     | —                     | 3 250                 | —              | 20 |                 |                               |
| 3 400                               | 3 630               | 3 560                         | 36                          | 76      | M33  | 3 420                         | —                     | —                     | 90                    | —                     | —                     | —                     | —                | —                       | —                     | 194                     | 28                    | —                     | —                     | —                     | 3 450                 | —              | 20 |                 |                               |
| 3 600                               | 3 840               | 3 770                         | 36                          | 80      | M33  | 3 620                         | —                     | —                     | 96                    | —                     | —                     | —                     | —                | —                       | —                     | 201                     | 28                    | —                     | —                     | —                     | 3 652                 | —              | 20 |                 |                               |
| 3 800                               | 4 045               | 3 970                         | 39                          | 80      | M36  | 3 820                         | —                     | —                     | 102                   | —                     | —                     | —                     | —                | —                       | —                     | 212                     | 28                    | —                     | —                     | —                     | 3 852                 | —              | 20 |                 |                               |
| 4 000                               | 4 245               | 4 170                         | 39                          | 84      | M36  | 4 020                         | —                     | —                     | 106                   | —                     | —                     | —                     | —                | —                       | —                     | 226                     | 28                    | —                     | —                     | —                     | 4 052                 | —              | 20 |                 |                               |
| a To be specified by the purchaser. |                     |                               |                             |         |      |                               |                       |                       |                       |                       |                       |                       |                  |                         |                       |                         |                       |                       |                       |                       |                       |                |    |                 |                               |



This diagram illustrates the arrangement but not necessarily the correct number of bolt holes.

Refer to the column "Bolting Number" in Table 11 for the actual number.



NOTE 1 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.

NOTE 2 For dimension  $d_1$ , see Table 8.

NOTE 3 For dimensions  $G_{max}$  refer to NOTE 1 of 5.6.1.

NOTE 4 Type 33; lapped pipe end without determination of thickness and height.

Figure 6 — Dimensions of PN 6 flanges

## EN 1092-1:2007 (E)

Table 11 — Dimensions of PN 6 flanges

Dimensions in millimetres

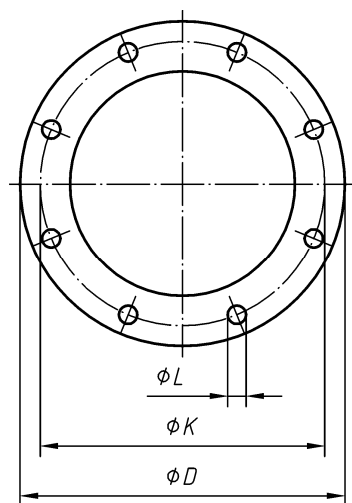
| DN                         | Mating dimensions |                         |                       |         |      | Outside diameter of neck         | Bore diameters |                | Flange thickness |                      |                                  | Chamfer | Collar thickness |    |     |                  | Diameter of shoulder | Length         |                |                |                |                | Neck diameters |                |                | Corner radii | Wall thickness (see 5.6.1) |                    |   |
|----------------------------|-------------------|-------------------------|-----------------------|---------|------|----------------------------------|----------------|----------------|------------------|----------------------|----------------------------------|---------|------------------|----|-----|------------------|----------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|--------------|----------------------------|--------------------|---|
|                            | Outside diameter  | Diameter of bolt circle | Diameter of bolt hole | Bolting |      |                                  | A              | B <sub>1</sub> | B <sub>2</sub>   | C <sub>1</sub>       | C <sub>2</sub><br>C <sub>3</sub> |         | C <sub>4</sub>   | E  | F   | G <sub>max</sub> |                      | H <sub>1</sub> | H <sub>2</sub> | H <sub>3</sub> | H <sub>4</sub> | H <sub>5</sub> | N <sub>1</sub> | N <sub>2</sub> | N <sub>3</sub> |              |                            | R <sub>1</sub>     | S |
|                            |                   |                         |                       | Number  | Size |                                  |                |                |                  |                      |                                  |         |                  |    |     |                  |                      |                |                |                |                |                |                |                |                |              |                            |                    |   |
|                            | Flange type       |                         |                       |         |      |                                  |                |                |                  |                      |                                  |         |                  |    |     |                  |                      |                |                |                |                |                |                |                |                |              |                            |                    |   |
| 01, 02, 05, 11, 12, 13, 21 |                   |                         |                       |         |      | 11<br>21 <sup>a</sup><br>35 - 37 | 01<br>12<br>32 | 02             | 01<br>02         | 11<br>12<br>13<br>21 | 05                               | 02      | 32               | 35 | 36  | 37               | 05                   | 12<br>13       | 11             | 11             | 35             | 36             | 37             | 11             | 12<br>13       | 21           | 11<br>12<br>13<br>21       | 11, 35<br>to<br>37 |   |
| 10                         | 75                | 50                      | 11                    | 4       | M10  | 17,2                             | 18,0           | 21             | 12               | 12                   | 12                               | 3       | 10               | 5  | 2   | 2,5              | —                    | 20             | 28             | 6              | 28             | 35             | 7              | 26             | 25             | 20           | 4                          | See Annex A        |   |
| 15                         | 80                | 55                      | 11                    | 4       | M10  | 21,3                             | 22,0           | 25             | 12               | 12                   | 12                               | 3       | 10               | 5  | 2   | 2,5              | —                    | 20             | 30             | 6              | 30             | 38             | 7              | 30             | 30             | 26           | 4                          |                    |   |
| 20                         | 90                | 65                      | 11                    | 4       | M10  | 26,9                             | 27,5           | 31             | 14               | 14                   | 14                               | 4       | 10               | 6  | 2,5 | 3                | —                    | 24             | 32             | 6              | 32             | 40             | 8              | 38             | 40             | 34           | 4                          |                    |   |
| 25                         | 100               | 75                      | 11                    | 4       | M10  | 33,7                             | 34,5           | 38             | 14               | 14                   | 14                               | 4       | 10               | 7  | 2,5 | 3                | —                    | 24             | 35             | 6              | 35             | 40             | 10             | 42             | 50             | 44           | 4                          |                    |   |
| 32                         | 120               | 90                      | 14                    | 4       | M12  | 42,4                             | 43,5           | 46             | 16               | 14                   | 14                               | 5       | 10               | 8  | 3   | 3                | —                    | 26             | 35             | 6              | 35             | 42             | 12             | 55             | 60             | 54           | 6                          |                    |   |
| 40                         | 130               | 100                     | 14                    | 4       | M12  | 48,3                             | 49,5           | 53             | 16               | 14                   | 14                               | 5       | 10               | 8  | 3   | 3                | —                    | 26             | 38             | 7              | 38             | 45             | 15             | 62             | 70             | 64           | 6                          |                    |   |
| 50                         | 140               | 110                     | 14                    | 4       | M12  | 60,3                             | 61,5           | 65             | 16               | 14                   | 14                               | 5       | 12               | 8  | 3   | 3                | —                    | 28             | 38             | 8              | 38             | 45             | 20             | 74             | 80             | 74           | 6                          |                    |   |
| 65                         | 160               | 130                     | 14                    | 4       | M12  | 76,1                             | 77,5           | 81             | 16               | 14                   | 14                               | 6       | 12               | 8  | 3   | 3                | 55                   | 32             | 38             | 9              | 38             | 45             | 20             | 88             | 100            | 94           | 6                          |                    |   |
| 80                         | 190               | 150                     | 18                    | 4       | M16  | 88,9                             | 90,5           | 94             | 18               | 16                   | 16                               | 6       | 12               | 10 | 3   | 4                | 70                   | 34             | 42             | 10             | 42             | 50             | 25             | 102            | 110            | 110          | 8                          |                    |   |
| 100                        | 210               | 170                     | 18                    | 4       | M16  | 114,3                            | 116,0          | 120            | 18               | 16                   | 16                               | 6       | 14               | 10 | 4   | 4                | 90                   | 40             | 45             | 10             | 45             | 52             | 25             | 130            | 130            | 130          | 8                          |                    |   |
| 125                        | 240               | 200                     | 18                    | 8       | M16  | 139,7                            | 141,5          | 145            | 20               | 18                   | 18                               | 6       | 14               | 10 | 4   | 4                | 115                  | 44             | 48             | 10             | 48             | 55             | 25             | 155            | 160            | 160          | 8                          |                    |   |
| 150                        | 265               | 225                     | 18                    | 8       | M16  | 168,3                            | 170,5          | 174            | 20               | 18                   | 18                               | 6       | 14               | 10 | 5   | 4                | 140                  | 44             | 48             | 12             | 48             | 55             | 25             | 184            | 185            | 182          | 10                         |                    |   |
| 200                        | 320               | 280                     | 18                    | 8       | M16  | 219,1                            | 221,5          | 226            | 22               | 20                   | 20                               | 6       | 16               | 11 | 5   | 5                | 190                  | 44             | 55             | 15             | 55             | 62             | 30             | 236            | 240            | 238          | 10                         |                    |   |
| 250                        | 375               | 335                     | 18                    | 12      | M16  | 273,0                            | 276,5          | 281            | 24               | 22                   | 22                               | 8       | 18               | 12 | 8   |                  | 235                  | 44             | 60             | 15             | 60             | 68             | —              | 290            | 295            | 284          | 12                         |                    |   |
| 300                        | 440               | 395                     | 22                    | 12      | M20  | 323,9                            | 327,5          | 333            | 24               | 22                   | 22                               | 8       | 18               | 12 | 8   |                  | 285                  | 44             | 62             | 15             | 62             | 68             | —              | 342            | 355            | 342          | 12                         |                    |   |
| 350                        | 490               | 445                     | 22                    | 12      | M20  | 355,6                            | 359,5          | 365            | 26               | 22                   | 22                               | 8       | 18               | 13 | 8   |                  | 330                  | —              | 62             | 15             | 62             | 68             | —              | 385            | —              | 392          | 12                         |                    |   |
| 400                        | 540               | 495                     | 22                    | 16      | M20  | 406,4                            | 411,0          | 416            | 28               | 22                   | 22                               | 8       | 20               | 14 | 8   |                  | 380                  | —              | 65             | 15             | 65             | 72             | —              | 438            | —              | 442          | 12                         |                    |   |
| 450                        | 595               | 550                     | 22                    | 16      | M20  | 457,0                            | 462,0          | 467            | 30               | 22                   | 24                               | 8       | 20               | 15 | 8   | —                | 425                  | —              | 65             | 15             | 72             | 72             | —              | 492            | —              | 494          | 12                         |                    |   |

Table 11 (concluded)

Dimensions in millimetres

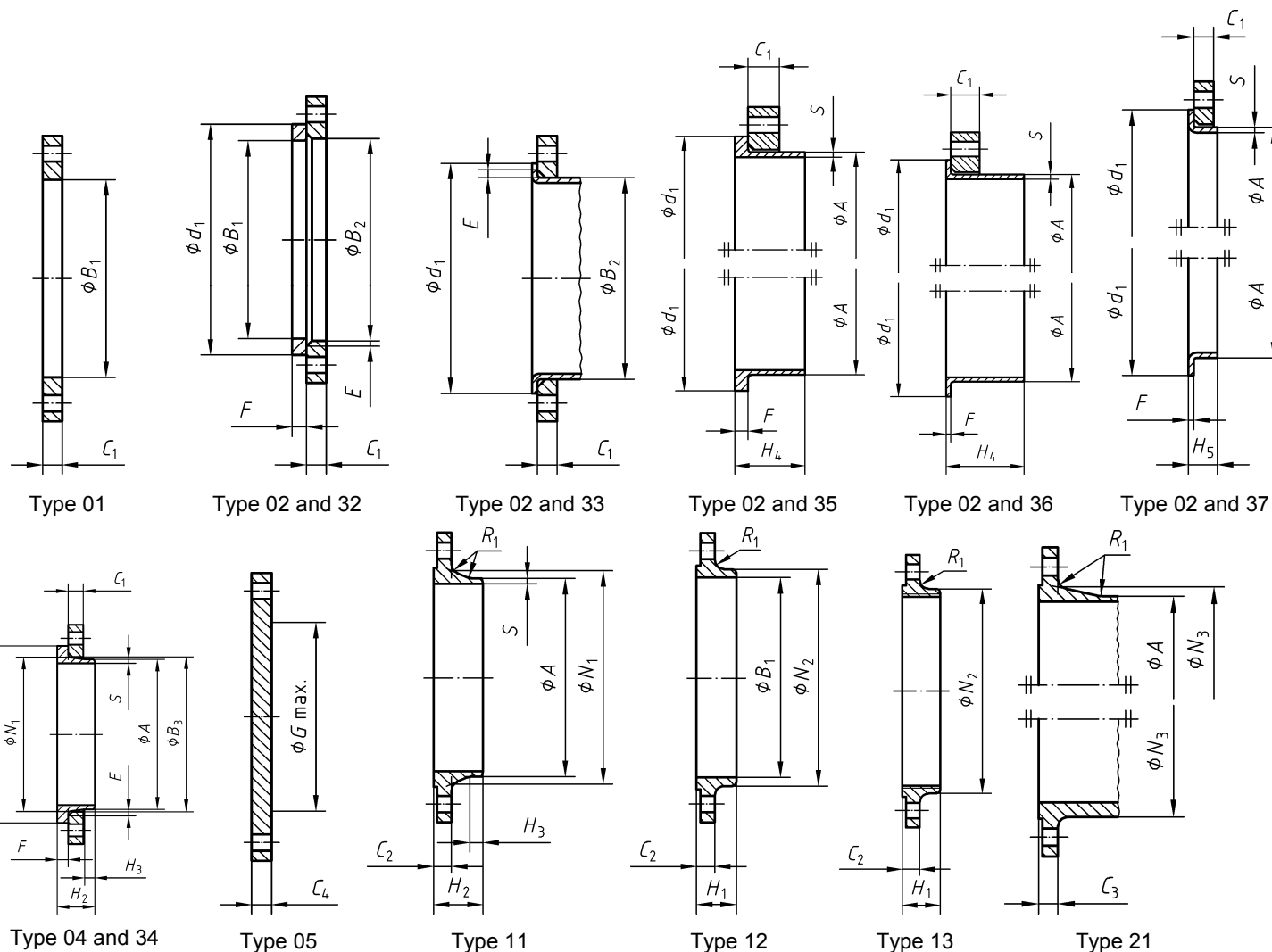
| DN                                                                                                                | Mating dimensions            |                                     |                                   |         |     | Outside diameter of neck<br><i>A</i> | Bore diameters       |                      | Flange thickness     |                                              |                      | Chamfer<br><i>E</i> | Collar thickness |                        |                      | Diameter of shoulder<br><i>G<sub>max</sub></i> | Length               |                      |                      |                      |                      | Neck diameters       |                      |          | Corner radii<br><i>R<sub>1</sub></i> | Wall thickness (see 5.6.1) |                      |                    |
|-------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------------------------|-----------------------------------|---------|-----|--------------------------------------|----------------------|----------------------|----------------------|----------------------------------------------|----------------------|---------------------|------------------|------------------------|----------------------|------------------------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------|--------------------------------------|----------------------------|----------------------|--------------------|
|                                                                                                                   | Outside diameter<br><i>D</i> | Diameter of bolt circle<br><i>K</i> | Diameter of bolt hole<br><i>L</i> | Bolting |     |                                      | <i>B<sub>1</sub></i> | <i>B<sub>2</sub></i> | <i>C<sub>1</sub></i> | <i>C<sub>2</sub></i><br><i>C<sub>3</sub></i> | <i>C<sub>4</sub></i> |                     | <i>F</i>         | <i>G<sub>max</sub></i> | <i>H<sub>1</sub></i> |                                                | <i>H<sub>2</sub></i> | <i>H<sub>3</sub></i> | <i>H<sub>4</sub></i> | <i>H<sub>5</sub></i> | <i>N<sub>1</sub></i> | <i>N<sub>2</sub></i> | <i>N<sub>3</sub></i> | <i>S</i> |                                      |                            |                      |                    |
|                                                                                                                   |                              |                                     |                                   |         |     |                                      |                      |                      |                      |                                              |                      |                     |                  |                        |                      |                                                |                      |                      |                      |                      |                      |                      |                      |          |                                      |                            |                      |                    |
|                                                                                                                   |                              |                                     |                                   |         |     |                                      |                      |                      |                      |                                              |                      |                     |                  |                        |                      |                                                |                      |                      |                      |                      |                      |                      |                      |          |                                      |                            |                      |                    |
| Flange type                                                                                                       |                              |                                     |                                   |         |     |                                      |                      |                      |                      |                                              |                      |                     |                  |                        |                      |                                                |                      |                      |                      |                      |                      |                      |                      |          |                                      |                            |                      |                    |
| 01, 02, 05, 11, 12, 13, 21                                                                                        |                              |                                     |                                   |         |     | 11<br>21 <sup>a</sup><br>35 - 37     | 01<br>12<br>32       | 02                   | 01<br>02             | 11<br>12<br>13<br>21                         | 05                   | 02                  | 32               | 35                     | 36                   | 37                                             | 05                   | 12<br>13             | 11                   | 11                   | 35                   | 36                   | 37                   | 11       | 12<br>13                             | 21                         | 11<br>12<br>13<br>21 | 11, 35<br>to<br>37 |
| 500                                                                                                               | 645                          | 600                                 | 22                                | 20      | M20 | 508,0                                | 513,5                | 519                  | 30                   | 24                                           | 24                   | 8                   | 22               | 16                     | 8                    | —                                              | 475                  | —                    | 68                   | 15                   | 75                   | 75                   | —                    | 538      | —                                    | 544                        | 12                   | See Annex A        |
| 600                                                                                                               | 755                          | 705                                 | 26                                | 20      | M24 | 610,0                                | 616,5                | 622                  | 32                   | 30                                           | 30                   | 8                   | 22               | 16                     | —                    | —                                              | 575                  | —                    | 70                   | 16                   | 70                   | —                    | —                    | 640      | —                                    | 642                        | 12                   |                    |
| 700                                                                                                               | 860                          | 810                                 | 26                                | 24      | M24 | 711,0                                | b                    | 721                  | 40                   | 30                                           | 40                   | 4                   | —                | 16                     | —                    | —                                              | 670                  | —                    | 76                   | 16                   | 70                   | —                    | —                    | 740      | —                                    | 746                        | 12                   |                    |
| 800                                                                                                               | 975                          | 920                                 | 30                                | 24      | M27 | 813,0                                |                      | 824                  | 44                   | 30                                           | 44                   | 4                   | —                | 16                     | —                    | —                                              | 770                  | —                    | 76                   | 16                   | 70                   | —                    | —                    | 842      | —                                    | 850                        | 12                   |                    |
| 900                                                                                                               | 1 075                        | 1 020                               | 30                                | 24      | M27 | 914,0                                |                      | 926                  | 48                   | 34                                           | 48                   | 4                   | —                | 16                     | —                    | —                                              | 860                  | —                    | 78                   | 16                   | 70                   | —                    | —                    | 942      | —                                    | 950                        | 12                   |                    |
| 1 000                                                                                                             | 1 175                        | 1 120                               | 30                                | 28      | M27 | 1 016,0                              |                      | 1 028                | 52                   | 38                                           | 52                   | 4                   | —                | 18                     | —                    | —                                              | 960                  | —                    | 82                   | 16                   | 70                   | —                    | —                    | 1 045    | —                                    | 1 050                      | 16                   |                    |
| 1 200                                                                                                             | 1 405                        | 1 340                               | 33                                | 32      | M30 | 1 219,0                              |                      | 1 234                | 60                   | 42                                           | 60                   | 5                   | —                | 20                     | —                    | —                                              | 1 160                | —                    | 104                  | 20                   | 90                   | —                    | —                    | 1 248    | —                                    | 1 264                      | 16                   |                    |
| 1 400                                                                                                             | 1 630                        | 1 560                               | 36                                | 36      | M33 | 1 422,0                              |                      | —                    | 72                   | 56                                           | 68                   | —                   | —                | —                      | —                    | —                                              | 1 346                | —                    | 114                  | 20                   | —                    | —                    | —                    | 1 452    | —                                    | 1 480                      | 16                   |                    |
| 1 600                                                                                                             | 1 830                        | 1 760                               | 36                                | 40      | M33 | 1 626,0                              |                      | —                    | 80                   | 63                                           | 76                   | —                   | —                | —                      | —                    | —                                              | 1 546                | —                    | 119                  | 20                   | —                    | —                    | —                    | 1 655    | —                                    | 1 680                      | 16                   |                    |
| 1 800                                                                                                             | 2 045                        | 1 970                               | 39                                | 44      | M36 | 1 829,0                              |                      | —                    | 88                   | 69                                           | 84                   | —                   | —                | —                      | —                    | —                                              | 1 746                | —                    | 133                  | 20                   | —                    | —                    | —                    | 1 855    | —                                    | 1 878                      | 16                   |                    |
| 2 000                                                                                                             | 2 265                        | 2 180                               | 42                                | 48      | M39 | 2 032,0                              |                      | —                    | 96                   | 74                                           | 92                   | —                   | —                | —                      | —                    | —                                              | 1 950                | —                    | 146                  | 25                   | —                    | —                    | —                    | 2 058    | —                                    | 2 082                      | 16                   |                    |
| 2 200                                                                                                             | 2 475                        | 2 390                               | 42                                | 52      | M39 | 2 235,0                              | —                    | —                    | —                    | 81                                           | —                    | —                   | —                | —                      | —                    | —                                              | —                    | —                    | 154                  | 25                   | —                    | —                    | —                    | 2 260    | —                                    | —                          | 18                   |                    |
| 2 400                                                                                                             | 2 685                        | 2 600                               | 42                                | 56      | M39 | 2 438,0                              | —                    | —                    | —                    | 87                                           | —                    | —                   | —                | —                      | —                    | —                                              | —                    | —                    | 168                  | 25                   | —                    | —                    | —                    | 2 462    | —                                    | —                          | 18                   |                    |
| 2 600                                                                                                             | 2 905                        | 2 810                               | 48                                | 60      | M45 | 2 620,0                              | —                    | —                    | —                    | 91                                           | —                    | —                   | —                | —                      | —                    | —                                              | —                    | —                    | 175                  | 25                   | —                    | —                    | —                    | 2 665    | —                                    | —                          | 18                   |                    |
| 2 800                                                                                                             | 3 115                        | 3 020                               | 48                                | 64      | M45 | 2 820,0                              | —                    | —                    | —                    | 101                                          | —                    | —                   | —                | —                      | —                    | —                                              | —                    | —                    | 188                  | 30                   | —                    | —                    | —                    | 2 865    | —                                    | —                          | 18                   |                    |
| 3 000                                                                                                             | 3 315                        | 3 220                               | 48                                | 68      | M45 | 3 020,0                              | —                    | —                    | —                    | 102                                          | —                    | —                   | —                | —                      | —                    | —                                              | —                    | —                    | 192                  | 30                   | —                    | —                    | —                    | 3 068    | —                                    | —                          | 18                   |                    |
| 3 200                                                                                                             | 3 525                        | 3 430                               | 48                                | 72      | M45 | 3 220,0                              | —                    | —                    | —                    | 106                                          | —                    | —                   | —                | —                      | —                    | —                                              | —                    | —                    | 202                  | 30                   | —                    | —                    | —                    | 3 272    | —                                    | —                          | 20                   |                    |
| 3 400                                                                                                             | 3 735                        | 3 640                               | 48                                | 76      | M45 | 3 420,0                              | —                    | —                    | —                    | 110                                          | —                    | —                   | —                | —                      | —                    | —                                              | —                    | —                    | 214                  | 35                   | —                    | —                    | —                    | 3 475    | —                                    | —                          | 20                   |                    |
| 3 600                                                                                                             | 3 970                        | 3 860                               | 56                                | 80      | M52 | 3 620,0                              | —                    | —                    | —                    | 124                                          | —                    | —                   | —                | —                      | —                    | —                                              | —                    | —                    | 229                  | 35                   | —                    | —                    | —                    | 3 678    | —                                    | —                          | 20                   |                    |
| <sup>a</sup> For flanges type 21 the outside hub diameter approximately corresponds to the outside pipe diameter. |                              |                                     |                                   |         |     |                                      |                      |                      |                      |                                              |                      |                     |                  |                        |                      |                                                |                      |                      |                      |                      |                      |                      |                      |          |                                      |                            |                      |                    |
| <sup>b</sup> To be specified by the purchaser.                                                                    |                              |                                     |                                   |         |     |                                      |                      |                      |                      |                                              |                      |                     |                  |                        |                      |                                                |                      |                      |                      |                      |                      |                      |                      |          |                                      |                            |                      |                    |

EN 1092-1:2007 (E)



This diagram illustrates the arrangement but not necessarily the correct number of bolt holes.

Refer to the column "Bolting Number" in Table 12 for the actual number.



- NOTE 1 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.  
 NOTE 2 For dimension  $d_1$ , see Table 8.  
 NOTE 3 For dimensions  $G_{max}$  refer to NOTE 1 of 5.6.1.  
 NOTE 4 Type 33; lapped pipe end without determination of thickness and height.

Figure 7 — Dimensions of PN 10 flanges

Table 12 — Dimensions of PN 10 flanges

Dimensions in millimetres

| DN          | Mating dimensions              |                                     |                                   |         |      | Outside diameter of neck<br><i>A</i>                | Bore diameters        |                       |                       | Flange thick-ness     |                       |                       |                       | Cham-fer<br><i>E</i> | Collar thickness |                       |                       |                       | Diameter of shoulder<br><i>G</i> <sub>max</sub> | Length                |                       |                       |                       |                       | Neck diameters |                       |          | Corner radii<br><i>R</i> <sub>1</sub> | Wall thickness (see 5.6.1) |     |                    |
|-------------|--------------------------------|-------------------------------------|-----------------------------------|---------|------|-----------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------|------------------|-----------------------|-----------------------|-----------------------|-------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------|-----------------------|----------|---------------------------------------|----------------------------|-----|--------------------|
|             | Outside diameter<br><i>D</i>   | Diameter of bolt circle<br><i>K</i> | Diameter of bolt hole<br><i>L</i> | Bolting |      |                                                     | <i>B</i> <sub>1</sub> | <i>B</i> <sub>2</sub> | <i>B</i> <sub>3</sub> | <i>C</i> <sub>1</sub> | <i>C</i> <sub>2</sub> | <i>C</i> <sub>3</sub> | <i>C</i> <sub>4</sub> |                      | <i>F</i>         | <i>H</i> <sub>1</sub> | <i>H</i> <sub>2</sub> | <i>H</i> <sub>3</sub> |                                                 | <i>H</i> <sub>4</sub> | <i>H</i> <sub>5</sub> | <i>N</i> <sub>1</sub> | <i>N</i> <sub>2</sub> | <i>N</i> <sub>3</sub> | <i>S</i>       |                       |          |                                       |                            |     |                    |
|             |                                |                                     |                                   | Number  | Size |                                                     |                       |                       |                       |                       |                       |                       |                       |                      |                  |                       |                       |                       |                                                 |                       |                       |                       |                       |                       |                |                       |          |                                       |                            |     |                    |
|             |                                |                                     |                                   |         |      |                                                     |                       |                       |                       |                       |                       |                       |                       |                      |                  |                       |                       |                       |                                                 |                       |                       |                       |                       |                       |                |                       |          |                                       |                            |     |                    |
| Flange type |                                |                                     |                                   |         |      |                                                     |                       |                       |                       |                       |                       |                       |                       |                      |                  |                       |                       |                       |                                                 |                       |                       |                       |                       |                       |                |                       |          |                                       |                            |     |                    |
|             | 01, 02, 04, 05, 11, 12, 13, 21 |                                     |                                   |         |      | 11<br>21 <sup>a</sup><br>34 <sup>c</sup><br>35 - 37 | 01<br>12<br>32        | 02                    | 04                    | 01<br>02<br>04        | 11<br>12<br>13        | 21                    | 05                    | 02<br>04             | 32<br>34         | 35                    | 36                    | 37                    | 05                                              | 12<br>13              | 11<br>34 <sup>c</sup> | 11<br>34 <sup>c</sup> | 35                    | 36                    | 37             | 11<br>34 <sup>c</sup> | 12<br>13 | 21                                    | 11<br>12<br>13<br>21, 34   | 34  | 11, 35<br>to<br>37 |
| 10          | 90                             | 60                                  | 14                                | 4       | M12  | 17,2                                                | 18,0                  | 21                    | 31                    | 14                    | 16                    | 16                    | 16                    | 3                    | 12               | 5                     | 2                     | 2,5                   | —                                               | 22                    | 35                    | 6                     | 35                    | 35                    | 7              | 28                    | 30       | 28                                    | 4                          | 1,8 |                    |
| 15          | 95                             | 65                                  | 14                                | 4       | M12  | 21,3                                                | 22,0                  | 25                    | 35                    | 14                    | 16                    | 16                    | 16                    | 3                    | 12               | 5                     | 2                     | 2,5                   | —                                               | 22                    | 38                    | 6                     | 38                    | 38                    | 7              | 32                    | 35       | 32                                    | 4                          | 2,0 |                    |
| 20          | 105                            | 75                                  | 14                                | 4       | M12  | 26,9                                                | 27,5                  | 31                    | 42                    | 16                    | 18                    | 18                    | 18                    | 4                    | 14               | 6                     | 2,5                   | 3                     | —                                               | 26                    | 40                    | 6                     | 40                    | 40                    | 8              | 40                    | 45       | 40                                    | 4                          | 2,3 |                    |
| 25          | 115                            | 85                                  | 14                                | 4       | M12  | 33,7                                                | 34,5                  | 38                    | 49                    | 16                    | 18                    | 18                    | 18                    | 4                    | 14               | 7                     | 2,5                   | 3                     | —                                               | 28                    | 40                    | 6                     | 40                    | 40                    | 10             | 46                    | 52       | 50                                    | 4                          | 2,6 |                    |
| 32          | 140                            | 100                                 | 18                                | 4       | M16  | 42,4                                                | 43,5                  | 47                    | 59                    | 18                    | 18                    | 18                    | 18                    | 5                    | 14               | 8                     | 3                     | 3                     | —                                               | 30                    | 42                    | 6                     | 42                    | 42                    | 12             | 56                    | 60       | 60                                    | 6                          | 2,6 |                    |
| 40          | 150                            | 110                                 | 18                                | 4       | M16  | 48,3                                                | 49,5                  | 53                    | 67                    | 18                    | 18                    | 18                    | 18                    | 5                    | 14               | 8                     | 3                     | 3                     | —                                               | 32                    | 45                    | 7                     | 45                    | 45                    | 15             | 64                    | 70       | 70                                    | 6                          | 2,6 |                    |
| 50          | 165                            | 125                                 | 18                                | 4       | M16  | 60,3                                                | 61,5                  | 65                    | 77                    | 20                    | 18                    | 18                    | 18                    | 5                    | 16               | 8                     | 3                     | 4                     | —                                               | 28                    | 45                    | 8                     | 45                    | 45                    | 20             | 74                    | 84       | 84                                    | 6                          | 2,9 |                    |
| 65          | 185                            | 145                                 | 18                                | 8       | M16  | 76,1                                                | 77,5                  | 81                    | 96                    | 20                    | 18                    | 18                    | 18                    | 6                    | 16               | 8                     | 3                     | 4                     | 55                                              | 32                    | 45                    | 10                    | 45                    | 45                    | 20             | 92                    | 104      | 104                                   | 6                          | 2,9 |                    |
| 80          | 200                            | 160                                 | 18                                | 8       | M16  | 88,9                                                | 90,5                  | 94                    | 108                   | 20                    | 20                    | 20                    | 20                    | 6                    | 16               | 10                    | 3                     | 4                     | 70                                              | 34                    | 50                    | 10                    | 50                    | 50                    | 25             | 105                   | 118      | 120                                   | 6                          | 3,2 |                    |
| 100         | 220                            | 180                                 | 18                                | 8       | M16  | 114,3                                               | 116,0                 | 120                   | 134                   | 22                    | 20                    | 20                    | 20                    | 6                    | 18               | 10                    | 4                     | 4                     | 90                                              | 40                    | 52                    | 12                    | 52                    | 52                    | 25             | 131                   | 140      | 140                                   | 8                          | 3,6 |                    |
| 125         | 250                            | 210                                 | 18                                | 8       | M16  | 139,7                                               | 141,5                 | 145                   | 162                   | 22                    | 22                    | 22                    | 22                    | 6                    | 18               | 10                    | 4                     | 4                     | 115                                             | 44                    | 55                    | 12                    | 55                    | 55                    | 25             | 156                   | 168      | 170                                   | 8                          | 4,0 |                    |
| 150         | 285                            | 240                                 | 22                                | 8       | M20  | 168,3                                               | 170,5                 | 174                   | 188                   | 24                    | 22                    | 22                    | 22                    | 6                    | 20               | 10                    | 4                     | 4                     | 140                                             | 44                    | 55                    | 12                    | 55                    | 55                    | 25             | 184                   | 195      | 190                                   | 10                         | 4,5 |                    |
| 200         | 340                            | 295                                 | 22                                | 8       | M20  | 219,1                                               | 221,5                 | 226                   | 240                   | 24                    | 24                    | 24                    | 24                    | 6                    | 20               | 11                    | 5                     | 4                     | 190                                             | 44                    | 62                    | 16                    | 62                    | 62                    | 30             | 234                   | 246      | 246                                   | 10                         | 6,3 |                    |
| 250         | 395                            | 350                                 | 22                                | 12      | M20  | 273,0                                               | 276,5                 | 281                   | 294                   | 26                    | 26                    | 26                    | 26                    | 8                    | 22               | 12                    | 8                     | —                     | 235                                             | 46                    | 68                    | 16                    | 68                    | 68                    | —              | 292                   | 298      | 298                                   | 12                         | 6,3 |                    |
| 300         | 445                            | 400                                 | 22                                | 12      | M20  | 323,9                                               | 327,5                 | 333                   | 348                   | 26                    | 26                    | 26                    | 26                    | 8                    | 22               | 12                    | 8                     | —                     | 285                                             | 46                    | 68                    | 16                    | 68                    | 68                    | —              | 342                   | 350      | 348                                   | 12                         | 7,1 |                    |
| 350         | 505                            | 460                                 | 22                                | 16      | M20  | 355,6                                               | 359,5                 | 365                   | 400                   | 30                    | 26                    | 26                    | 26                    | 8                    | 22               | 13                    | 8                     | —                     | 330                                             | 53                    | 68                    | 16                    | 68                    | 68                    | —              | 385                   | 400      | 408                                   | 12                         | 7,1 |                    |
| 400         | 565                            | 515                                 | 26                                | 16      | M24  | 406,4                                               | 411,0                 | 416                   | 450                   | 32                    | 26                    | 26                    | 26                    | 8                    | 24               | 14                    | 8                     | —                     | 380                                             | 57                    | 72                    | 16                    | 72                    | 72                    | —              | 440                   | 456      | 456                                   | 12                         | 7,1 |                    |
| 450         | 615                            | 565                                 | 26                                | 20      | M24  | 457,0                                               | 462,0                 | 467                   | 498                   | 36                    | 28                    | 28                    | 28                    | 8                    | 24               | 15                    | —                     | —                     | 425                                             | 63                    | 72                    | 16                    | 72                    | —                     | —              | 488                   | 502      | 502                                   | 12                         | 7,1 |                    |
| 500         | 670                            | 620                                 | 26                                | 20      | M24  | 508,0                                               | 513,5                 | 519                   | 550                   | 38                    | 28                    | 28                    | 28                    | 8                    | 26               | 16                    | —                     | —                     | 475                                             | 67                    | 75                    | 16                    | 75                    | —                     | —              | 542                   | 559      | 559                                   | 12                         | 7,1 |                    |
| 600         | 780                            | 725                                 | 30                                | 20      | M27  | 610,0                                               | 616,5                 | 622                   | 650                   | 42                    | 30                    | 34                    | 34                    | 8                    | 26               | 18                    | —                     | —                     | 575                                             | 75                    | 82                    | 18                    | 80                    | —                     | —              | 642                   | 658      | 658                                   | 12                         | —   |                    |
| 700         | 895                            | 840                                 | 30                                | 24      | M27  | 711,0                                               | b                     | 721                   | —                     | 50                    | 35                    | b                     | 38                    | 8                    | —                | 20                    | —                     | —                     | 670                                             | —                     | 85                    | 18                    | 80                    | —                     | —              | 746                   | —        | 772                                   | 12                         | —   |                    |
| 800         | 1 015                          | 950                                 | 33                                | 24      | M30  | 813,0                                               |                       | 824                   | —                     | 56                    | 38                    |                       | 48                    | 8                    | —                | 20                    | —                     | —                     | 770                                             | —                     | 96                    | 18                    | 90                    | —                     | —              | 850                   | —        | 876                                   | 12                         | —   |                    |
| 900         | 1 115                          | 1 050                               | 33                                | 28      | M30  | 914,0                                               |                       | 926                   | —                     | 62                    | 38                    |                       | 50                    | 8                    | —                | 22                    | —                     | —                     | 860                                             | —                     | 99                    | 20                    | 95                    | —                     | —              | 950                   | —        | 976                                   | 12                         | —   |                    |
| 1 000       | 1 230                          | 1 160                               | 36                                | 28      | M33  | 1 016,0                                             |                       | 1 028                 | —                     | 70                    | 44                    |                       | 54                    | 8                    | —                | 24                    | —                     | —                     | 960                                             | —                     | 105                   | 20                    | 95                    | —                     | —              | 1 052                 | —        | 1 080                                 | 16                         | —   |                    |
| 1 200       | 1 455                          | 1 380                               | 39                                | 32      | M36  | 1 219,0                                             |                       | 1 234                 | —                     | 83                    | 55                    |                       | 66                    | 8                    | —                | 26                    | —                     | —                     | 1 160                                           | —                     | 132                   | 25                    | 115                   | —                     | —              | 1 256                 | —        | 1 292                                 | 16                         | —   |                    |
| 1 400       | 1 675                          | 1 590                               | 42                                | 36      | M39  | 1 422,0                                             |                       | —                     | —                     | —                     | 65                    |                       | b                     | —                    | —                | —                     | —                     | —                     | —                                               | —                     | —                     | 143                   | 25                    | —                     | —              | —                     | 1 460    | —                                     | 1 496                      | 16  | —                  |
| 1 600       | 1 915                          | 1 820                               | 48                                | 40      | M45  | 1 626,0                                             | —                     | —                     | —                     | 75                    | —                     | —                     |                       | —                    | —                | —                     | —                     | —                     | —                                               | —                     | 159                   | 25                    | —                     | —                     | —              | 1 666                 | —        | 1 712                                 | 16                         | —   |                    |
| 1 800       | 2 115                          | 2 020                               | 48                                | 44      | M45  | 1 829,0                                             | —                     | —                     | —                     | 85                    | —                     | —                     |                       | —                    | —                | —                     | —                     | —                     | —                                               | —                     | 175                   | 30                    | —                     | —                     | —              | 1 868                 | —        | 1 910                                 | 16                         | —   |                    |

See Annex A

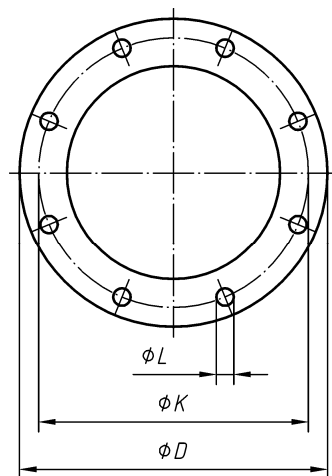
See Annex A

## EN 1092-1:2007 (E)

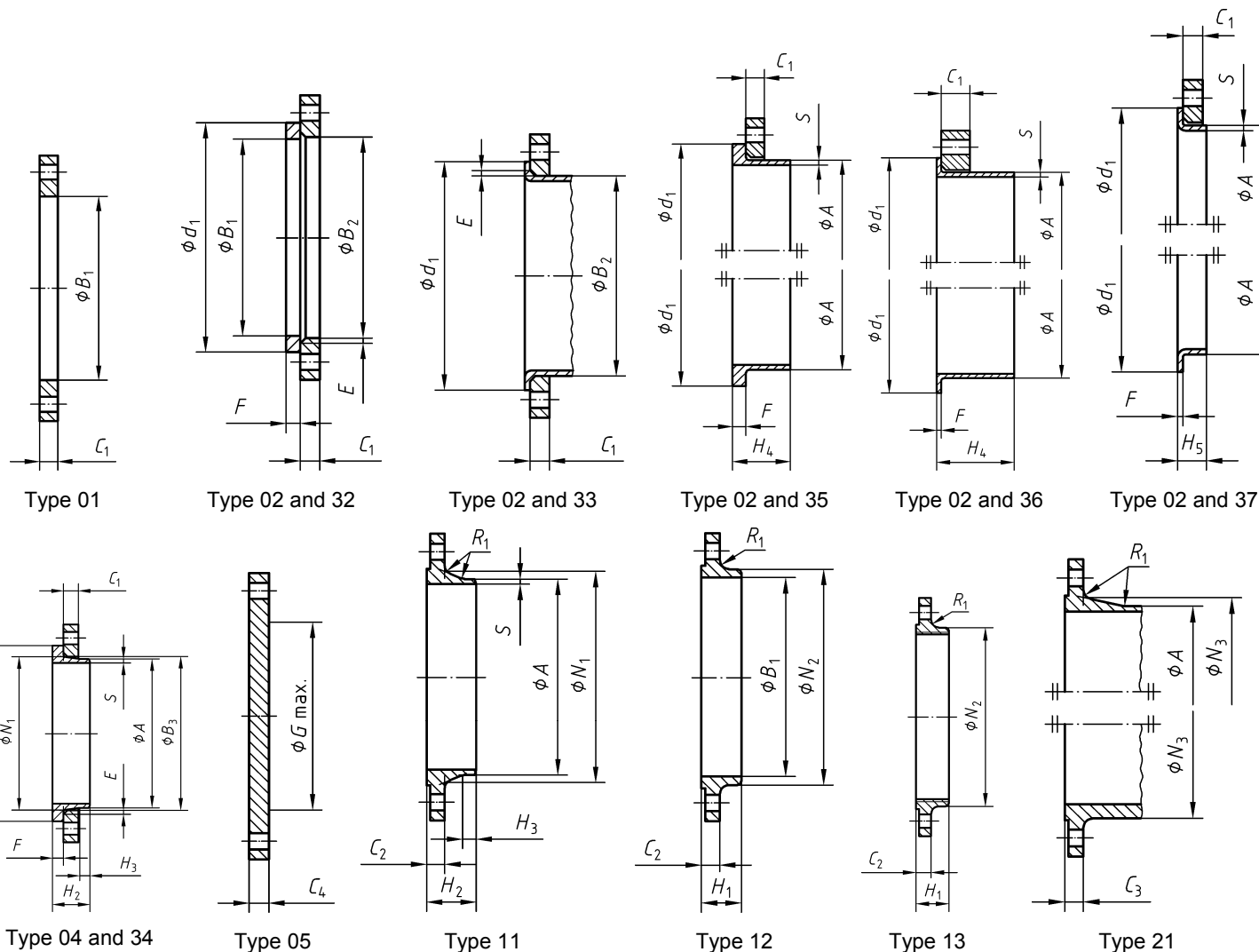
Table 12 (concluded)

Dimensions in millimetres

| DN                                                                                                                | Mating dimensions            |                                     |                                   |         |      | Outside diameter of neck<br><i>A</i>                | Bore diameters        |                       |                       | Flange thick-ness     |                       |                       |                       | Chamfer<br><i>E</i> | Collar thickness<br><i>F</i> | Diameter of shoulder<br><i>G</i> <sub>max</sub> | Length                |                       |                       |                       |                       | Neck diameters        |                       |                       | Corner radii<br><i>R</i> <sub>1</sub> | Wall thickness (see 5.6.1)<br><i>S</i> |          |       |                          |    |                    |   |
|-------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------------------------|-----------------------------------|---------|------|-----------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|---------------------|------------------------------|-------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|---------------------------------------|----------------------------------------|----------|-------|--------------------------|----|--------------------|---|
|                                                                                                                   | Outside diameter<br><i>D</i> | Diameter of bolt circle<br><i>K</i> | Diameter of bolt hole<br><i>L</i> | Bolting |      |                                                     | <i>B</i> <sub>1</sub> | <i>B</i> <sub>2</sub> | <i>B</i> <sub>3</sub> | <i>C</i> <sub>1</sub> | <i>C</i> <sub>2</sub> | <i>C</i> <sub>3</sub> | <i>C</i> <sub>4</sub> |                     |                              |                                                 | <i>H</i> <sub>1</sub> | <i>H</i> <sub>2</sub> | <i>H</i> <sub>3</sub> | <i>H</i> <sub>4</sub> | <i>H</i> <sub>5</sub> | <i>N</i> <sub>1</sub> | <i>N</i> <sub>2</sub> | <i>N</i> <sub>3</sub> |                                       |                                        |          |       |                          |    |                    |   |
|                                                                                                                   |                              |                                     |                                   | Number  | Size |                                                     |                       |                       |                       |                       |                       |                       |                       |                     |                              |                                                 |                       |                       |                       |                       |                       |                       |                       |                       |                                       |                                        |          |       |                          |    |                    |   |
|                                                                                                                   | Flange type                  |                                     |                                   |         |      |                                                     |                       |                       |                       |                       |                       |                       |                       |                     |                              |                                                 |                       |                       |                       |                       |                       |                       |                       |                       |                                       |                                        |          |       |                          |    |                    |   |
| 01, 02, 04, 05, 11, 12, 13, 21                                                                                    |                              |                                     |                                   |         |      | 11<br>21 <sup>a</sup><br>34 <sup>c</sup><br>35 - 37 | 01<br>12<br>32        | 02                    | 04                    | 01<br>02<br>04        | 11<br>12<br>13        | 21                    | 05                    | 02<br>04            | 32<br>34                     | 35                                              | 36                    | 37                    | 05                    | 12<br>13              | 11<br>34              | 11<br>34              | 35                    | 36                    | 37                                    | 11<br>34                               | 12<br>13 | 21    | 11<br>12<br>13<br>21, 34 | 34 | 11, 35<br>to<br>37 |   |
| 2 000                                                                                                             | 2 325                        | 2 230                               | 48                                | 48      | M45  | 2 032,0                                             | —                     | —                     | —                     | b                     | 90                    | —                     | —                     | —                   | —                            | —                                               | —                     | —                     | —                     | —                     | 186                   | 30                    | —                     | —                     | —                                     | 2 072                                  | —        | 2 120 | 16                       | —  | See Annex A        |   |
| 2 200                                                                                                             | 2 550                        | 2 440                               | 56                                | 52      | M52  | 2 235,0                                             | —                     | —                     | —                     |                       | 100                   | —                     | —                     | —                   | —                            | —                                               | —                     | —                     | —                     | —                     | —                     | 202                   | 35                    | —                     | —                                     | —                                      | 2 275    | —     | —                        | 18 |                    | — |
| 2 400                                                                                                             | 2 760                        | 2 650                               | 56                                | 56      | M52  | 2 438,0                                             | —                     | —                     | —                     |                       | 110                   | —                     | —                     | —                   | —                            | —                                               | —                     | —                     | —                     | —                     | —                     | 218                   | 35                    | —                     | —                                     | —                                      | 2 478    | —     | —                        | 18 |                    | — |
| 2 600                                                                                                             | 2 960                        | 2 850                               | 56                                | 60      | M52  | 2 620,0                                             | —                     | —                     | —                     |                       | 110                   | —                     | —                     | —                   | —                            | —                                               | —                     | —                     | —                     | —                     | —                     | 224                   | 40                    | —                     | —                                     | —                                      | 2 680    | —     | —                        | 18 |                    | — |
| 2 800                                                                                                             | 3 180                        | 3 070                               | 56                                | 64      | M52  | 2 820,0                                             | —                     | —                     | —                     |                       | 124                   | —                     | —                     | —                   | —                            | —                                               | —                     | —                     | —                     | —                     | —                     | 244                   | 40                    | —                     | —                                     | —                                      | 2 882    | —     | —                        | 18 |                    | — |
| 3 000                                                                                                             | 3 405                        | 3 290                               | 62                                | 68      | M56  | 3 020,0                                             | —                     | —                     | —                     |                       | 132                   | —                     | —                     | —                   | —                            | —                                               | —                     | —                     | —                     | —                     | —                     | 257                   | 45                    | —                     | —                                     | —                                      | 3 085    | —     | —                        | 18 |                    | — |
| <sup>a</sup> For flanges type 21 the outside hub diameter approximately corresponds to the outside pipe diameter. |                              |                                     |                                   |         |      |                                                     |                       |                       |                       |                       |                       |                       |                       |                     |                              |                                                 |                       |                       |                       |                       |                       |                       |                       |                       |                                       |                                        |          |       |                          |    |                    |   |
| <sup>b</sup> To be specified by the purchaser.                                                                    |                              |                                     |                                   |         |      |                                                     |                       |                       |                       |                       |                       |                       |                       |                     |                              |                                                 |                       |                       |                       |                       |                       |                       |                       |                       |                                       |                                        |          |       |                          |    |                    |   |
| <sup>c</sup> Use is limited up to DN 600.                                                                         |                              |                                     |                                   |         |      |                                                     |                       |                       |                       |                       |                       |                       |                       |                     |                              |                                                 |                       |                       |                       |                       |                       |                       |                       |                       |                                       |                                        |          |       |                          |    |                    |   |



This diagram illustrates the arrangement but not necessarily the correct number of bolt holes. Refer to the column "Bolting Number" in Table 13 for the actual number.



- NOTE 1 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.  
 NOTE 2 For dimension  $d_1$ , see Table 8.  
 NOTE 3 For dimensions  $G_{max}$  refer to NOTE 1 of 5.6.1.  
 NOTE 4 Type 33; lapped pipe end without determination of thickness and height.

Figure 8 — Dimensions of PN 16 flanges

## EN 1092-1:2007 (E)

Table 13 — Dimensions of PN 16 flanges

| Dimensions in millimetres      |                       |                            |                               |                |      |                                                     |                |                |                |                  |                |                |                |          |                  |    |                  |                |                      |                |                       |                       |                |                |                |                       |                |              |                             |     |                       |
|--------------------------------|-----------------------|----------------------------|-------------------------------|----------------|------|-----------------------------------------------------|----------------|----------------|----------------|------------------|----------------|----------------|----------------|----------|------------------|----|------------------|----------------|----------------------|----------------|-----------------------|-----------------------|----------------|----------------|----------------|-----------------------|----------------|--------------|-----------------------------|-----|-----------------------|
| DN                             | Mating dimensions     |                            |                               |                |      | Outside diameter of neck                            | Bore diameters |                |                | Flange thickness |                |                |                | Chamfer  | Collar thickness |    |                  |                | Diameter of shoulder | Length         |                       |                       |                |                | Neck diameters |                       |                | Corner radii | Wall thick-ness (see 5.6.1) |     |                       |
|                                | Outside di-<br>ameter | Diameter of bolt<br>circle | Diamete-<br>r of<br>bolt hole | Bolting        |      |                                                     | B <sub>1</sub> | B <sub>2</sub> | B <sub>3</sub> | C <sub>1</sub>   | C <sub>2</sub> | C <sub>3</sub> | C <sub>4</sub> |          | E                | F  | G <sub>max</sub> | H <sub>1</sub> |                      | H <sub>2</sub> | H <sub>3</sub>        | H <sub>4</sub>        | H <sub>5</sub> | N <sub>1</sub> | N <sub>2</sub> | N <sub>3</sub>        | R <sub>1</sub> |              | S                           |     |                       |
|                                |                       |                            |                               | Num-<br>ber    | Size |                                                     |                |                |                |                  |                |                |                |          |                  |    |                  |                |                      |                |                       |                       |                |                |                |                       |                |              |                             |     |                       |
|                                | Flange type           |                            |                               |                |      |                                                     |                |                |                |                  |                |                |                |          |                  |    |                  |                |                      |                |                       |                       |                |                |                |                       |                |              |                             |     |                       |
| 01, 02, 04, 05, 11, 12, 13, 21 |                       |                            |                               |                |      | 11<br>21 <sup>a</sup><br>34 <sup>d</sup><br>35 - 37 | 01<br>12<br>32 | 02             | 04             | 01<br>02<br>04   | 11<br>12<br>13 | 21             | 05             | 02<br>04 | 32<br>34         | 35 | 36               | 37             | 05                   | 12<br>13       | 11<br>34 <sup>c</sup> | 11<br>34 <sup>c</sup> | 35             | 36             | 37             | 11<br>34 <sup>c</sup> | 12<br>13       | 21           | 11<br>12<br>13<br>21,<br>34 | 34  | 11,<br>35<br>to<br>37 |
| 10                             | 90                    | 60                         | 14                            | 4              | M12  | 17,2                                                | 18,0           | 21             | 31             | 14               | 16             | 16             | 16             | 3        | 12               | 5  | 2                | 2,5            | —                    | 22             | 35                    | 6                     | 35             | 35             | 7              | 28                    | 30             | 28           | 4                           | 1,8 | See Annex A           |
| 15                             | 95                    | 65                         | 14                            | 4              | M12  | 21,3                                                | 22,0           | 25             | 35             | 14               | 16             | 16             | 16             | 3        | 12               | 5  | 2                | 2,5            | —                    | 22             | 38                    | 6                     | 38             | 38             | 7              | 32                    | 35             | 32           | 4                           | 2,0 |                       |
| 20                             | 105                   | 75                         | 14                            | 4              | M12  | 26,9                                                | 27,5           | 31             | 42             | 16               | 18             | 18             | 18             | 4        | 14               | 6  | 2,5              | 3              | —                    | 26             | 40                    | 6                     | 40             | 40             | 8              | 40                    | 45             | 40           | 4                           | 2,3 |                       |
| 25                             | 115                   | 85                         | 14                            | 4              | M12  | 33,7                                                | 34,5           | 38             | 49             | 16               | 18             | 18             | 18             | 4        | 14               | 7  | 2,5              | 3              | —                    | 28             | 40                    | 6                     | 40             | 40             | 10             | 46                    | 52             | 50           | 4                           | 2,6 |                       |
| 32                             | 140                   | 100                        | 18                            | 4              | M16  | 42,4                                                | 43,5           | 47             | 59             | 18               | 18             | 18             | 18             | 5        | 14               | 8  | 3                | 3              | —                    | 30             | 42                    | 6                     | 42             | 42             | 12             | 56                    | 60             | 60           | 6                           | 2,6 |                       |
| 40                             | 150                   | 110                        | 18                            | 4              | M16  | 48,3                                                | 49,5           | 53             | 67             | 18               | 18             | 18             | 18             | 5        | 14               | 8  | 3                | 3              | —                    | 32             | 45                    | 7                     | 45             | 45             | 15             | 64                    | 70             | 70           | 6                           | 2,6 |                       |
| 50                             | 165                   | 125                        | 18                            | 4              | M16  | 60,3                                                | 61,5           | 65             | 77             | 20               | 18             | 18             | 18             | 5        | 16               | 8  | 3                | 4              | —                    | 28             | 45                    | 8                     | 45             | 45             | 20             | 74                    | 84             | 84           | 6                           | 2,9 |                       |
| 65                             | 185                   | 145                        | 18                            | 8 <sup>b</sup> | M16  | 76,1                                                | 77,5           | 81             | 96             | 20               | 18             | 18             | 18             | 6        | 16               | 8  | 3                | 4              | 55                   | 32             | 45                    | 10                    | 45             | 45             | 20             | 92                    | 104            | 104          | 6                           | 2,9 |                       |
| 80                             | 200                   | 160                        | 18                            | 8              | M16  | 88,9                                                | 90,5           | 94             | 108            | 20               | 20             | 20             | 20             | 6        | 16               | 10 | 3                | 4              | 70                   | 34             | 50                    | 10                    | 50             | 50             | 25             | 105                   | 118            | 120          | 6                           | 3,2 |                       |
| 100                            | 220                   | 180                        | 18                            | 8              | M16  | 114,3                                               | 116,0          | 120            | 134            | 22               | 20             | 20             | 20             | 6        | 18               | 10 | 4                | 4              | 90                   | 40             | 52                    | 12                    | 52             | 52             | 25             | 131                   | 140            | 140          | 8                           | 3,6 |                       |
| 125                            | 250                   | 210                        | 18                            | 8              | M16  | 139,7                                               | 141,5          | 145            | 162            | 22               | 22             | 22             | 22             | 6        | 18               | 10 | 4                | 4              | 115                  | 44             | 55                    | 12                    | 55             | 55             | 25             | 156                   | 168            | 170          | 8                           | 4,0 |                       |
| 150                            | 285                   | 240                        | 22                            | 8              | M20  | 168,3                                               | 170,5          | 174            | 188            | 24               | 22             | 22             | 22             | 6        | 20               | 10 | 5                | 5              | 140                  | 44             | 55                    | 12                    | 55             | 55             | 25             | 184                   | 195            | 190          | 10                          | 4,5 |                       |
| 200                            | 340                   | 295                        | 22                            | 12             | M20  | 219,1                                               | 221,5          | 226            | 240            | 26               | 24             | 24             | 24             | 6        | 20               | 11 | 6                | 6              | 190                  | 44             | 62                    | 16                    | 62             | 62             | 30             | 235                   | 246            | 246          | 10                          | 6,3 |                       |
| 250                            | 405                   | 355                        | 26                            | 12             | M24  | 273,0                                               | 276,5          | 281            | 294            | 29               | 26             | 26             | 26             | 8        | 22               | 12 | 10               | —              | 235                  | 46             | 70                    | 16                    | 70             | 68             | —              | 292                   | 298            | 296          | 12                          | 6,3 |                       |
| 300                            | 460                   | 410                        | 26                            | 12             | M24  | 323,9                                               | 327,5          | 333            | 348            | 32               | 28             | 28             | 28             | 8        | 24               | 14 | 10               | —              | 285                  | 46             | 78                    | 16                    | 78             | 68             | —              | 344                   | 350            | 350          | 12                          | 7,1 |                       |
| 350                            | 520                   | 470                        | 26                            | 16             | M24  | 355,6                                               | 359,0          | 365            | 400            | 35               | 30             | 30             | 30             | 8        | 26               | 18 | 10               | —              | 330                  | 57             | 82                    | 16                    | 82             | 68             | —              | 390                   | 400            | 410          | 12                          | 8,0 |                       |

See Annex A

|       |       |       |    |    |     |         |       |       |     |    |     |    |    |   |    |    |    |   |       |     |     |    |     |    |   |       |       |       |    |     |
|-------|-------|-------|----|----|-----|---------|-------|-------|-----|----|-----|----|----|---|----|----|----|---|-------|-----|-----|----|-----|----|---|-------|-------|-------|----|-----|
| 400   | 580   | 525   | 30 | 16 | M27 | 406,4   | 411,0 | 416   | 454 | 38 | 32  | 32 | 32 | 8 | 28 | 20 | 10 | — | 380   | 63  | 85  | 16 | 85  | 72 | — | 445   | 456   | 458   | 12 | 8,0 |
| 450   | 640   | 585   | 30 | 20 | M27 | 457,0   | 462,0 | 467   | 500 | 42 | 34  | 40 | 40 | 8 | 30 | 22 | —  | — | 425   | 68  | 83  | 16 | 87  | —  | — | 490   | 502   | 516   | 12 | 8,0 |
| 500   | 715   | 650   | 33 | 20 | M30 | 508,0   | 513,5 | 519   | 556 | 46 | 36  | 44 | 44 | 8 | 32 | 22 | —  | — | 475   | 73  | 84  | 16 | 90  | —  | — | 548   | 559   | 576   | 12 | 8,0 |
| 600   | 840   | 770   | 36 | 20 | M33 | 610,0   | 616,5 | 622   | 660 | 55 | 40  | 54 | 54 | 8 | 32 | 24 | —  | — | 575   | 83  | 88  | 18 | 95  | —  | — | 670   | 658   | 690   | 12 | 8,8 |
| 700   | 910   | 840   | 36 | 24 | M33 | 711,0   | c     | 721   | —   | 63 | 40  | c  | 58 | 8 | —  | 26 | —  | — | 670   | 83  | 104 | 18 | 100 | —  | — | 755   | 760   | 760   | 12 | —   |
| 800   | 1 025 | 950   | 39 | 24 | M36 | 813,0   |       | 824   | —   | 74 | 41  |    | 62 | 8 | —  | 28 | —  | — | 770   | 90  | 108 | 20 | 105 | —  | — | 855   | 864   | 862   | 12 | —   |
| 900   | 1 125 | 1 050 | 39 | 28 | M36 | 914,0   |       | 926   | —   | 82 | 48  |    | 64 | 8 | —  | 30 | —  | — | 860   | 94  | 118 | 20 | 110 | —  | — | 955   | 968   | 962   | 12 | —   |
| 1 000 | 1 255 | 1 170 | 42 | 28 | M39 | 1 016,0 |       | 1 030 | —   | 90 | 59  |    | 68 | 8 | —  | 35 | —  | — | 960   | 100 | 137 | 22 | 120 | —  | — | 1 058 | 1 072 | 1 076 | 16 | —   |
| 1 200 | 1 485 | 1 390 | 48 | 32 | M45 | 1 219,0 | —     | —     | —   | c  | 78  | c  | —  | — | —  | —  | —  | — | 1 160 | —   | 160 | 30 | —   | —  | — | 1 262 | —     | 1 282 | 16 | —   |
| 1 400 | 1 685 | 1 590 | 48 | 36 | M45 | 1 422,0 | —     | —     | —   |    | 84  |    | —  | — | —  | —  | —  | — | 1 346 | —   | 177 | 30 | —   | —  | — | 1 465 | —     | 1 482 | 16 | —   |
| 1 600 | 1 930 | 1 820 | 56 | 40 | M52 | 1 626,0 | —     | —     | —   |    | 102 |    | —  | — | —  | —  | —  | — | 1 546 | —   | 204 | 35 | —   | —  | — | 1 668 | —     | 1 696 | 16 | —   |
| 1 800 | 2 130 | 2 020 | 56 | 44 | M52 | 1 829,0 | —     | —     | —   |    | 110 |    | —  | — | —  | —  | —  | — | 1 746 | —   | 218 | 35 | —   | —  | — | 1 870 | —     | 1 896 | 16 | —   |
| 2 000 | 2 345 | 2 230 | 62 | 48 | M56 | 2 032,0 | —     | —     | —   |    | 124 |    | —  | — | —  | —  | —  | — | 1 950 | —   | 238 | 40 | —   | —  | — | 2 072 | —     | 2 100 | 16 | —   |

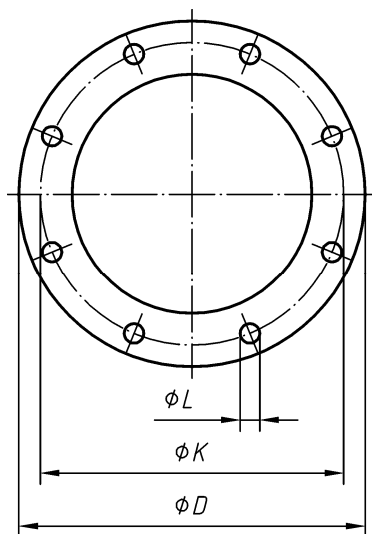
<sup>a</sup> For flanges type 21 the outside hub diameter approximately corresponds to the outside pipe diameter.

<sup>b</sup> According to EN 1092-2 (Cast iron flanges) and EN 1092-3 (Copper alloy flanges), the flanges in this DN and PN may be supplied with 4 holes. Where steel flanges are required with 4 holes, these may be supplied by agreement between flange manufacturer and purchaser.

<sup>c</sup> To be specified by the purchaser.

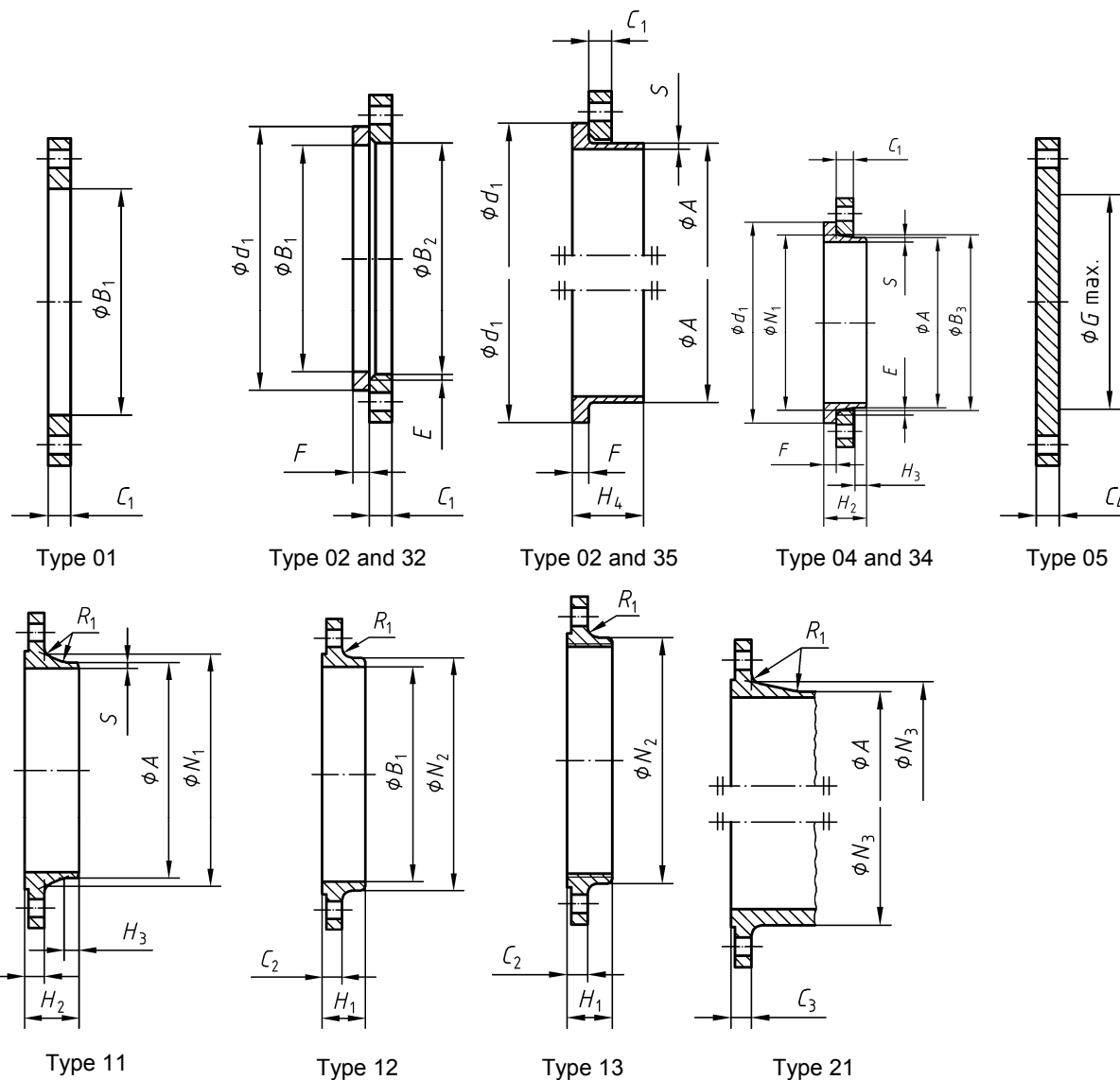
<sup>d</sup> Use is limited up to DN 600.

EN 1092-1:2007 (E)



This diagram illustrates the arrangement but not necessarily the correct number of bolt holes.

Refer to the column "Bolting Number" in Table 14 for the actual number.



- NOTE 1 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.  
 NOTE 2 For dimension  $d_1$ , see Table 8.  
 NOTE 3 For dimensions  $G_{max}$  refer to NOTE 1 of 5.6.1.

Figure 9 — Dimensions of PN 25 flanges

Table 14 — Dimensions of PN 25 flanges

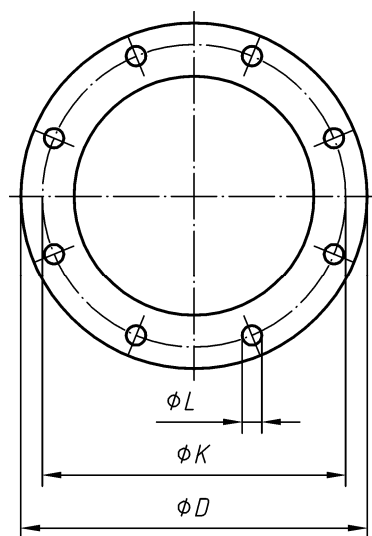
Dimensions in millimetres

| DN                             | Mating dimensions |                         |                       |         |      | Outside diameter of neck                       | Bore diameters |     |     | Flange thickness |                |                |                | Chamfer        | Collar thickness | Diameter of shoulder | Length |          |                       |                       | Neck diameters |                |                | Corner radii   | Wall thickness (see 5.6.1) |                |                |                |
|--------------------------------|-------------------|-------------------------|-----------------------|---------|------|------------------------------------------------|----------------|-----|-----|------------------|----------------|----------------|----------------|----------------|------------------|----------------------|--------|----------|-----------------------|-----------------------|----------------|----------------|----------------|----------------|----------------------------|----------------|----------------|----------------|
|                                | Outside diameter  | Diameter of bolt circle | Diameter of bolt hole | Bolting |      |                                                |                |     |     |                  |                |                |                |                |                  |                      |        |          |                       |                       |                |                |                |                | A                          | B <sub>1</sub> | B <sub>2</sub> | B <sub>3</sub> |
|                                |                   |                         |                       | Number  | Size | D                                              | K              | L   | A   | B <sub>1</sub>   | B <sub>2</sub> | B <sub>3</sub> | C <sub>1</sub> | C <sub>2</sub> | C <sub>3</sub>   | C <sub>4</sub>       | E      | F        | G <sub>max</sub>      | H <sub>1</sub>        | H <sub>2</sub> | H <sub>3</sub> | H <sub>4</sub> | N <sub>1</sub> |                            |                |                |                |
|                                | Flange type       |                         |                       |         |      |                                                |                |     |     |                  |                |                |                |                |                  |                      |        |          |                       |                       |                |                |                |                |                            |                |                |                |
| 01, 02, 04, 05, 11, 12, 13, 21 |                   |                         |                       |         |      | 11<br>21 <sup>a</sup><br>34 <sup>c</sup><br>35 | 01<br>12<br>32 | 02  | 04  | 01<br>02<br>04   | 11<br>12<br>13 | 21             | 05             | 02<br>04       | 32<br>34         | 35                   | 05     | 12<br>13 | 11<br>34 <sup>c</sup> | 11<br>34 <sup>c</sup> | 35             | 11<br>34       | 12<br>13       | 21             | 11<br>12<br>13<br>21, 34   | 34             | 11,<br>35      |                |
| 10                             | 90                | 60                      | 14                    | 4       | M12  | 17,2                                           | 18,0           | 21  | 31  | 14               | 16             | 16             | 16             | 3              | 12               | 5                    | —      | 22       | 35                    | 6                     | 35             | 28             | 30             | 28             | 4                          | 1,8            | See Annex A    |                |
| 15                             | 95                | 65                      | 14                    | 4       | M12  | 21,3                                           | 22,0           | 25  | 35  | 14               | 16             | 16             | 16             | 3              | 12               | 5                    | —      | 22       | 38                    | 6                     | 38             | 32             | 35             | 32             | 4                          | 2,0            |                |                |
| 20                             | 105               | 75                      | 14                    | 4       | M12  | 26,9                                           | 27,5           | 31  | 42  | 16               | 18             | 18             | 18             | 4              | 14               | 6                    | —      | 26       | 40                    | 6                     | 40             | 40             | 45             | 40             | 4                          | 2,3            |                |                |
| 25                             | 115               | 85                      | 14                    | 4       | M12  | 33,7                                           | 34,5           | 38  | 49  | 16               | 18             | 18             | 18             | 4              | 14               | 7                    | —      | 28       | 40                    | 6                     | 40             | 46             | 52             | 50             | 4                          | 2,6            |                |                |
| 32                             | 140               | 100                     | 18                    | 4       | M16  | 42,4                                           | 43,5           | 47  | 59  | 18               | 18             | 18             | 18             | 5              | 14               | 8                    | —      | 30       | 42                    | 6                     | 42             | 56             | 60             | 60             | 6                          | 2,6            |                |                |
| 40                             | 150               | 110                     | 18                    | 4       | M16  | 48,3                                           | 49,5           | 53  | 67  | 18               | 18             | 18             | 18             | 5              | 14               | 8                    | —      | 32       | 45                    | 7                     | 45             | 64             | 70             | 70             | 6                          | 2,6            |                |                |
| 50                             | 165               | 125                     | 18                    | 4       | M16  | 60,3                                           | 61,5           | 65  | 77  | 20               | 20             | 20             | 20             | 5              | 16               | 10                   | —      | 34       | 48                    | 8                     | 48             | 75             | 84             | 84             | 6                          | 2,9            |                |                |
| 65                             | 185               | 145                     | 18                    | 8       | M16  | 76,1                                           | 77,5           | 81  | 96  | 22               | 22             | 22             | 22             | 6              | 16               | 11                   | 55     | 38       | 52                    | 10                    | 52             | 90             | 104            | 104            | 6                          | 2,9            |                |                |
| 80                             | 200               | 160                     | 18                    | 8       | M16  | 88,9                                           | 90,5           | 94  | 114 | 24               | 24             | 24             | 24             | 6              | 18               | 12                   | 70     | 40       | 58                    | 12                    | 58             | 105            | 118            | 120            | 8                          | 3,2            |                |                |
| 100                            | 235               | 190                     | 22                    | 8       | M20  | 114,3                                          | 116,0          | 120 | 138 | 26               | 24             | 24             | 24             | 6              | 20               | 14                   | 90     | 44       | 65                    | 12                    | 65             | 134            | 145            | 142            | 8                          | 3,6            |                |                |
| 125                            | 270               | 220                     | 26                    | 8       | M24  | 139,7                                          | 141,5          | 145 | 166 | 28               | 26             | 26             | 26             | 6              | 22               | 16                   | 115    | 48       | 68                    | 12                    | 68             | 162            | 170            | 162            | 8                          | 4,0            |                |                |
| 150                            | 300               | 250                     | 26                    | 8       | M24  | 168,3                                          | 170,5          | 174 | 194 | 30               | 28             | 28             | 28             | 6              | 24               | 18                   | 140    | 52       | 75                    | 12                    | 75             | 192            | 200            | 192            | 10                         | 4,5            |                |                |
| 200                            | 360               | 310                     | 26                    | 12      | M24  | 219,1                                          | 221,5          | 226 | 250 | 32               | 30             | 30             | 30             | 6              | 26               | 18                   | 190    | 52       | 80                    | 16                    | 80             | 244            | 256            | 252            | 10                         | 6,3            |                |                |
| 250                            | 425               | 370                     | 30                    | 12      | M27  | 273,0                                          | 276,5          | 281 | 302 | 35               | 32             | 32             | 32             | 8              | 26               | 18                   | 235    | 60       | 88                    | 18                    | 88             | 298            | 310            | 304            | 12                         | 7,1            |                |                |
| 300                            | 485               | 430                     | 30                    | 16      | M27  | 323,9                                          | 327,5          | 333 | 356 | 38               | 34             | 34             | 34             | 8              | 28               | 20                   | 285    | 67       | 92                    | 18                    | 92             | 352            | 364            | 364            | 12                         | 8,0            |                |                |
| 350                            | 555               | 490                     | 33                    | 16      | M30  | 355,6                                          | 359,5          | 365 | 408 | 42               | 38             | 38             | 38             | 8              | 32               | 22                   | 332    | 72       | 100                   | 20                    | 100            | 398            | 418            | 418            | 12                         | 8,0            |                |                |
| 400                            | 620               | 550                     | 36                    | 16      | M33  | 406,4                                          | 411,0          | 416 | 462 | 48               | 40             | 40             | 40             | 8              | 34               | 24                   | 380    | 78       | 110                   | 20                    | 110            | 452            | 472            | 472            | 12                         | 8,8            |                |                |
| 450                            | 670               | 600                     | 36                    | 20      | M33  | 457,0                                          | 462,0          | 467 | 510 | 54               | 46             | 46             | 50             | 8              | 36               | 26                   | 425    | 84       | 110                   | 20                    | 110            | 500            | 520            | 520            | 12                         | 8,8            |                |                |
| 500                            | 730               | 660                     | 36                    | 20      | M33  | 508,0                                          | 513,5          | 519 | 568 | 58               | 48             | 48             | 51             | 8              | 38               | 28                   | 475    | 90       | 125                   | 20                    | 125            | 558            | 580            | 580            | 12                         | 10,0           |                |                |
| 600                            | 845               | 770                     | 39                    | 20      | M36  | 610,0                                          | 616,5          | 622 | 670 | 68               | 48             | 58             | 66             | 8              | 40               | 30                   | 575    | 100      | 125                   | 20                    | 115            | 660            | 684            | 684            | 12                         | 11,0           |                |                |
| 700                            | 960               | 875                     | 42                    | 24      | M39  | 711,0                                          | b              | 721 | —   | 85               | 50             | b              | b              | 8              | —                | 30                   | —      | —        | 129                   | 20                    | 125            | 760            | —              | 780            | 12                         | —              |                |                |
| 800                            | 1 085             | 990                     | 48                    | 24      | M45  | 813,0                                          |                | 824 | —   | 95               | 53             |                |                | 8              | —                | 35                   | —      | —        | —                     | 138                   | 22             | 135            | 864            | —              | 882                        | 12             |                | —              |
| 900                            | 1 185             | 1 090                   | 48                    | 28      | M45  | 914,0                                          |                | —   | —   | b                | 57             |                |                | —              | —                | —                    | —      | —        | —                     | 148                   | 24             | —              | 968            | —              | 982                        | 12             |                | —              |
| 1 000                          | 1 320             | 1 210                   | 56                    | 28      | M52  | 1 016,0                                        |                | —   | —   |                  | 63             |                |                | —              | —                | —                    | —      | —        | —                     | —                     | 160            | 24             | —              | 1 070          | —                          | 1 086          |                | 16             |
| 1 200                          | d                 |                         |                       |         |      |                                                |                |     |     |                  |                |                |                |                |                  |                      |        |          |                       |                       |                |                |                |                |                            |                |                |                |
| 1 400                          |                   |                         |                       |         |      |                                                |                |     |     |                  |                |                |                |                |                  |                      |        |          |                       |                       |                |                |                |                |                            |                |                |                |
| 1 600                          |                   |                         |                       |         |      |                                                |                |     |     |                  |                |                |                |                |                  |                      |        |          |                       |                       |                |                |                |                |                            |                |                |                |
| 1 800                          |                   |                         |                       |         |      |                                                |                |     |     |                  |                |                |                |                |                  |                      |        |          |                       |                       |                |                |                |                |                            |                |                |                |
| 2 000                          |                   |                         |                       |         |      |                                                |                |     |     |                  |                |                |                |                |                  |                      |        |          |                       |                       |                |                |                |                |                            |                |                |                |

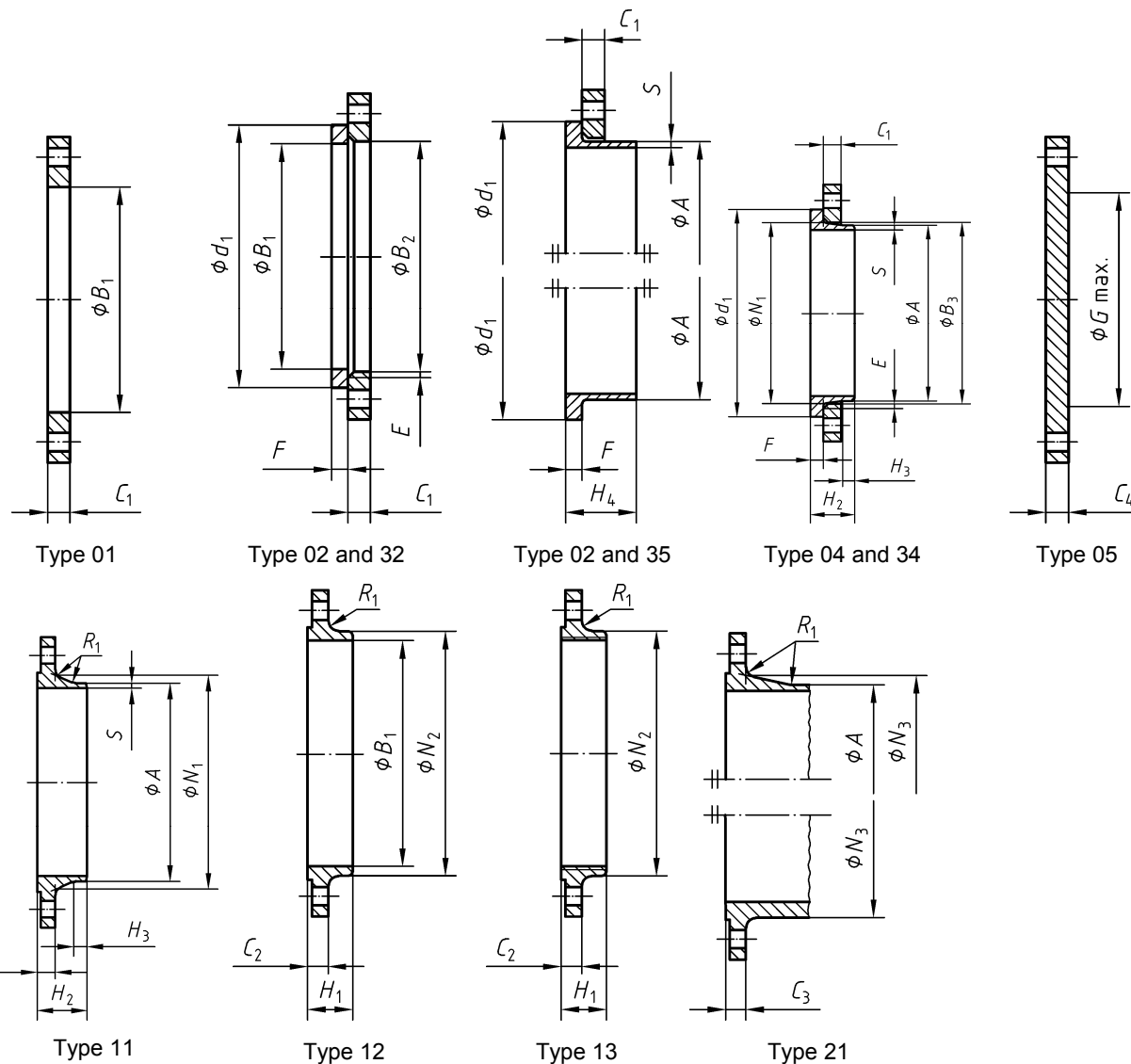
See Annex A

<sup>a</sup> For flanges type 21 the outside hub diameter approximately corresponds to the outside pipe diameter.<sup>b</sup> To be specified by the purchaser.<sup>c</sup> Use is limited up to DN 500.<sup>d</sup> Only mating dimensions fixed, see Annex J.

EN 1092-1:2007 (E)



This diagram illustrates the arrangement but not necessarily the correct number of bolt holes. Refer to the column "Bolting Number" in Table 15 for the actual number.



- NOTE 1 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.  
 NOTE 2 For dimension  $d_1$ , see Table 8.  
 NOTE 3 For dimensions  $G_{max}$  refer to NOTE 1 of 5.6.1.

Figure 10 — Dimensions of PN 40 flanges

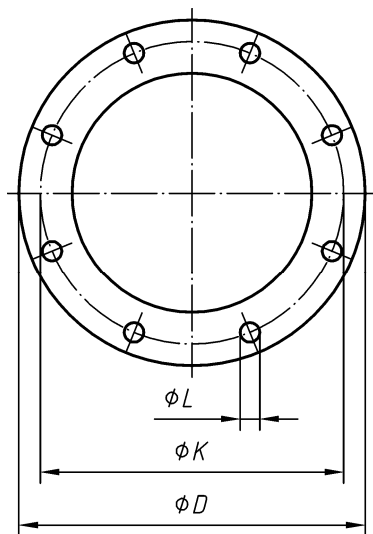
Table 15 — Dimensions of PN 40 flanges

Dimensions in millimetres

| DN                             | Mating dimensions            |                                     |                                   |         |     | Outside diameter of neck<br><i>A</i>     | Bore diameters        |                       |                       | Flange thickness      |                       |                       |                       | Chamfer<br><i>E</i> | Collar thickness<br><i>F</i> | Diameter of shoulder<br><i>G</i> <sub>max</sub> | Length                |                       |                       |                       | Neck diameters        |                       |                       | Corner radii<br><i>R</i> <sub>1</sub> | Neck thickness (see 5.6.1) |                 |        |
|--------------------------------|------------------------------|-------------------------------------|-----------------------------------|---------|-----|------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|---------------------|------------------------------|-------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|---------------------------------------|----------------------------|-----------------|--------|
|                                | Outside diameter<br><i>D</i> | Diameter of bolt circle<br><i>K</i> | Diameter of bolt hole<br><i>L</i> | Bolting |     |                                          | <i>B</i> <sub>1</sub> | <i>B</i> <sub>2</sub> | <i>B</i> <sub>3</sub> | <i>C</i> <sub>1</sub> | <i>C</i> <sub>2</sub> | <i>C</i> <sub>3</sub> | <i>C</i> <sub>4</sub> |                     |                              |                                                 | <i>H</i> <sub>1</sub> | <i>H</i> <sub>2</sub> | <i>H</i> <sub>3</sub> | <i>H</i> <sub>4</sub> | <i>N</i> <sub>1</sub> | <i>N</i> <sub>2</sub> | <i>N</i> <sub>3</sub> |                                       | <i>S</i>                   |                 |        |
|                                |                              |                                     |                                   |         |     |                                          |                       |                       |                       |                       |                       |                       |                       |                     |                              |                                                 |                       |                       |                       |                       |                       |                       |                       |                                       |                            |                 |        |
|                                |                              |                                     |                                   |         |     |                                          |                       |                       |                       |                       |                       |                       |                       |                     |                              |                                                 |                       |                       |                       |                       |                       |                       |                       |                                       |                            |                 |        |
| Flange type                    |                              |                                     |                                   |         |     |                                          |                       |                       |                       |                       |                       |                       |                       |                     |                              |                                                 |                       |                       |                       |                       |                       |                       |                       |                                       |                            |                 |        |
| 01, 02, 04, 05, 11, 12, 13, 21 |                              |                                     |                                   |         |     | 11<br>21 <sup>a</sup><br>34 <sup>c</sup> | 01<br>12<br>32        | 02                    | 04                    | 01<br>02<br>04        | 11<br>12<br>13        | 21                    | 05                    | 02<br>04            | 32<br>34 <sup>c</sup>        | 35                                              | 05                    | 12<br>13              | 11<br>34 <sup>c</sup> | 11<br>34 <sup>c</sup> | 35                    | 11<br>34              | 12<br>13              | 21                                    | 11<br>12<br>13<br>21       | 34 <sup>c</sup> | 11, 35 |
| 10                             | 90                           | 60                                  | 14                                | 4       | M12 | 17,2                                     | 18,0                  | 21                    | 31                    | 14                    | 16                    | 16                    | 3                     | 12                  | 5                            | —                                               | 22                    | 35                    | 6                     | 35                    | 28                    | 30                    | 28                    | 4                                     | 1,8                        | See Annex A     |        |
| 15                             | 95                           | 65                                  | 14                                | 4       | M12 | 21,3                                     | 22,0                  | 25                    | 35                    | 14                    | 16                    | 16                    | 3                     | 12                  | 5                            | —                                               | 22                    | 38                    | 6                     | 38                    | 32                    | 35                    | 32                    | 4                                     | 2,0                        |                 |        |
| 20                             | 105                          | 75                                  | 14                                | 4       | M12 | 26,9                                     | 27,5                  | 31                    | 42                    | 16                    | 18                    | 18                    | 4                     | 14                  | 6                            | —                                               | 26                    | 40                    | 6                     | 40                    | 40                    | 45                    | 40                    | 4                                     | 2,3                        |                 |        |
| 25                             | 115                          | 85                                  | 14                                | 4       | M12 | 33,7                                     | 34,5                  | 38                    | 49                    | 16                    | 18                    | 18                    | 4                     | 14                  | 7                            | —                                               | 28                    | 40                    | 6                     | 40                    | 46                    | 52                    | 50                    | 4                                     | 2,6                        |                 |        |
| 32                             | 140                          | 100                                 | 18                                | 4       | M16 | 42,4                                     | 43,5                  | 47                    | 59                    | 18                    | 18                    | 18                    | 5                     | 14                  | 8                            | —                                               | 30                    | 42                    | 6                     | 42                    | 56                    | 60                    | 60                    | 6                                     | 2,6                        |                 |        |
| 40                             | 150                          | 110                                 | 18                                | 4       | M16 | 48,3                                     | 49,5                  | 53                    | 67                    | 18                    | 18                    | 18                    | 5                     | 14                  | 8                            | —                                               | 32                    | 45                    | 7                     | 45                    | 64                    | 70                    | 70                    | 6                                     | 2,6                        |                 |        |
| 50                             | 165                          | 125                                 | 18                                | 4       | M16 | 60,3                                     | 61,5                  | 65                    | 77                    | 20                    | 20                    | 20                    | 5                     | 16                  | 10                           | —                                               | 34                    | 48                    | 8                     | 48                    | 75                    | 84                    | 84                    | 6                                     | 2,9                        |                 |        |
| 65                             | 185                          | 145                                 | 18                                | 8       | M16 | 76,1                                     | 77,5                  | 81                    | 96                    | 22                    | 22                    | 22                    | 6                     | 16                  | 11                           | 55                                              | 38                    | 52                    | 10                    | 52                    | 90                    | 104                   | 104                   | 6                                     | 2,9                        |                 |        |
| 80                             | 200                          | 160                                 | 18                                | 8       | M16 | 88,9                                     | 90,5                  | 94                    | 114                   | 24                    | 24                    | 24                    | 6                     | 18                  | 12                           | 70                                              | 40                    | 58                    | 12                    | 58                    | 105                   | 118                   | 120                   | 8                                     | 3,2                        |                 |        |
| 100                            | 235                          | 190                                 | 22                                | 8       | M20 | 114,3                                    | 116,0                 | 120                   | 138                   | 26                    | 24                    | 24                    | 6                     | 20                  | 14                           | 90                                              | 44                    | 65                    | 12                    | 65                    | 134                   | 145                   | 142                   | 8                                     | 3,6                        |                 |        |
| 125                            | 270                          | 220                                 | 26                                | 8       | M24 | 139,7                                    | 141,5                 | 145                   | 166                   | 28                    | 26                    | 26                    | 6                     | 22                  | 16                           | 115                                             | 48                    | 68                    | 12                    | 68                    | 162                   | 170                   | 162                   | 8                                     | 4,0                        |                 |        |
| 150                            | 300                          | 250                                 | 26                                | 8       | M24 | 168,3                                    | 170,5                 | 174                   | 194                   | 30                    | 28                    | 28                    | 6                     | 24                  | 18                           | 140                                             | 52                    | 75                    | 12                    | 75                    | 192                   | 200                   | 192                   | 10                                    | 4,5                        |                 |        |
| 200                            | 375                          | 320                                 | 30                                | 12      | M27 | 219,1                                    | 221,5                 | 226                   | 250                   | 36                    | 34                    | 36                    | 6                     | 28                  | 20                           | 190                                             | 52                    | 88                    | 16                    | 88                    | 244                   | 260                   | 254                   | 10                                    | 6,3                        |                 |        |
| 250                            | 450                          | 385                                 | 33                                | 12      | M30 | 273,0                                    | 276,5                 | 281                   | 312                   | 42                    | 38                    | 38                    | 8                     | 30                  | 22                           | 235                                             | 60                    | 105                   | 18                    | 105                   | 306                   | 312                   | 312                   | 12                                    | 7,1                        |                 |        |
| 300                            | 515                          | 450                                 | 33                                | 16      | M30 | 323,9                                    | 327,5                 | 333                   | 368                   | 52                    | 42                    | 42                    | 8                     | 34                  | 25                           | 285                                             | 67                    | 115                   | 18                    | 115                   | 362                   | 380                   | 378                   | 12                                    | 8,0                        |                 |        |
| 350                            | 580                          | 510                                 | 36                                | 16      | M33 | 355,6                                    | 359,5                 | 365                   | 418                   | 58                    | 46                    | 46                    | 8                     | 36                  | 28                           | 330                                             | 72                    | 125                   | 20                    | 125                   | 408                   | 424                   | 432                   | 12                                    | 8,8                        |                 |        |
| 400                            | 660                          | 585                                 | 39                                | 16      | M36 | 406,4                                    | 411,0                 | 416                   | 472                   | 65                    | 50                    | 50                    | 8                     | 42                  | 32                           | 380                                             | 78                    | 135                   | 20                    | 135                   | 462                   | 478                   | 498                   | 12                                    | 11,0                       |                 |        |
| 450                            | 685                          | 610                                 | 39                                | 20      | M36 | 457,0                                    | 462,0                 | 467                   | 510                   | d                     | 57                    | 57                    | 8                     | 46                  | —                            | 425                                             | 84                    | 135                   | 20                    | —                     | 500                   | 522                   | 522                   | 12                                    | 12,5                       |                 |        |
| 500                            | 755                          | 670                                 | 42                                | 20      | M39 | 508,0                                    | 513,5                 | 519                   | 572                   |                       | 57                    | 57                    | 8                     | 50                  | —                            | 475                                             | 90                    | 140                   | 20                    | —                     | 562                   | 576                   | 576                   | 12                                    | 14,2                       |                 |        |
| 600                            | 890                          | 795                                 | 48                                | 20      | M45 | 610,0                                    | 616,5                 | 622                   | 676                   |                       | 72                    | 72                    | 8                     | 54                  | —                            | 575                                             | 100                   | 150                   | 20                    | —                     | 666                   | 686                   | 686                   | 12                                    | 16,0                       |                 |        |
| 700                            | b                            |                                     |                                   |         |     |                                          |                       |                       |                       |                       |                       |                       |                       |                     |                              |                                                 |                       |                       |                       |                       |                       |                       |                       |                                       |                            |                 |        |
| 800                            |                              |                                     |                                   |         |     |                                          |                       |                       |                       |                       |                       |                       |                       |                     |                              |                                                 |                       |                       |                       |                       |                       |                       |                       |                                       |                            |                 |        |
| 900                            |                              |                                     |                                   |         |     |                                          |                       |                       |                       |                       |                       |                       |                       |                     |                              |                                                 |                       |                       |                       |                       |                       |                       |                       |                                       |                            |                 |        |
| 1 000                          |                              |                                     |                                   |         |     |                                          |                       |                       |                       |                       |                       |                       |                       |                     |                              |                                                 |                       |                       |                       |                       |                       |                       |                       |                                       |                            |                 |        |
| 1 200                          |                              |                                     |                                   |         |     |                                          |                       |                       |                       |                       |                       |                       |                       |                     |                              |                                                 |                       |                       |                       |                       |                       |                       |                       |                                       |                            |                 |        |
| 1 400                          |                              |                                     |                                   |         |     |                                          |                       |                       |                       |                       |                       |                       |                       |                     |                              |                                                 |                       |                       |                       |                       |                       |                       |                       |                                       |                            |                 |        |
| 1 600                          |                              |                                     |                                   |         |     |                                          |                       |                       |                       |                       |                       |                       |                       |                     |                              |                                                 |                       |                       |                       |                       |                       |                       |                       |                                       |                            |                 |        |

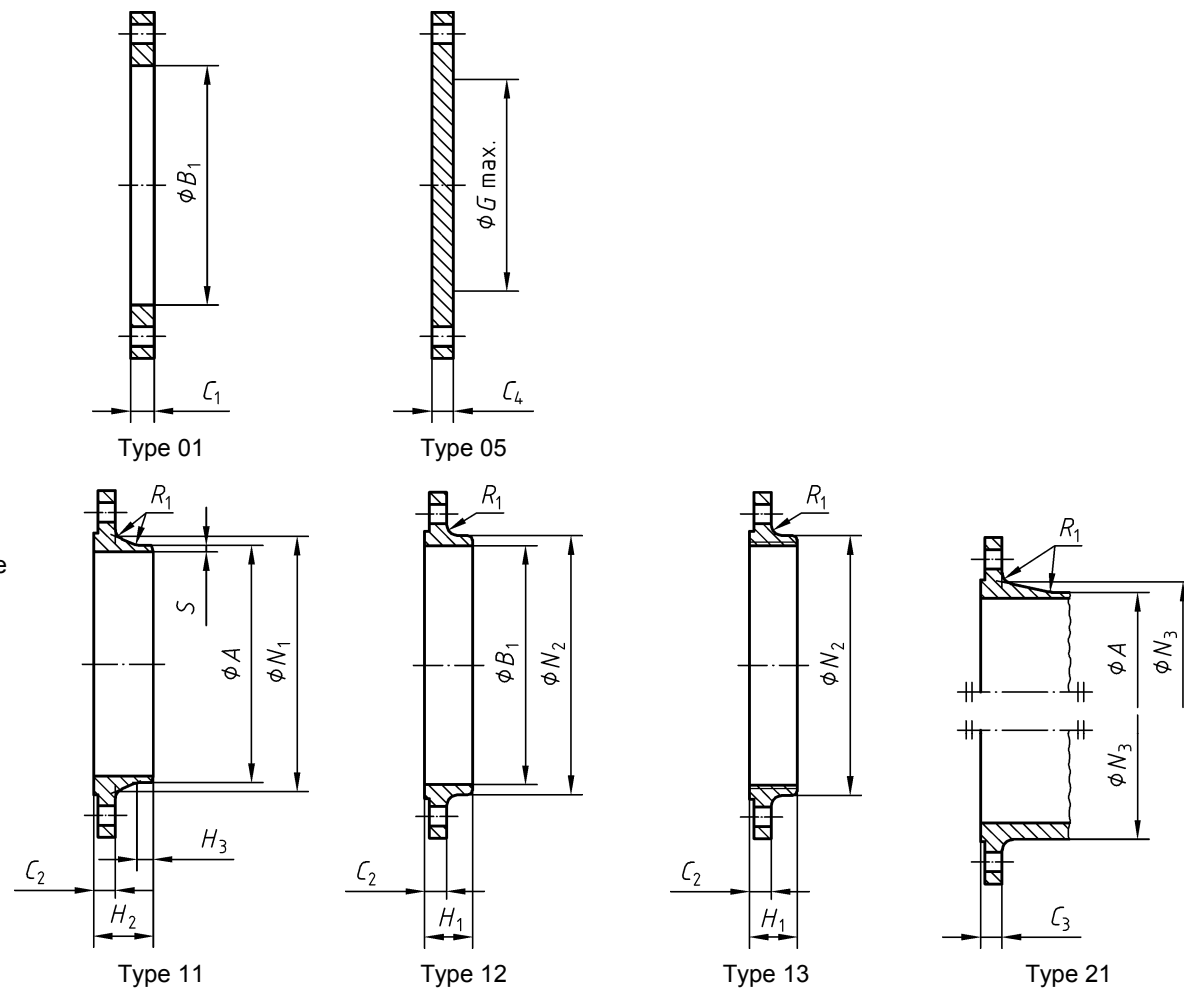
<sup>a</sup> For flanges type 21 the outside hub diameter approximately corresponds to the outside pipe diameter.<sup>b</sup> Only mating dimensions fixed, see Annex J.<sup>c</sup> Use is limited up to DN 600.<sup>d</sup> To be specified by the purchaser.

EN 1092-1:2007 (E)



This diagram illustrates the arrangement but not necessarily the correct number of bolt holes.

Refer to the column "Bolting Number" in Table 16 for the actual number.



NOTE 1 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.

NOTE 2 For dimensions  $G_{max}$  refer to NOTE 1 of 5.6.1.

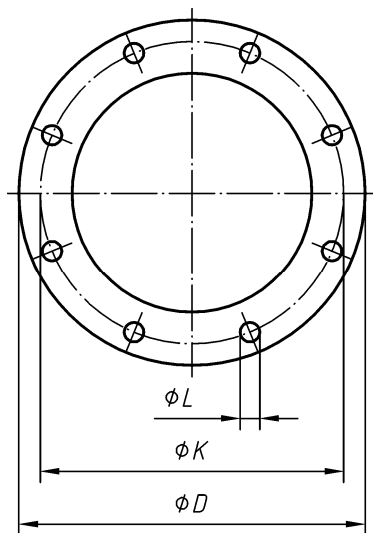
Figure 11 — Dimensions of PN 63 flanges

Table 16 — Dimensions of PN 63 flanges

Dimensions in millimetres

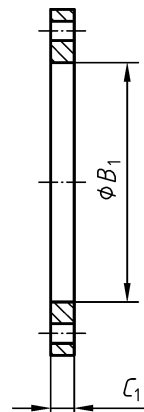
| DN                                                                                                                | Mating dimensions            |                                     |                                   |         |      | Outside diameter of neck<br><i>A</i> | Bore diameter<br><i>B</i> <sub>1</sub> | Flange thickness      |                       |                       |                       | Diameter of shoulder<br><i>G</i> max | Length                |                       |                       | Neck diameters        |                       |                       | Corner radii<br><i>R</i> <sub>1</sub> | Wall thickness (see 5.6.1)<br><i>S</i> |    |  |
|-------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------------------------|-----------------------------------|---------|------|--------------------------------------|----------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|--------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|---------------------------------------|----------------------------------------|----|--|
|                                                                                                                   | Outside diameter<br><i>D</i> | Diameter of bolt circle<br><i>K</i> | Diameter of bolt hole<br><i>L</i> | Bolting |      |                                      |                                        | <i>C</i> <sub>1</sub> | <i>C</i> <sub>2</sub> | <i>C</i> <sub>3</sub> | <i>C</i> <sub>4</sub> |                                      | <i>H</i> <sub>1</sub> | <i>H</i> <sub>2</sub> | <i>H</i> <sub>3</sub> | <i>N</i> <sub>1</sub> | <i>N</i> <sub>2</sub> | <i>N</i> <sub>3</sub> |                                       |                                        |    |  |
|                                                                                                                   |                              |                                     |                                   | Number  | Size |                                      |                                        |                       |                       |                       |                       |                                      |                       |                       |                       |                       |                       |                       |                                       |                                        |    |  |
|                                                                                                                   | Flange type                  |                                     |                                   |         |      |                                      |                                        |                       |                       |                       |                       |                                      |                       |                       |                       |                       |                       |                       |                                       |                                        |    |  |
|                                                                                                                   | 01, 05, 11, 12, 13, 21       |                                     |                                   |         |      |                                      | 11<br>21 <sup>a</sup>                  | 01<br>12              | 01                    | 11<br>12<br>13        | 21                    | 05                                   | 05                    | 12<br>13              | 11                    | 11                    | 11                    | 12<br>13              | 21                                    | 11<br>12<br>13<br>21                   | 11 |  |
| 10                                                                                                                | 100                          | 70                                  | 14                                | 4       | M12  | 17,2                                 | 18,0                                   | 20                    | 20                    | 20                    | 20                    | —                                    | 28                    | 45                    | 6                     | 32                    | 40                    | 40                    | 4                                     | See Annex A                            |    |  |
| 15                                                                                                                | 105                          | 75                                  | 14                                | 4       | M12  | 21,3                                 | 22,0                                   | 20                    | 20                    | 20                    | 20                    | —                                    | 28                    | 45                    | 6                     | 34                    | 43                    | 45                    | 4                                     |                                        |    |  |
| 20                                                                                                                | 130                          | 90                                  | 18                                | 4       | M16  | 26,9                                 | 27,5                                   | 22                    | 22                    | 22                    | 22                    | —                                    | 30                    | 48                    | 8                     | 42                    | 52                    | 50                    | 4                                     |                                        |    |  |
| 25                                                                                                                | 140                          | 100                                 | 18                                | 4       | M16  | 33,7                                 | 34,5                                   | 24                    | 24                    | 24                    | 24                    | —                                    | 32                    | 58                    | 8                     | 52                    | 60                    | 61                    | 4                                     |                                        |    |  |
| 32                                                                                                                | 155                          | 110                                 | 22                                | 4       | M20  | 42,4                                 | 43,5                                   | 24                    | 24                    | 26                    | 24                    | —                                    | 32                    | 60                    | 8                     | 62                    | 68                    | 68                    | 6                                     |                                        |    |  |
| 40                                                                                                                | 170                          | 125                                 | 22                                | 4       | M20  | 48,3                                 | 49,5                                   | 26                    | 26                    | 28                    | 26                    | —                                    | 34                    | 62                    | 10                    | 70                    | 80                    | 82                    | 6                                     |                                        |    |  |
| 50                                                                                                                | 180                          | 135                                 | 22                                | 4       | M20  | 60,3                                 | 61,5                                   | 26                    | 26                    | 26                    | 26                    | —                                    | 36                    | 62                    | 10                    | 82                    | 90                    | 90                    | 6                                     |                                        |    |  |
| 65                                                                                                                | 205                          | 160                                 | 22                                | 8       | M20  | 76,1                                 | 77,5                                   | 26                    | 26                    | 26                    | 26                    | 45                                   | 40                    | 68                    | 12                    | 98                    | 112                   | 105                   | 6                                     |                                        |    |  |
| 80                                                                                                                | 215                          | 170                                 | 22                                | 8       | M20  | 88,9                                 | 90,5                                   | 30                    | 28                    | 28                    | 28                    | 60                                   | 44                    | 72                    | 12                    | 112                   | 125                   | 122                   | 8                                     |                                        |    |  |
| 100                                                                                                               | 250                          | 200                                 | 26                                | 8       | M24  | 114,3                                | 116,0                                  | 32                    | 30                    | 30                    | 30                    | 80                                   | 52                    | 78                    | 12                    | 138                   | 152                   | 146                   | 8                                     |                                        |    |  |
| 125                                                                                                               | 295                          | 240                                 | 30                                | 8       | M27  | 139,7                                | 141,5                                  | 34                    | 34                    | 34                    | 34                    | 105                                  | 56                    | 88                    | 12                    | 168                   | 185                   | 177                   | 8                                     |                                        |    |  |
| 150                                                                                                               | 345                          | 280                                 | 33                                | 8       | M30  | 168,3                                | 170,5                                  | 36                    | 36                    | 36                    | 36                    | 130                                  | 60                    | 95                    | 12                    | 202                   | 215                   | 204                   | 10                                    |                                        |    |  |
| 200                                                                                                               | 415                          | 345                                 | 36                                | 12      | M33  | 219,1                                | 221,5                                  | 48                    | 42                    | 42                    | 42                    | 180                                  | —                     | 110                   | 16                    | 256                   | —                     | 264                   | 10                                    |                                        |    |  |
| 250                                                                                                               | 470                          | 400                                 | 36                                | 12      | M33  | 273,0                                | 276,5                                  | 55                    | 46                    | 46                    | 46                    | 220                                  | —                     | 125                   | 18                    | 316                   | —                     | 320                   | 12                                    |                                        |    |  |
| 300                                                                                                               | 530                          | 460                                 | 36                                | 16      | M33  | 323,9                                | 327,5                                  | 65                    | 52                    | 52                    | 52                    | 270                                  | —                     | 140                   | 18                    | 372                   | —                     | 378                   | 12                                    |                                        |    |  |
| 350                                                                                                               | 600                          | 525                                 | 39                                | 16      | M36  | 355,6                                | 359,5                                  | 72                    | 56                    | 56                    | 56                    | 310                                  | —                     | 150                   | 20                    | 420                   | —                     | 434                   | 12                                    |                                        |    |  |
| 400                                                                                                               | 670                          | 585                                 | 42                                | 16      | M39  | 406,4                                | 411,0                                  | 80                    | 60                    | 60                    | 60                    | 360                                  | —                     | 160                   | 20                    | 475                   | —                     | 490                   | 12                                    |                                        |    |  |
| 500                                                                                                               | b                            |                                     |                                   |         |      |                                      |                                        |                       |                       |                       |                       |                                      |                       |                       |                       |                       |                       |                       |                                       |                                        |    |  |
| 600                                                                                                               |                              |                                     |                                   |         |      |                                      |                                        |                       |                       |                       |                       |                                      |                       |                       |                       |                       |                       |                       |                                       |                                        |    |  |
| 700                                                                                                               |                              |                                     |                                   |         |      |                                      |                                        |                       |                       |                       |                       |                                      |                       |                       |                       |                       |                       |                       |                                       |                                        |    |  |
| 800                                                                                                               |                              |                                     |                                   |         |      |                                      |                                        |                       |                       |                       |                       |                                      |                       |                       |                       |                       |                       |                       |                                       |                                        |    |  |
| 900                                                                                                               |                              |                                     |                                   |         |      |                                      |                                        |                       |                       |                       |                       |                                      |                       |                       |                       |                       |                       |                       |                                       |                                        |    |  |
| 1 000                                                                                                             |                              |                                     |                                   |         |      |                                      |                                        |                       |                       |                       |                       |                                      |                       |                       |                       |                       |                       |                       |                                       |                                        |    |  |
| 1 200                                                                                                             |                              |                                     |                                   |         |      |                                      |                                        |                       |                       |                       |                       |                                      |                       |                       |                       |                       |                       |                       |                                       |                                        |    |  |
| <sup>a</sup> For flanges type 21 the outside hub diameter approximately corresponds to the outside pipe diameter. |                              |                                     |                                   |         |      |                                      |                                        |                       |                       |                       |                       |                                      |                       |                       |                       |                       |                       |                       |                                       |                                        |    |  |
| <sup>b</sup> Only mating dimensions fixed, see Annex J.                                                           |                              |                                     |                                   |         |      |                                      |                                        |                       |                       |                       |                       |                                      |                       |                       |                       |                       |                       |                       |                                       |                                        |    |  |

EN 1092-1:2007 (E)

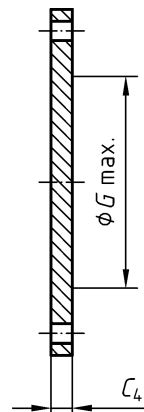


This diagram illustrates the arrangement but not necessarily the correct number of bolt holes.

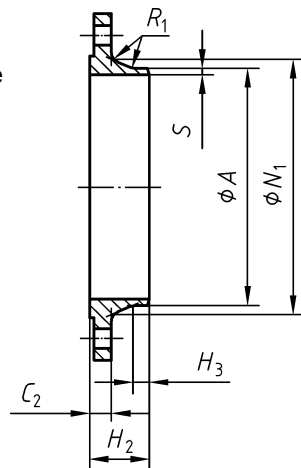
Refer to the column "Bolting Number" in Table 17 for the actual number.



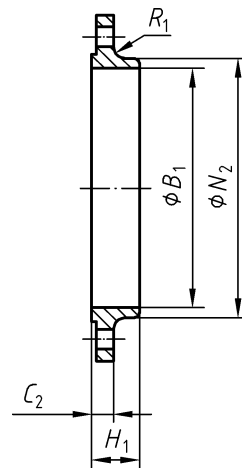
Type 01



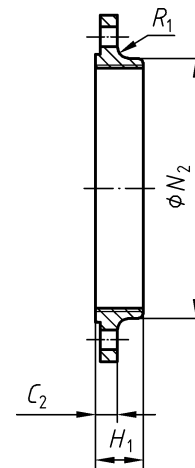
Type 05



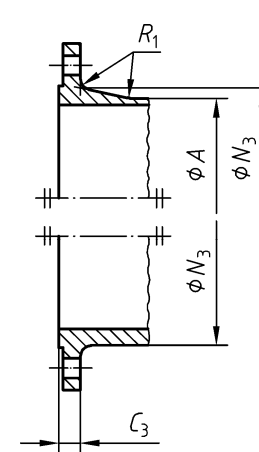
Type 11



Type 12



Type 13



Type 21

NOTE 1 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.

NOTE 2 For dimensions  $G_{max}$  refer to NOTE 1 of 5.6.1.

Figure 12 — Dimensions of PN 100 flanges

Table 17 — Dimensions of PN 100 flanges

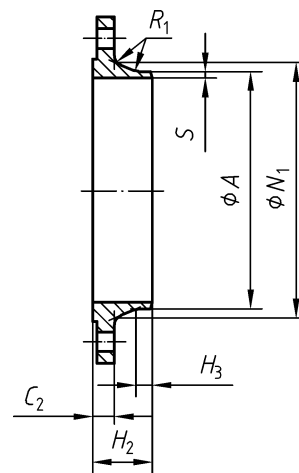
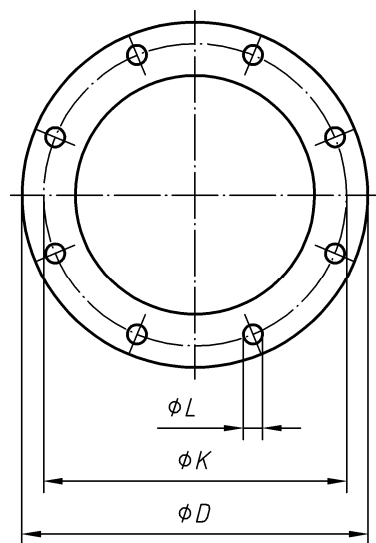
Dimensions in millimetres

| DN          | Mating dimensions            |                                     |                                   |         |      | Outside diameter of neck<br><i>A</i> | Bore diameter<br><i>B</i> <sub>1</sub> | Flange thickness      |                       |                       |                       |                       | Diameter of shoulder<br><i>G</i> <sub>max</sub> | Length                |                       |                       | Neck diameters        |                       |                      | Corner radii<br><i>R</i> <sub>1</sub> | Wall thickness (see 5.6.1)<br><i>S</i> |
|-------------|------------------------------|-------------------------------------|-----------------------------------|---------|------|--------------------------------------|----------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------|---------------------------------------|----------------------------------------|
|             | Outside diameter<br><i>D</i> | Diameter of bolt circle<br><i>K</i> | Diameter of bolt hole<br><i>L</i> | Bolting |      |                                      |                                        | <i>C</i> <sub>1</sub> | <i>C</i> <sub>2</sub> | <i>C</i> <sub>3</sub> | <i>C</i> <sub>4</sub> | <i>H</i> <sub>1</sub> |                                                 | <i>H</i> <sub>2</sub> | <i>H</i> <sub>3</sub> | <i>N</i> <sub>1</sub> | <i>N</i> <sub>2</sub> | <i>N</i> <sub>3</sub> |                      |                                       |                                        |
|             |                              |                                     |                                   | Number  | Size |                                      |                                        |                       |                       |                       |                       |                       |                                                 |                       |                       |                       |                       |                       |                      |                                       |                                        |
|             |                              |                                     |                                   |         |      |                                      |                                        |                       |                       |                       |                       |                       |                                                 |                       |                       |                       |                       |                       |                      |                                       |                                        |
| Flange type |                              |                                     |                                   |         |      |                                      |                                        |                       |                       |                       |                       |                       |                                                 |                       |                       |                       |                       |                       |                      |                                       |                                        |
|             | 01, 05, 11, 12, 13, 21       |                                     |                                   |         |      | 11<br>21 <sup>a</sup>                | 01<br>12                               | 01                    | 11<br>12<br>13        | 21                    | 05                    | 05                    | 12<br>13                                        | 11                    | 11                    | 11                    | 12<br>13              | 21                    | 11<br>12<br>13<br>21 | 11                                    |                                        |
| 10          | 100                          | 70                                  | 14                                | 4       | M12  | 17,2                                 | 18,0                                   | 20                    | 20                    | 20                    | 20                    | —                     | 28                                              | 45                    | 6                     | 32                    | 40                    | 40                    | 4                    | Se Annex A                            |                                        |
| 15          | 105                          | 75                                  | 14                                | 4       | M12  | 21,3                                 | 22,0                                   | 20                    | 20                    | 20                    | 20                    | —                     | 28                                              | 45                    | 6                     | 34                    | 43                    | 45                    | 4                    |                                       |                                        |
| 20          | 130                          | 90                                  | 18                                | 4       | M16  | 26,9                                 | 27,5                                   | 22                    | 22                    | 22                    | 22                    | —                     | 30                                              | 48                    | 8                     | 42                    | 52                    | 50                    | 4                    |                                       |                                        |
| 25          | 140                          | 100                                 | 18                                | 4       | M16  | 33,7                                 | 34,5                                   | 24                    | 24                    | 24                    | 24                    | —                     | 32                                              | 58                    | 8                     | 52                    | 60                    | 61                    | 4                    |                                       |                                        |
| 32          | 155                          | 110                                 | 22                                | 4       | M20  | 42,4                                 | 43,5                                   | 24                    | 24                    | 26                    | 24                    | —                     | 32                                              | 60                    | 8                     | 62                    | 68                    | 68                    | 6                    |                                       |                                        |
| 40          | 170                          | 125                                 | 22                                | 4       | M20  | 48,3                                 | 49,5                                   | 26                    | 26                    | 28                    | 26                    | —                     | 34                                              | 62                    | 10                    | 70                    | 80                    | 82                    | 6                    |                                       |                                        |
| 50          | 195                          | 145                                 | 26                                | 4       | M24  | 60,3                                 | 61,5                                   | 28                    | 28                    | 30                    | 28                    | —                     | 36                                              | 68                    | 10                    | 90                    | 95                    | 96                    | 6                    |                                       |                                        |
| 65          | 220                          | 170                                 | 26                                | 8       | M24  | 76,1                                 | 77,5                                   | 30                    | 30                    | 34                    | 30                    | 45                    | 40                                              | 76                    | 12                    | 108                   | 118                   | 118                   | 6                    |                                       |                                        |
| 80          | 230                          | 180                                 | 26                                | 8       | M24  | 88,9                                 | 90,5                                   | 34                    | 32                    | 36                    | 32                    | 60                    | 44                                              | 78                    | 12                    | 120                   | 130                   | 128                   | 8                    |                                       |                                        |
| 100         | 265                          | 210                                 | 30                                | 8       | M27  | 114,3                                | 116,0                                  | 36                    | 36                    | 40                    | 36                    | 80                    | 52                                              | 90                    | 12                    | 150                   | 158                   | 150                   | 8                    |                                       |                                        |
| 125         | 315                          | 250                                 | 33                                | 8       | M30  | 139,7                                | 141,5                                  | 42                    | 40                    | 40                    | 40                    | 105                   | 56                                              | 105                   | 12                    | 180                   | 188                   | 185                   | 8                    |                                       |                                        |
| 150         | 355                          | 290                                 | 33                                | 12      | M30  | 168,3                                | 170,5                                  | 48                    | 44                    | 44                    | 44                    | 130                   | 60                                              | 115                   | 12                    | 210                   | 225                   | 216                   | 10                   |                                       |                                        |
| 200         | 430                          | 360                                 | 36                                | 12      | M33  | 219,1                                | 221,5                                  | 60                    | 52                    | 52                    | 52                    | 180                   | —                                               | 130                   | 16                    | 278                   | —                     | 278                   | 10                   |                                       |                                        |
| 250         | 505                          | 430                                 | 39                                | 12      | M36  | 273,0                                | 276,5                                  | 72                    | 60                    | 60                    | 60                    | 210                   | —                                               | 157                   | 18                    | 340                   | —                     | 340                   | 12                   |                                       |                                        |
| 300         | 585                          | 500                                 | 42                                | 16      | M39  | 323,9                                | 327,5                                  | 84                    | 68                    | 68                    | 68                    | 260                   | —                                               | 170                   | 18                    | 400                   | —                     | 407                   | 12                   |                                       |                                        |
| 350         | 655                          | 560                                 | 48                                | 16      | M45  | 355,6                                | 359,5                                  | 95                    | 74                    | 74                    | 74                    | 300                   | —                                               | 189                   | 20                    | 460                   | —                     | 460                   | 12                   |                                       |                                        |
| 400         | b                            |                                     |                                   |         |      |                                      |                                        |                       |                       |                       |                       |                       |                                                 |                       |                       |                       |                       |                       |                      |                                       |                                        |
| 500         |                              |                                     |                                   |         |      |                                      |                                        |                       |                       |                       |                       |                       |                                                 |                       |                       |                       |                       |                       |                      |                                       |                                        |

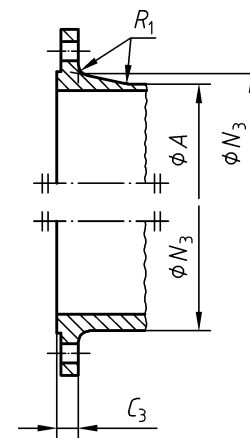
<sup>a</sup> For flanges type 21 the outside hub diameter approximately corresponds to the outside pipe diameter.

<sup>b</sup> Only mating dimensions fixed, see Annex J.

EN 1092-1:2007 (E)



Type 11



Type 21

This diagram illustrates the arrangement but not necessarily the correct number of bolt holes.

Refer to the column "Bolting Number" in Table 18 for the actual number.

NOTE Dimensions  $N_1$  and  $N_3$  are measured at the intersection of the hub draft angle and the back face of the flange.

Figure 13 — Dimensions of PN 160 flanges

Table 18 — Dimensions of PN 160 flanges

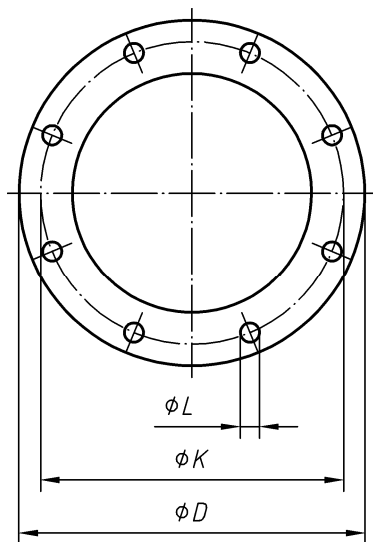
Dimensions in millimetres

| DN  | Mating dimensions            |                                     |                                   |         |      | Outside diameter of neck<br><i>A</i> | Flange thickness      |    | Length |    | Neck diameters |     | Corner radii |    | Wall thickness (see 5.6.1)<br><i>S</i> |
|-----|------------------------------|-------------------------------------|-----------------------------------|---------|------|--------------------------------------|-----------------------|----|--------|----|----------------|-----|--------------|----|----------------------------------------|
|     | Outside diameter<br><i>D</i> | Diameter of bolt circle<br><i>K</i> | Diameter of bolt hole<br><i>L</i> | Bolting |      |                                      |                       |    |        |    |                |     |              |    |                                        |
|     |                              |                                     |                                   | Number  | Size |                                      |                       |    |        |    |                |     |              |    |                                        |
|     | Flange type                  |                                     |                                   |         |      |                                      |                       |    |        |    |                |     |              |    |                                        |
|     | 11, 21                       |                                     |                                   |         |      |                                      | 11<br>21 <sup>a</sup> | 11 | 21     | 11 | 11             | 11  | 21           | 11 | 21                                     |
| 10  | 100                          | 70                                  | 14                                | 4       | M12  | 17,2                                 | 20                    | 20 | 45     | 6  | 32             | 40  | 4            | 4  | 2,0                                    |
| 15  | 105                          | 75                                  | 14                                | 4       | M12  | 21,3                                 | 20                    | 20 | 45     | 6  | 34             | 45  | 4            | 4  | 2,0                                    |
| 25  | 140                          | 100                                 | 18                                | 4       | M16  | 33,7                                 | 24                    | 24 | 58     | 8  | 52             | 61  | 4            | 4  | 2,9                                    |
| 40  | 170                          | 125                                 | 22                                | 4       | M20  | 48,3                                 | 28                    | 28 | 64     | 10 | 70             | 82  | 6            | 4  | 3,6                                    |
| 50  | 195                          | 145                                 | 26                                | 4       | M24  | 60,3                                 | 30                    | 30 | 75     | 10 | 90             | 96  | 6            | 4  | 4,0                                    |
| 65  | 220                          | 170                                 | 26                                | 8       | M24  | 76,1                                 | 34                    | 34 | 82     | 12 | 108            | 118 | 6            | 5  | 5,0                                    |
| 80  | 230                          | 180                                 | 26                                | 8       | M24  | 88,9                                 | 36                    | 36 | 86     | 12 | 120            | 128 | 8            | 5  | 6,3                                    |
| 100 | 265                          | 210                                 | 30                                | 8       | M27  | 114,3                                | 40                    | 40 | 100    | 12 | 150            | 150 | 8            | 5  | 8,0                                    |
| 125 | 315                          | 250                                 | 33                                | 8       | M30  | 139,7                                | 44                    | 44 | 115    | 14 | 180            | 184 | 8            | 6  | 10,0                                   |
| 150 | 355                          | 290                                 | 33                                | 12      | M30  | 168,3                                | 50                    | 50 | 128    | 14 | 210            | 224 | 10           | 6  | 12,5                                   |
| 200 | 430                          | 360                                 | 36                                | 12      | M33  | 219,1                                | 60                    | 60 | 140    | 16 | 278            | 288 | 10           | 8  | 16,0                                   |
| 250 | 515                          | 430                                 | 42                                | 12      | M39  | 273,0                                | 68                    | 68 | 155    | 18 | 340            | 346 | 12           | 8  | 20,0                                   |
| 300 | 585                          | 500                                 | 42                                | 16      | M39  | 323,9                                | 78                    | 78 | 175    | 18 | 400            | 414 | 12           | 10 | 22,2                                   |

<sup>a</sup> For flanges type 21 the outside hub diameter approximately corresponds to the outside pipe diameter.

<sup>a</sup> For flanges type 21 the outside hub diameter approximately corresponds to the outside pipe diameter.

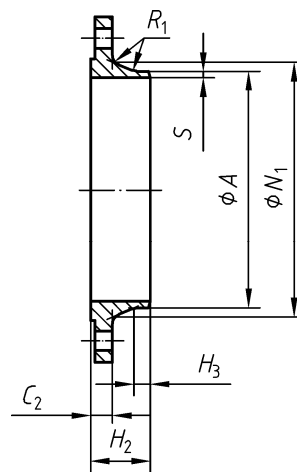
**EN 1092-1:2007 (E)**



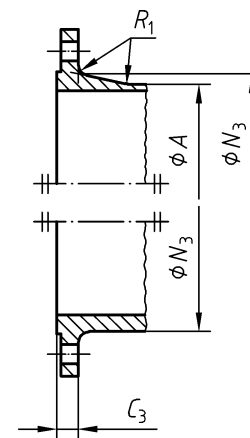
This diagram illustrates the arrangement but not necessarily the correct number of bolt holes.

Refer to the column "Bolting Number" in Table 19 for the actual number.

**NOTE** Dimensions  $N_1$  and  $N_3$  are measured at the intersection of the hub draft angle and the back face of the flange.



Type 11



Type 21

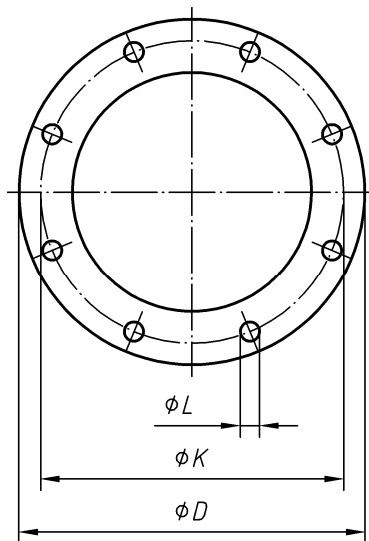
**Figure 14 — Dimensions of PN 250 flanges**

Table 19 — Dimensions of PN 250 flanges

Dimensions in millimetres

| DN                                                                                                                | Mating dimensions |                         |                       |          |          | Outside diameter of neck | Flange thickness      |      | Length   |                       | Neck diameters        |                       | Corner radii          | Wall thickness (see 5.6.1) |                       |
|-------------------------------------------------------------------------------------------------------------------|-------------------|-------------------------|-----------------------|----------|----------|--------------------------|-----------------------|------|----------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------------|-----------------------|
|                                                                                                                   | Outside diameter  | Diameter of bolt circle | Diameter of bolt hole | Bolting  |          |                          |                       |      |          |                       |                       |                       |                       |                            |                       |
|                                                                                                                   |                   |                         |                       | <i>D</i> | <i>K</i> | <i>L</i>                 | Number                | Size | <i>A</i> | <i>C</i> <sub>2</sub> | <i>C</i> <sub>3</sub> | <i>H</i> <sub>2</sub> | <i>H</i> <sub>3</sub> | <i>N</i> <sub>1</sub>      | <i>N</i> <sub>3</sub> |
|                                                                                                                   | Flange type       |                         |                       |          |          |                          |                       |      |          |                       |                       |                       |                       |                            |                       |
|                                                                                                                   | 11, 21            |                         |                       |          |          |                          | 11<br>21 <sup>a</sup> | 11   | 21       | 11                    | 11                    | 11                    | 21                    | 11                         | 21                    |
| 10 <sup>b, c</sup>                                                                                                | 125               | 85                      | 18                    | 4        | M16      | —                        | —                     | 24   | —        | —                     | —                     | 46                    | —                     | 4                          | —                     |
| 15                                                                                                                | 130               | 90                      | 18                    | 4        | M16      | 21,3                     | 26                    | 26   | 60       | 6                     | 48                    | 52                    | 4                     | 4                          | 2,6                   |
| 25                                                                                                                | 150               | 105                     | 22                    | 4        | M20      | 33,7                     | 28                    | 28   | 65       | 8                     | 60                    | 63                    | 4                     | 4                          | 3,6                   |
| 40                                                                                                                | 185               | 135                     | 26                    | 4        | M24      | 48,3                     | 34                    | 34   | 80       | 10                    | 84                    | 90                    | 6                     | 4                          | 5,0                   |
| 50                                                                                                                | 200               | 150                     | 26                    | 8        | M24      | 60,3                     | 38                    | 38   | 85       | 10                    | 95                    | 102                   | 6                     | 5                          | 6,3                   |
| 65                                                                                                                | 230               | 180                     | 26                    | 8        | M24      | 76,1                     | 42                    | 42   | 95       | 12                    | 124                   | 125                   | 6                     | 5                          | 8,0                   |
| 80                                                                                                                | 255               | 200                     | 30                    | 8        | M27      | 101,6                    | 46                    | 46   | 102      | 12                    | 136                   | 142                   | 8                     | 6                          | 11,0                  |
| 100                                                                                                               | 300               | 235                     | 33                    | 8        | M30      | 127,0                    | 54                    | 54   | 120      | 14                    | 164                   | 168                   | 8                     | 6                          | 14,2                  |
| 125                                                                                                               | 340               | 275                     | 33                    | 12       | M30      | 152,4                    | 60                    | 60   | 140      | 16                    | 200                   | 207                   | 8                     | 6                          | 16,0                  |
| 150                                                                                                               | 390               | 320                     | 36                    | 12       | M33      | 177,8                    | 68                    | 68   | 160      | 18                    | 240                   | 246                   | 10                    | 8                          | 17,5                  |
| 200                                                                                                               | 485               | 400                     | 42                    | 12       | M39      | 244,5                    | 82                    | 82   | 190      | 25                    | 305                   | 314                   | 10                    | 8                          | 25,0                  |
| 250                                                                                                               | 585               | 490                     | 48                    | 16       | M45      | 298,5                    | 100                   | 100  | 215      | 30                    | 385                   | 394                   | 12                    | 10                         | 32,0                  |
| 300 <sup>b</sup>                                                                                                  | 690               | 590                     | 52                    | 16       | M48      | —                        | —                     | 120  | —        | —                     | —                     | 480                   | —                     | 10                         | —                     |
| <sup>a</sup> For flanges type 21 the outside hub diameter approximately corresponds to the outside pipe diameter. |                   |                         |                       |          |          |                          |                       |      |          |                       |                       |                       |                       |                            |                       |
| <sup>b</sup> For flanges type 21.                                                                                 |                   |                         |                       |          |          |                          |                       |      |          |                       |                       |                       |                       |                            |                       |
| <sup>c</sup> For flanges type 11 use flanges PN 320.                                                              |                   |                         |                       |          |          |                          |                       |      |          |                       |                       |                       |                       |                            |                       |

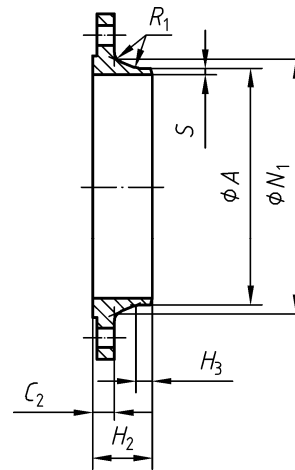
EN 1092-1:2007 (E)



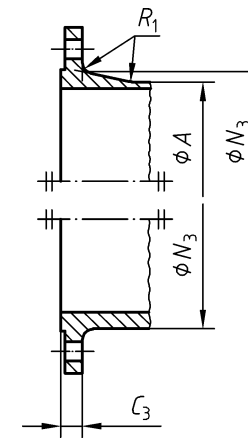
This diagram illustrates the arrangement but not necessarily the correct number of bolt holes.

Refer to the column "Bolting Number" in Table 20 for the actual number.

NOTE Dimensions  $N_1$  and  $N_3$  are measured at the intersection of the hub draft angle and the back face of the flange.



Type 11



Type 21

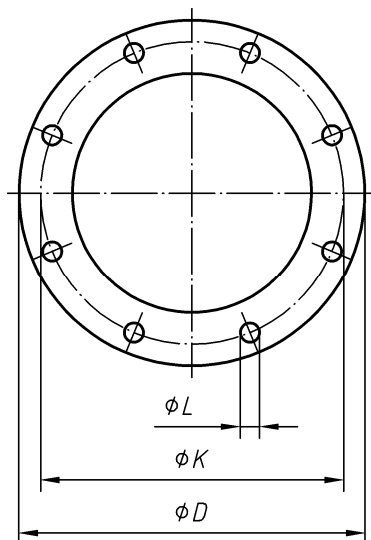
Figure 15 — Dimensions of PN 320 flanges

Table 20 — Dimensions of PN 320 flanges

Dimensions in millimetres

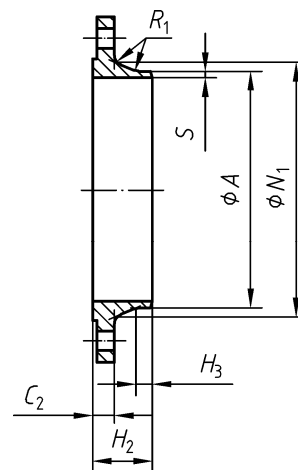
| DN                                                                                                                | Mating dimensions            |                                     |                                   |         |      | Outside diameter of neck<br><i>A</i> | Flange thickness      |                       | Length                |                       | Neck diameters        |                       | Corner radii<br><i>R</i> <sub>1</sub> | Wall thickness (see 5.6.1)<br><i>S</i> |      |
|-------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------------------------|-----------------------------------|---------|------|--------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|---------------------------------------|----------------------------------------|------|
|                                                                                                                   | Outside diameter<br><i>D</i> | Diameter of bolt circle<br><i>K</i> | Diameter of bolt hole<br><i>L</i> | Bolting |      |                                      | <i>C</i> <sub>2</sub> | <i>C</i> <sub>3</sub> | <i>H</i> <sub>2</sub> | <i>H</i> <sub>3</sub> | <i>N</i> <sub>1</sub> | <i>N</i> <sub>3</sub> |                                       |                                        |      |
|                                                                                                                   |                              |                                     |                                   | Number  | Size |                                      |                       |                       |                       |                       |                       |                       |                                       |                                        |      |
|                                                                                                                   | Flange type                  |                                     |                                   |         |      |                                      |                       |                       |                       |                       |                       |                       |                                       |                                        |      |
|                                                                                                                   | 11, 21                       |                                     |                                   |         |      |                                      | 11<br>21 <sup>a</sup> | 11                    | 21                    | 11                    | 11                    | 11                    | 21                                    | 11                                     | 21   |
| 10                                                                                                                | 125                          | 85                                  | 18                                | 4       | M16  | 17,2                                 | 24                    | 24                    | 58                    | 6                     | 44                    | 46                    | 4                                     | 4                                      | 2,6  |
| 15                                                                                                                | 130                          | 90                                  | 18                                | 4       | M16  | 21,3                                 | 26                    | 26                    | 60                    | 6                     | 48                    | 52                    | 4                                     | 4                                      | 3,2  |
| 25                                                                                                                | 160                          | 115                                 | 22                                | 4       | M20  | 33,7                                 | 34                    | 34                    | 78                    | 8                     | 68                    | 72                    | 4                                     | 4                                      | 5,0  |
| 40                                                                                                                | 195                          | 145                                 | 26                                | 4       | M24  | 48,3                                 | 38                    | 38                    | 88                    | 10                    | 92                    | 96                    | 6                                     | 5                                      | 6,3  |
| 50                                                                                                                | 210                          | 160                                 | 26                                | 8       | M24  | 63,5                                 | 42                    | 42                    | 100                   | 10                    | 106                   | 110                   | 6                                     | 5                                      | 8,0  |
| 65                                                                                                                | 255                          | 200                                 | 30                                | 8       | M27  | 88,9                                 | 51                    | 51                    | 120                   | 12                    | 138                   | 137                   | 6                                     | 6                                      | 11,0 |
| 80                                                                                                                | 275                          | 220                                 | 30                                | 8       | M27  | 101,6                                | 55                    | 55                    | 130                   | 14                    | 156                   | 160                   | 8                                     | 6                                      | 12,5 |
| 100                                                                                                               | 335                          | 265                                 | 36                                | 8       | M33  | 133,0                                | 65                    | 65                    | 145                   | 16                    | 186                   | 190                   | 8                                     | 8                                      | 16,0 |
| 125                                                                                                               | 380                          | 310                                 | 36                                | 12      | M33  | 168,3                                | 75                    | 75                    | 175                   | 20                    | 230                   | 235                   | 8                                     | 8                                      | 20,0 |
| 150                                                                                                               | 425                          | 350                                 | 39                                | 12      | M36  | 193,7                                | 84                    | 84                    | 195                   | 25                    | 265                   | 266                   | 10                                    | 10                                     | 25,0 |
| 200                                                                                                               | 525                          | 440                                 | 42                                | 16      | M39  | 244,5                                | 103                   | 103                   | 235                   | 30                    | 345                   | 350                   | 10                                    | 10                                     | 30,0 |
| 250                                                                                                               | 640                          | 540                                 | 52                                | 16      | M48  | 323,9                                | 125                   | 125                   | 300                   | 40                    | 428                   | 432                   | 12                                    | 10                                     | 40,0 |
| <sup>a</sup> For flanges type 21 the outside hub diameter approximately corresponds to the outside pipe diameter. |                              |                                     |                                   |         |      |                                      |                       |                       |                       |                       |                       |                       |                                       |                                        |      |

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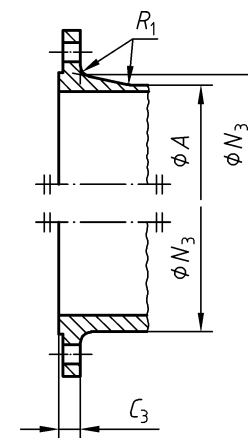


This diagram illustrates the arrangement but not necessarily the correct number of bolt holes.

Refer to the column "Bolting Number" in Table 21 for the actual number.



Type 11



Type 21

NOTE Dimensions  $N_1$ , and  $N_3$  are measured at the intersection of the hub draft angle and the back face of the flange.

Figure 16 — Dimensions of PN 400 flanges

Table 21 — Dimensions of PN 400 flanges

Dimensions in millimetres

| DN                                                                                                                | Mating dimensions            |                                     |                                   |         |      | Outside diameter of neck<br><i>A</i> | Flange thickness      |     | Length |    | Neck diameters |     | Corner radii |    | Wall thickness (see 5.6.1)<br><i>S</i> |    |
|-------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------------------------|-----------------------------------|---------|------|--------------------------------------|-----------------------|-----|--------|----|----------------|-----|--------------|----|----------------------------------------|----|
|                                                                                                                   | Outside diameter<br><i>D</i> | Diameter of bolt circle<br><i>K</i> | Diameter of bolt hole<br><i>L</i> | Bolting |      |                                      |                       |     |        |    |                |     |              |    |                                        |    |
|                                                                                                                   |                              |                                     |                                   | Number  | Size |                                      |                       |     |        |    |                |     |              |    |                                        |    |
|                                                                                                                   | Flange type                  |                                     |                                   |         |      |                                      |                       |     |        |    |                |     |              |    |                                        |    |
|                                                                                                                   | 11, 21                       |                                     |                                   |         |      |                                      | 11<br>21 <sup>a</sup> | 11  | 21     | 11 | 11             | 11  | 21           | 11 | 21                                     | 11 |
| 10                                                                                                                | 125                          | 85                                  | 18                                | 4       | M16  | 17,2                                 | 28                    | 28  | 65     | 8  | 48             | 48  | 4            | 4  | 3,6                                    |    |
| 15                                                                                                                | 145                          | 100                                 | 22                                | 4       | M20  | 26,9                                 | 30                    | 30  | 68     | 8  | 56             | 57  | 4            | 4  | 5,0                                    |    |
| 25                                                                                                                | 180                          | 130                                 | 26                                | 4       | M24  | 42,4                                 | 38                    | 38  | 90     | 10 | 82             | 81  | 4            | 5  | 7,1                                    |    |
| 40                                                                                                                | 220                          | 165                                 | 30                                | 4       | M27  | 60,3                                 | 48                    | 48  | 110    | 12 | 106            | 105 | 6            | 5  | 10,0                                   |    |
| 50                                                                                                                | 235                          | 180                                 | 30                                | 8       | M27  | 76,1                                 | 52                    | 52  | 120    | 15 | 120            | 120 | 6            | 6  | 12,5                                   |    |
| 65                                                                                                                | 290                          | 225                                 | 33                                | 8       | M30  | 101,6                                | 64                    | 64  | 135    | 18 | 158            | 158 | 6            | 6  | 16,0                                   |    |
| 80                                                                                                                | 305                          | 240                                 | 33                                | 8       | M30  | 114,3                                | 68                    | 68  | 150    | 20 | 174            | 174 | 8            | 8  | 17,5                                   |    |
| 100                                                                                                               | 370                          | 295                                 | 39                                | 8       | M36  | 139,7                                | 80                    | 80  | 175    | 25 | 216            | 216 | 8            | 8  | 22,2                                   |    |
| 125                                                                                                               | 415                          | 340                                 | 39                                | 12      | M36  | 193,7                                | 92                    | 92  | 200    | 30 | 258            | 259 | 8            | 10 | 30,0                                   |    |
| 150                                                                                                               | 475                          | 390                                 | 42                                | 12      | M39  | 219,1                                | 105                   | 105 | 225    | 35 | 302            | 302 | 10           | 10 | 35,0                                   |    |
| 200                                                                                                               | 585                          | 490                                 | 48                                | 16      | M45  | 273,0                                | 130                   | 130 | 280    | 40 | 388            | 388 | 10           | 10 | 40,0                                   |    |
| <sup>a</sup> For flanges type 21 the outside hub diameter approximately corresponds to the outside pipe diameter. |                              |                                     |                                   |         |      |                                      |                       |     |        |    |                |     |              |    |                                        |    |

Table 22 — Tolerances

| Dimension                     | Flange Type         | Size                       | Tolerance<br>mm                                  |                                                   |
|-------------------------------|---------------------|----------------------------|--------------------------------------------------|---------------------------------------------------|
| Outside diameter of neck $A$  | 11, 21, 34          | $\leq$ DN 125              | $+3,0$<br>$0$                                    |                                                   |
|                               |                     | $>$ DN 125 $\leq$ DN 1200  | $+4,5$<br>$0$                                    |                                                   |
|                               |                     | $>$ DN 1200                | $+6,0$<br>$0$                                    |                                                   |
|                               | 35, 36, 37          | $\leq$ DN 150              | $\pm 0,75\%$ <sup>a</sup> ,<br>min. $\pm 0,3$ mm |                                                   |
|                               |                     | $>$ DN 150                 | $\pm 1\%$ <sup>a</sup> ,<br>max $\pm 3,0$ mm     |                                                   |
| Bore diameter $B_1, B_2, B_3$ | 01, 02, 04, 12, 32  | $\leq$ DN 100              | $+0,5$<br>$0$                                    |                                                   |
|                               |                     | $>$ DN 100 $\leq$ DN 400   | $+1,0$<br>$0$                                    |                                                   |
|                               |                     | $>$ DN 400 $\leq$ DN 600   | $+1,5$<br>$0$                                    |                                                   |
|                               |                     | $>$ DN 600                 | $+3,0$<br>$0$                                    |                                                   |
| Wall thickness $S^c$          | 11, 34 <sup>b</sup> |                            | machined neck<br>(both faces)                    | neck one<br>face ma-<br>chined or un-<br>machined |
|                               |                     | $\leq$ DN 100              | $+1,0$<br>$0$                                    | $+2,0$<br>$0$                                     |
|                               |                     | $>$ DN 100 $\leq$ DN 400   | $+1,5$<br>$0$                                    | $+2,5$<br>$0$                                     |
|                               |                     | $>$ DN 400                 | $+2,0$<br>$0$                                    | $+3,5$<br>$0$                                     |
|                               | 35                  | $S \leq 8$                 | $+15\%$<br>$-10\%$                               |                                                   |
|                               |                     | $S > 8$                    | $+15\%$<br>$-5\%$                                |                                                   |
|                               | 36, 37              | $\leq$ DN 600              | $-12,5\%$ <sup>a</sup><br>$+15\%$                |                                                   |
|                               |                     | $>$ DN 600                 | $-0,5$ mm <sup>a</sup><br>$+15\%$                |                                                   |
| Bevelled wall thickness $S_p$ | 35, 36, 37          | $S \leq 6$                 | $+1,0$<br>$0$                                    |                                                   |
|                               |                     | $S > 6$                    | $+2,0$<br>$0$                                    |                                                   |
| Outside diameter $D$          | 21                  | $\leq$ DN 250              | $\pm 4,0$                                        |                                                   |
|                               |                     | $>$ DN 250 $\leq$ DN 500   | $\pm 5,0$                                        |                                                   |
|                               |                     | $>$ DN 500 $\leq$ DN 800   | $\pm 6,0$                                        |                                                   |
|                               |                     | $>$ DN 800 $\leq$ DN 1200  | $\pm 7,0$                                        |                                                   |
|                               |                     | $>$ DN 1200 $\leq$ DN 1600 | $\pm 8,0$                                        |                                                   |
|                               |                     | $>$ DN 1600 $\leq$ DN 2000 | $\pm 10,0$                                       |                                                   |
|                               | All other types     | $\leq$ DN 150              | $\pm 2,0$                                        |                                                   |
|                               |                     | $>$ DN 150 $\leq$ DN 500   | $\pm 3,0$                                        |                                                   |
|                               |                     | $>$ DN 500 $\leq$ DN 1200  | $\pm 5,0$                                        |                                                   |
|                               |                     | $>$ DN 1200 $\leq$ DN 1800 | $\pm 7,0$                                        |                                                   |
|                               |                     | $>$ DN 1800                | $\pm 10,0$                                       |                                                   |

Table 22 (continued)

| Dimension                                       | Flange Type                                                             | Size                             | Tolerance<br>mm |
|-------------------------------------------------|-------------------------------------------------------------------------|----------------------------------|-----------------|
| Length through hub<br>$H_1, H_2, H_3, H_4, H_5$ | 11, 12, 13, 34, 35, 36, 37                                              | $\leq$ DN 80                     | $\pm 1,5$       |
|                                                 |                                                                         | $>$ DN 80 $\leq$ DN 250          | $\pm 2,0$       |
|                                                 |                                                                         | $>$ DN 250                       | $\pm 3,0$       |
| Neck diameter<br>$N_1, N_2, N_3$                | 11, 21, 34                                                              | $\leq$ DN 50                     | 0<br>– 2,0      |
|                                                 |                                                                         | $>$ DN 50 $\leq$ DN 150          | 0<br>– 4,0      |
|                                                 |                                                                         | $>$ DN 150 $\leq$ DN 300         | 0<br>– 6,0      |
|                                                 |                                                                         | $>$ DN 300 $\leq$ DN 600         | 0<br>– 8,0      |
|                                                 |                                                                         | $>$ DN 600 $\leq$ DN 4000        | 0<br>– 10,0     |
|                                                 | 12, 13                                                                  | $\leq$ DN 50                     | + 1,0<br>0      |
|                                                 |                                                                         | $>$ DN 50 $\leq$ DN 150          | + 2,0<br>0      |
|                                                 |                                                                         | $>$ DN 150 $\leq$ DN 300         | + 4,0<br>0      |
|                                                 |                                                                         | $>$ DN 300 $\leq$ DN 600         | + 8,0<br>0      |
|                                                 |                                                                         | $>$ DN 600 $\leq$ DN 1200        | + 12,0<br>0     |
|                                                 |                                                                         | $>$ DN 1200 $\leq$ DN 1800       | + 16,0<br>0     |
|                                                 |                                                                         | $>$ DN 1800                      | + 20,0<br>0     |
| Collar thickness F                              | 35<br>(machined on both faces)                                          | $\leq$ 18 mm thickness           | $\pm 1,0$ mm    |
|                                                 |                                                                         | $>$ 18 mm $\leq$ 50 mm thickness | $\pm 1,5$ mm    |
|                                                 | 36<br>(machined on front face only or un-machined)                      | $\leq$ 18 mm thickness           | $\pm 10$ %      |
|                                                 | 37 (un-machined)                                                        | $\leq$ 5 mm thickness            | $\pm 0,20$ mm   |
| Flange thickness<br>$C_1, C_2, C_3, C_4$        | All types (machined on both faces)                                      | $\leq$ 18 mm thickness           | + 1,0<br>– 1,3  |
|                                                 |                                                                         | $>$ 18 mm $\leq$ 50 mm thickness | $\pm 1,5$       |
|                                                 |                                                                         | $>$ 50 mm thickness              | $\pm 2,0$       |
|                                                 | All types (machined on front face only)<br>Type 02 and 04 (un-machined) | $\leq$ 18 mm thickness           | + 2,0<br>– 1,3  |
|                                                 |                                                                         | $>$ 18 mm $\leq$ 50 mm thickness | + 4,0<br>– 1,5  |
|                                                 |                                                                         | $>$ 50 mm thickness              | + 7,0<br>– 2,0  |
| Collar thickness F                              | 32, 34                                                                  |                                  |                 |
| Facing diameter $d_1$                           | All types                                                               | $\leq$ DN 250                    | + 2,0<br>– 1,0  |
|                                                 |                                                                         | $>$ DN 250                       | + 3,0<br>– 1,0  |

Table 22 (concluded)

| Dimension                                                                           |     | Flange type                              | Size                  |      | Tolerance<br>mm |
|-------------------------------------------------------------------------------------|-----|------------------------------------------|-----------------------|------|-----------------|
| Facing height $f_1$                                                                 |     | All types (facing type B, D, F and G)    | $\leq$ DN 32          | 2 mm | 0<br>−1         |
|                                                                                     |     |                                          | > DN 32 to DN 250     | 3 mm | 0<br>−2         |
|                                                                                     |     |                                          | > DN 250 to DN 500    | 4 mm | 0<br>−3         |
|                                                                                     |     |                                          | > DN 500              | 5 mm | 0<br>−4         |
| Facing height $f_2$                                                                 |     | All types (facing types C, E and G)      | All DN                |      | + 0,5<br>0      |
| Facing height $f_3$                                                                 |     | All types (facing types D and F)         | All DN                |      | + 0,5<br>0      |
|                                                                                     |     | All types (facing type H)                | All DN                |      | + 0,2<br>0      |
| Facing height $f_4$                                                                 |     | All types (facing type H)                | All DN                |      | + 0,5<br>0      |
| Facing                                                                              | $W$ | All types                                | All DN                |      | + 0,5<br>0      |
|                                                                                     | $X$ |                                          |                       |      | 0<br>− 0,5      |
|                                                                                     | $Y$ |                                          |                       |      | + 0,5<br>0      |
|                                                                                     | $Z$ |                                          |                       |      | 0<br>− 0,5      |
| Diameter of bolt circle $K$                                                         |     | All types                                | Bolt sizes M10 to M24 |      | $\pm$ 1,0       |
|                                                                                     |     |                                          | Bolt sizes M27 to M45 |      | $\pm$ 1,5       |
| Centre-to-centre of adjacent bolt holes                                             |     | All types                                | Bolt sizes M10 to M24 |      | $\pm$ 1,0       |
|                                                                                     |     |                                          | Bolt sizes M27 to M45 |      | $\pm$ 1,5       |
| Eccentricity of machined facing diameters                                           |     | All types                                | $\leq$ DN 65          |      | 1,0             |
|                                                                                     |     |                                          | > DN 65               |      | 2,0             |
| Parallelism between bolting bearing surfaces and flange jointing faces              |     | All types (machined bearing surfaces)    | All DN                |      | 1°              |
|                                                                                     |     | All types (un-machined bearing surfaces) |                       |      | 2°              |
| a Tolerance in % from the outside diameter or respectively from the wall thickness. |     |                                          |                       |      |                 |
| b Bore tolerance not applicable.                                                    |     |                                          |                       |      |                 |
| c Preparation of ends see Annex A.                                                  |     |                                          |                       |      |                 |

Table 23 — Corner radii  $R_1$  and hub radius  $R_2$  after back facing

| Flange size                                                                                                                             | $R_1$ min. <sup>a</sup><br>mm | $R_1$ max. <sup>a</sup><br>mm | $R_2$ min.<br>mm |
|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------|------------------|
| Up to and including DN 50                                                                                                               | 3                             | 5                             | 1,6              |
| Over DN 50 and up to including DN 350                                                                                                   | 3                             | 6                             | 2,4              |
| Over DN 350                                                                                                                             | 5                             | 8                             | 3,2              |
| <sup>a</sup> Dimensions $R_1$ are valid for types 33 to 37.<br>Dimensions $R_1$ for other types 11, 12, 13 and 21, see Tables 10 to 21. |                               |                               |                  |

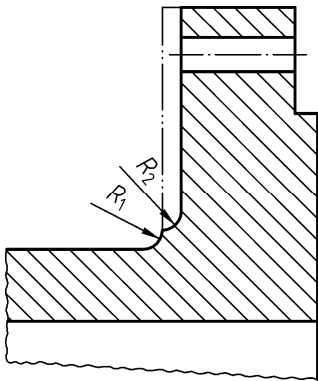


Figure 17 — Minimum hub radius after back facing

## Annex A (normative)

### Wall thickness and end preparation

#### A.1 Weld-end preparation for flanges types 11 and 34

Unless otherwise specified, for flanges in accordance with this European Standard the welding end connections given in Figures A.1 to A.3 shall be used. Additional types of welding ends are specified in EN ISO 9692-2 and example of designs in EN 1708-1 and may be used by agreement between the component or pressure equipment manufacturer and the flange manufacturer.

- Wall thickness  $S \leq 3$  mm: Flanges/collars may be delivered with square cut ends.
- Wall thickness  $3 < S < 22$ : Bevelled ends with an angle of  $30^\circ \begin{smallmatrix} +5^\circ \\ -0^\circ \end{smallmatrix}$  and root face of  $(1,6 \pm 0,8)$  mm.
- If flange wall thickness ( $S$ ) > pipe wall thickness ( $T$ ), the inner diameter shall be chamfered with an angle of  $15^\circ \begin{smallmatrix} +5^\circ \\ -0^\circ \end{smallmatrix}$  to match (see Figure A.3).

Dimensions in millimetres

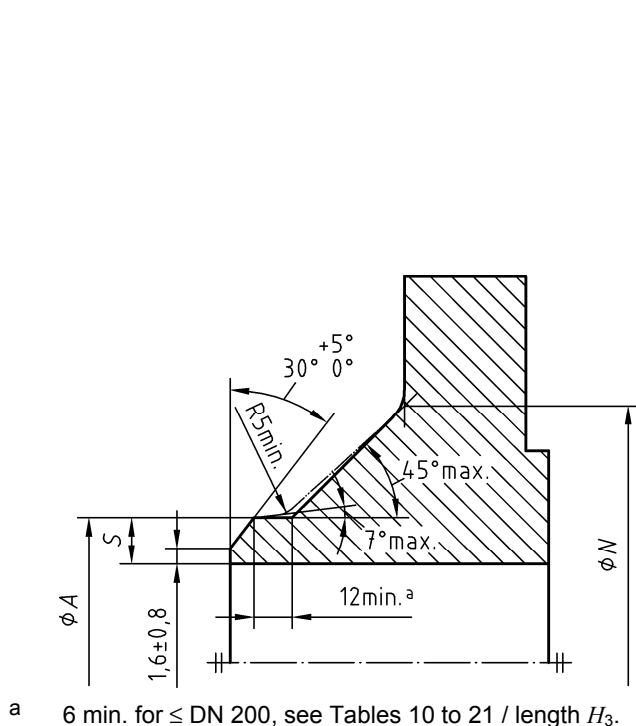


Figure A.1 — Welding end connection for wall thickness  $S$  up to 22 mm

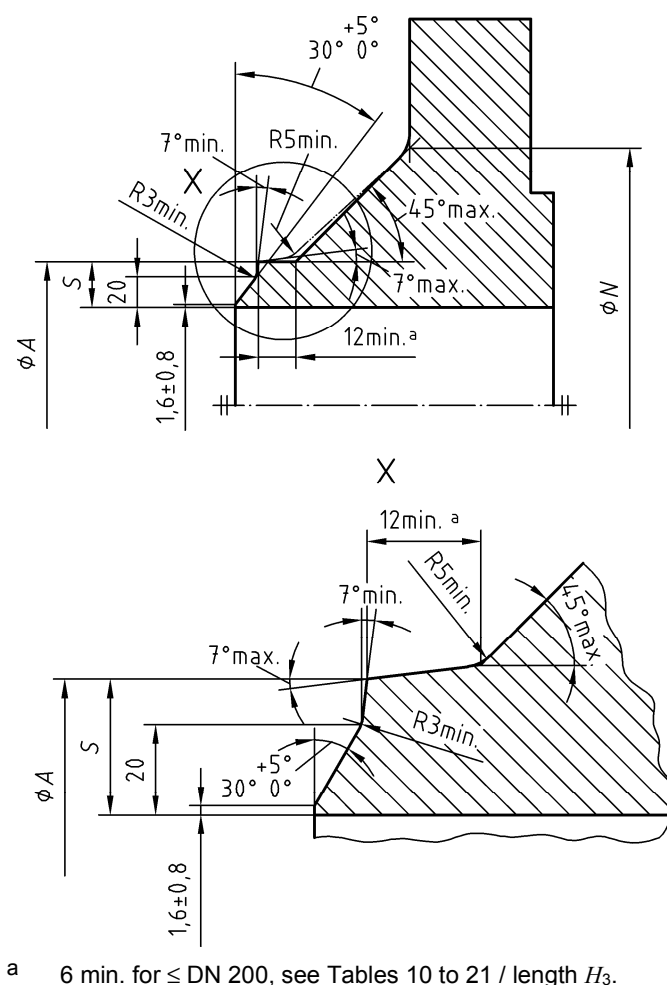
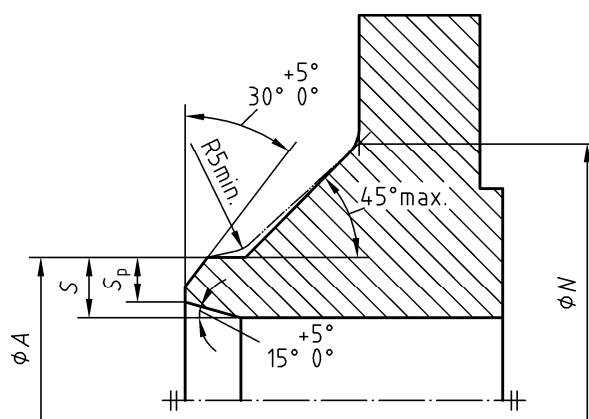


Figure A.2 — Welding end connection for wall thickness  $S \geq 22$  mm



$S$  Flange wall thickness

$S_p$  Reduced flange wall thickness

**Figure A.3 — Permissible bevel design for unequal wall thickness**

NOTE 1 For flanges required to connect to non-austenitic steel pipe of nominal wall thickness less than 4,8 mm, the welding ends should be finished to a slight chamfer or be square, at the option of the flange manufacturer, if nothing else has been agreed between flange manufacturer and purchaser or pressure equipment manufacturer.

NOTE 2 For flanges required to connect to austenitic stainless steel pipe of nominal wall thickness 3,2 mm or less, the welding ends should be square cut ends.

NOTE 3 The mating wall thickness of the flange ( $S_p$ ) shall match to the pipe wall thickness ( $T$ ).

Table A.1 — Wall thickness for type 11

| Ø A   | PN 2,5   |           | PN 6     |           | PN 10    |           | PN 16    |           | PN 25    |           | PN 40    |           | PN 63    |           | PN 100   |           |
|-------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
|       | <i>S</i> | <i>Sp</i> | <i>S</i> | <i>Sp</i> | <i>S</i> | <i>Sp</i> | <i>S</i> | <i>Sp</i> | <i>S</i> | <i>Sp</i> | <i>S</i> | <i>Sp</i> | <i>S</i> | <i>Sp</i> | <i>S</i> | <i>Sp</i> |
| 17,2  | 2        | 2         | 2        | 2         | 2        | 2         | 2        | 2         | 2        | 2         | 2        | 2         | 2        | 2         | 2        | 2         |
| 21,3  | 2        | 2         | 2        | 2         | 2        | 2         | 2        | 2         | 2        | 2         | 2        | 2         | 2        | 2         | 3,2      | 2         |
| 26,9  | 2,3      | 2,3       | 2,3      | 2,3       | 2,3      | 2,3       | 2,3      | 2,3       | 2,3      | 2,3       | 2,3      | 2,3       | 2,6      | 2,3       | 3,2      | 2,3       |
| 33,7  | 2,6      | 2,6       | 2,6      | 2,6       | 2,6      | 2,6       | 2,6      | 2,6       | 2,6      | 2,6       | 2,6      | 2,6       | 2,6      | 2,6       | 3,6      | 2,6       |
| 42,4  | 2,6      | 2,6       | 2,6      | 2,6       | 2,6      | 2,6       | 2,6      | 2,6       | 2,6      | 2,6       | 2,6      | 2,6       | 2,9      | 2,6       | 3,6      | 2,9       |
| 48,3  | 2,6      | 2,6       | 2,6      | 2,6       | 2,6      | 2,6       | 2,6      | 2,6       | 2,6      | 2,6       | 2,6      | 2,6       | 2,9      | 2,9       | 3,6      | 3,2       |
| 60,3  | 2,9      | 2,9       | 2,9      | 2,9       | 2,9      | 2,9       | 2,9      | 2,9       | 2,9      | 2,9       | 2,9      | 2,9       | 4        | 3,2       | 4        | 3,6       |
| 76,1  | 2,9      | 2,9       | 2,9      | 2,9       | 2,9      | 2,9       | 2,9      | 2,9       | 2,9      | 2,9       | 2,9      | 2,9       | 4        | 3,6       | 4        | 4         |
| 88,9  | 3,2      | 3,2       | 3,2      | 3,2       | 3,2      | 3,2       | 3,2      | 3,2       | 3,2      | 3,2       | 3,2      | 3,2       | 4,5      | 4         | 5        | 5         |
| 114,3 | 3,6      | 3,6       | 3,6      | 3,6       | 3,6      | 3,6       | 3,6      | 3,6       | 3,6      | 3,6       | 3,6      | 3,6       | 4,5      | 4,5       | 5,6      | 5,6       |
| 139,7 | 4        | 4         | 4        | 4         | 4        | 4         | 4        | 4         | 4        | 4         | 4        | 4         | 5,6      | 5,6       | 6,3      | 6,3       |
| 168,3 | 4,5      | 4,5       | 4,5      | 4,5       | 4,5      | 4,5       | 4,5      | 4,5       | 4,5      | 4,5       | 4,5      | 4,5       | 6,3      | 6,3       | 8        | 8         |
| 219,1 | 6,3      | 6,3       | 6,3      | 6,3       | 6,3      | 6,3       | 6,3      | 6,3       | 6,3      | 6,3       | 6,3      | 6,3       | 7,1      | 7,1       | 8,8      | 8,8       |
| 273   | 6,3      | 6,3       | 6,3      | 6,3       | 6,3      | 6,3       | 6,3      | 6,3       | 7,1      | 7,1       | 7,1      | 7,1       | 8,8      | 8,8       | 10       | 10        |
| 323,9 | 7,1      | 7,1       | 7,1      | 7,1       | 7,1      | 7,1       | 7,1      | 7,1       | 8        | 8         | 8        | 8         | 11       | 10        | 12,5     | 12,5      |
| 355,6 | 7,1      | 7,1       | 7,1      | 7,1       | 7,1      | 7,1       | 8        | 8         | 8        | 8         | 8,8      | 8,8       | 12,5     | 10        | 14,2     | 14,2      |
| 406,4 | 7,1      | 7,1       | 7,1      | 7,1       | 7,1      | 7,1       | 8        | 8         | 8,8      | 8,8       | 11       | 11        | 14,2     | 11        | 16       | 16        |
| 457   | 7,1      | 7,1       | 7,1      | 7,1       | 7,1      | 7,1       | 8        | 8         | 8,8      | 8,8       | 12,5     | 12,5      |          |           |          |           |
| 508   | 7,1      | 7,1       | 7,1      | 7,1       | 7,1      | 7,1       | 8        | 8         | 10       | 10        | 14,2     | 14,2      |          |           |          |           |
| 610   | 7,1      | 7,1       | 7,1      | 7,1       | 8        | 7,1       | 10       | 8,8       | 11       | 11        | 16       | 16        |          |           |          |           |
| 711   | 7,1      | 7,1       | 8        | 7,1       | 8,8      | 8         | 10       | 8,8       | 14,2     | 12,5      |          |           |          |           |          |           |
| 813   | 7,1      | 7,1       | 8        | 7,1       | 8,8      | 8         | 12,5     | 10        | 16       | 14,2      |          |           |          |           |          |           |
| 914   | 7,1      | 7,1       | 8        | 7,1       | 12,5     | 10        | 12,5     | 10        | 17,5     | 16        |          |           |          |           |          |           |
| 1 016 | 7,1      | 7,1       | 8        | 7,1       | 12,5     | 10        | 12,5     | 10        | 20       | 17,5      |          |           |          |           |          |           |
| 1 219 | 8        | 7,1       | 8,8      | 8         | 12,5     | 11        | 14,2     | 12,5      |          |           |          |           |          |           |          |           |
| 1 422 | 8        | 7,1       | 8,8      | 8         | 14,2     | 12,5      | 16       | 14,2      |          |           |          |           |          |           |          |           |
| 1 626 | 8,8      | 8         | 10       | 9         | 16       | 14,2      | 17,5     | 16        |          |           |          |           |          |           |          |           |
| 1 829 | 10       | 10        | 11       | 10        | 17,5     | 16        | 20       | 17,5      |          |           |          |           |          |           |          |           |
| 2 032 | 11       | 10        | 12,5     | 11        | 17,5     | 16        | 22       | 20        |          |           |          |           |          |           |          |           |
| 2 235 | 11       | 10        | 14       | 12,5      | 20       | 18        |          |           |          |           |          |           |          |           |          |           |
| 2 438 | 11       | 10        | 15       | 14,2      | 22,2     | 20        |          |           |          |           |          |           |          |           |          |           |
| 2 620 | 11       | 10        | 16       | 14,2      | 25       | 22,2      |          |           |          |           |          |           |          |           |          |           |
| 2 820 | 11       | 10        | 17       | 16        | 25       | 22,2      |          |           |          |           |          |           |          |           |          |           |
| 3 020 | 11       | 10        | 20       | 16        | 32       | 24        |          |           |          |           |          |           |          |           |          |           |
| 3 220 | 11       | 10        | 20       | 16        |          |           |          |           |          |           |          |           |          |           |          |           |
| 3 420 | 11       | 10        | 22       | 17,5      |          |           |          |           |          |           |          |           |          |           |          |           |
| 3 620 | 11       | 10        | 22       | 17,5      |          |           |          |           |          |           |          |           |          |           |          |           |
| 3 820 | 11       | 10        |          |           |          |           |          |           |          |           |          |           |          |           |          |           |
| 4 020 | 11       | 10        |          |           |          |           |          |           |          |           |          |           |          |           |          |           |

NOTE *Sp* valves shall match those given in EN 10220 respectively EN ISO 1127.

## A.2 Weld-end preparation for type 35

Dimensions see Table A.2

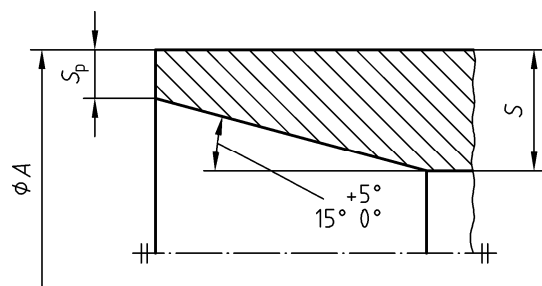


Figure A.4 — Chamfer A for type 35

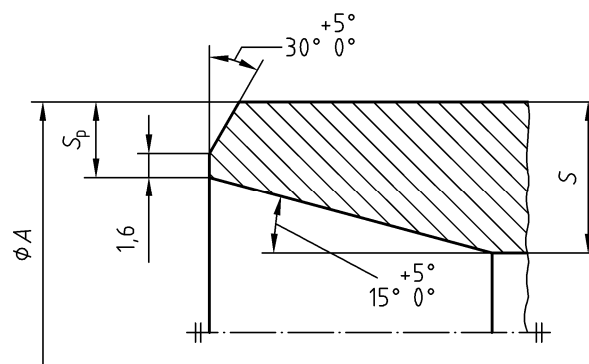


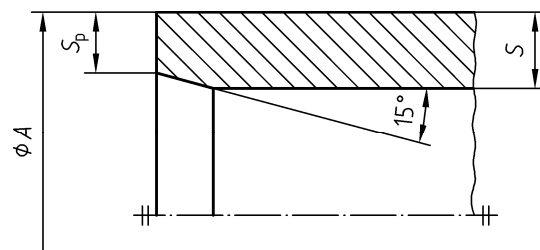
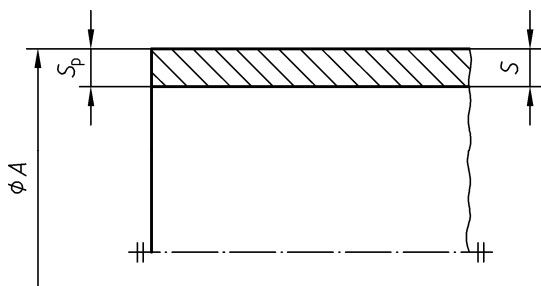
Figure A.5 — Chamfer B for type 35

Table A.2 — Wall thickness for type 35

| $\phi A$ | PN 2,5 |       | PN 6 |       | PN 10 |       | PN 16 |       | PN 25 |       | PN 40 |       | Chamfer |
|----------|--------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
|          | $S$    | $S_p$ | $S$  | $S_p$ | $S$   | $S_p$ | $S$   | $S_p$ | $S$   | $S_p$ | $S$   | $S_p$ |         |
| 17,2     | 3      | 2     | 3    | 2     | 3     | 2     | 3     | 2     | 3     | 2     | 3     | 2     | A       |
| 21,3     | 3      | 2     | 3    | 2     | 3     | 2     | 3     | 2     | 3     | 2     | 3     | 2     |         |
| 26,9     | 3      | 2     | 3    | 2     | 3     | 2     | 3     | 2     | 3     | 2     | 3     | 2     |         |
| 33,7     | 3      | 2     | 3    | 2     | 3     | 2     | 3     | 2     | 3     | 2     | 3     | 2     |         |
| 42,4     | 3      | 2     | 3    | 2     | 3     | 2     | 3     | 2     | 3     | 2     | 3     | 2     |         |
| 48,3     | 3      | 2     | 3    | 2     | 3     | 2     | 3     | 2     | 3     | 2     | 3     | 2     |         |
| 60,3     | 3      | 2     | 3    | 2     | 3     | 2     | 3     | 2     | 4     | 2,6   | 4     | 2,6   |         |
| 76,1     | 4      | 2     | 4    | 2     | 4     | 2     | 4     | 2     | 5     | 2,6   | 5     | 2,6   |         |
| 88,9     | 4      | 2     | 4    | 2     | 4     | 2     | 4     | 2     | 6     | 2,6   | 6     | 2,6   |         |
| 114,3    | 4      | 2     | 4    | 2     | 4     | 2     | 4     | 2     | 6     | 3,2   | 6     | 3,2   |         |
| 139,7    | 5      | 2     | 5    | 2     | 5     | 2     | 5     | 2     | 6     | 3,2   | 6     | 3,2   | B       |
| 168,3    | 6      | 2     | 6    | 2     | 6     | 2     | 6     | 2     | 8     | 3,2   | 8     | 4     |         |
| 219,1    | 6      | 2,6   | 6    | 2,6   | 6     | 2,6   | 6     | 2,6   | 8     | 3,2   | 10    | 5     |         |
| 273      | 8      | 3,2   | 8    | 3,2   | 8     | 3,2   | 8     | 3,2   | 10    | 5     | 12    | 6,3   |         |
| 323,9    | 8      | 3,2   | 8    | 3,2   | 8     | 3,2   | 10    | 4     | 10    | 6,3   | 12    | 8     |         |
| 355,6    | 8      | 3,2   | 8    | 3,2   | 8     | 3,2   | 10    | 4     | 12    | 6,3   | 14    | 8     |         |
| 406,4    | 8      | 3,2   | 8    | 3,2   | 8     | 3,2   | 12    | 5     | 14    | 8     | 16    | 10    |         |
| 457      | 8      | 3,6   | 8    | 3,6   | 8     | 3,6   | 12    | 5     | 15    | 8     |       |       |         |
| 508      | 8      | 4     | 8    | 4     | 8     | 4     | 12    | 6,3   | 16    | 10    |       |       |         |
| 610      | 8      | 5     | 8    | 5     | 10    | 5     | 12    | 8     | 18    | 10    |       |       |         |
| 711      | 8      | 5     | 8    | 5     | 10    | 6,3   | 14    | 8     | 20    | 14,2  |       |       |         |
| 813      | 10     | 6,3   | 10   | 6,3   | 12    | 6,3   | 16    | 10    | 20    | 14,2  |       |       |         |
| 914      | 10     | 6,3   | 10   | 6,3   | 12    | 8     | 18    | 10    |       |       |       |       |         |
| 1 016    | 12     | 8     | 12   | 8     | 12    | 8     | 18    | 10    |       |       |       |       |         |
| 1 219    | 14     | 10    | 14   | 10    | 16    | 10    |       |       |       |       |       |       |         |

### A.3 Weld end preparation for types 36 and 37

Dimensions see Table A.3.



Tolerance of angle:  $+5^\circ$   
 $-0^\circ$

Figure A.6 — Chamfer A for types 36 and 37

Figure A.7 — Chamfer B for types 36 and 37

Table A.3 — Wall thickness for types 36 and 37

| Ø A              | PN 2,5 to PN 10 |                  |         |     | PN 16   |                |         |     | Chamfer |
|------------------|-----------------|------------------|---------|-----|---------|----------------|---------|-----|---------|
|                  | Type 36         |                  | Type 37 |     | Type 36 |                | Type 37 |     |         |
|                  | S               | Sp               | S       | Sp  | S       | Sp             | S       | Sp  |         |
| 17,2             | 2               | 2                | 2       | 2   | 2       | 2              | 2       | 2   | A       |
| 21,3             | 2               | 2                | 2       | 2   | 2       | 2              | 2       | 2   |         |
| 26,9             | 2,6             | 2,6              | 2       | 2   | 2,6     | 2,6            | 2       | 2   |         |
| 33,7             | 2,6             | 2,6              | 2       | 2   | 2,6     | 2,6            | 2       | 2   |         |
| 42,4             | 3,2             | 3,2              | 2       | 2   | 3,2     | 3,2            | 2       | 2   |         |
| 48,3             | 3,2             | 3,2              | 2       | 2   | 3,2     | 3,2            | 2       | 2   |         |
| 60,3             | 3,2             | 3,2              | 2       | 2   | 3,2     | 3,2            | 2       | 2   |         |
| 76,1             | 3,2             | 3,2              | 2       | 2   | 3,2     | 3,2            | 2       | 2   |         |
| 88,9             | 3,2             | 3,2              | 2       | 2   | 3,2     | 3,2            | 3,2     | 3,2 |         |
| 114,3            | 3,2             | 3,2              | 3,2     | 3,2 | 3,2     | 3,2            | 3,2     | 3,2 |         |
| 139,7            | 4               | 3,2              | 3,2     | 3,2 | 4       | 3,2            | 3,5     | 3,2 | B       |
| 168,3            | 5               | 3,2              | 3,5     | 3,2 | 5       | 3,2            | 4,5     | 3,2 |         |
| 219,1            | 5               | 3,2              | 4,5     | 3,2 | 6       | 3,2            | 5,6     | 3,2 |         |
| 273              | 8               | 3,2              |         |     | 10      | 3,2            |         |     |         |
| 323,9            | 8               | 3,2              |         |     | 10      | 4 <sup>b</sup> |         |     |         |
| 355,6            | 8               | 3,2              |         |     | 10      | 4 <sup>b</sup> |         |     |         |
| 406,4            | 8               | 3,2              |         |     | 10      | 4 <sup>b</sup> |         |     |         |
| 457              | 8 <sup>a</sup>  | 3,2 <sup>a</sup> |         |     |         |                |         |     |         |
| 508 <sup>a</sup> | 8 <sup>a</sup>  | 3,2 <sup>a</sup> |         |     |         |                |         |     |         |

<sup>a</sup> These values are valid only for PN 2,5 and PN 6.

<sup>b</sup> Like chamfer B for Type 35.

## Annex B (informative)

### Material groups

The material groups contain 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.

The material groups 1E0 to 6E1 were part of several national standards of CEN Member nations and can be described as follows:

- 1E0 unalloyed structural steels without guaranteed elevated temperature properties, application range -10 °C to +100 °C;
- 1E1 unalloyed structural steels with elevated temperature properties;
- 2E0 unalloyed steels without guaranteed elevated temperature properties;
- 3E0 unalloyed steels with guaranteed elevated temperature properties;
- 3E1 unalloyed steels with specified properties up to 400 °C, upper yield strength > 265 N/mm<sup>2</sup>;
- 4E0 low alloyed steels with 0,3 % molybdenum;
- 5E0 low alloyed steels with 1 % chromium and 0,5 % molybdenum;
- 6E0 low alloyed steels with 2 % chromium and 1 % molybdenum;
- 6E1 alloy steel with 5 % chromium and 0,5 % molybdenum.

The following groups of materials contain steels with low temperature toughness:

- 7E0 low-temperature-tough fine-grain steel with minimum yield strength of 275 N/mm<sup>2</sup> at room temperature;
- 7E1 low-temperature-tough fine-grain steel with minimum yield strength of 355 N/mm<sup>2</sup> at room temperature;
- 7E2 low-temperature nickel alloyed steel (Nickel ≤ 3 %);
- 7E3 low temperature nickel alloyed steel (Nickel > 3 %).

The following groups of materials contain fine-grain steels:

- 8E0 yield strength 225 N/mm<sup>2</sup> min at room temperature;
- 8E2 yield strength 285 N/mm<sup>2</sup> min at room temperature;
- 8E3 yield strength 355 N/mm<sup>2</sup> min at room temperature.

The following groups of materials contain high-temperature-tough ferritic steel

- 9E0 high-temperature-tough ferritic steel with 12 % chromium, 1 % molybdenum and 0,5 % vanadium;
- 9E1 high-temperature-tough ferritic steel with 9 % chromium, 1 % molybdenum and 0,25 % vanadium and 0,1% niobium.

The following groups contain stainless austenitic and austenitic ferritic steels, with differences in corrosion resistance, weld ability and strength, Groups 10E0 up to 12E0 are not alloyed with molybdenum, groups 13E0 to 15E0 are alloyed with molybdenum:

- 10E0 LC-steel;

## EN 1092-1:2007 (E)

10E1 LC-steel, nitrogen-alloyed;

11E0 standard carbon-content;

12E0 standard carbon-content, stabilised with Ti resp. Nb;

13E0 LC-steel with molybdenum;

13E1 LC-steel with molybdenum and nitrogen alloyed;

14E0 standard carbon-content alloyed with molybdenum;

15E0 standard carbon-content, alloyed with molybdenum, stabilised with Ti resp. Nb;

16E0 comprise austenitic-ferritic steel.

## Annex C (informative)

### Approximate masses of flanges and collars

Tables C.1 to C.12 give calculated masses of flanges and collars, which may be used for guidance only.

These calculated masses are based on nominal dimensions given in Tables 10 to 21, and on densities of  $7,85 \text{ g/cm}^3$  for steel materials.

The actual masses may vary from the calculated masses due to dimensional variations within the permitted tolerances given in Table 22.

**Table C.1 — Masses of flanges PN 2,5**

Masses in kilograms

| DN          | Type 01                              | Type 05 | Type 11 | Type 35 | Type 36 | Type 37 |
|-------------|--------------------------------------|---------|---------|---------|---------|---------|
| 10 to 1 000 | Use masses of flanges PN 6/Table C.2 |         |         |         |         |         |
| 1 200       | —                                    | 574     | 104     | 56,3    | —       | —       |
| 1 400       | —                                    | —       | 133     | —       | —       | —       |
| 1 600       | —                                    | —       | 188     | —       | —       | —       |
| 1 800       | —                                    | —       | 215     | —       | —       | —       |
| 2 000       | —                                    | —       | 260     | —       | —       | —       |
| 2 200       | —                                    | —       | 332     | —       | —       | —       |
| 2 400       | —                                    | —       | 392     | —       | —       | —       |
| 2 600       | —                                    | —       | 497     | —       | —       | —       |
| 2 800       | —                                    | —       | 668     | —       | —       | —       |
| 3 000       | —                                    | —       | 772     | —       | —       | —       |
| 3 200       | —                                    | —       | 869     | —       | —       | —       |
| 3 400       | —                                    | —       | 988     | —       | —       | —       |
| 3 600       | —                                    | —       | 1 156   | —       | —       | —       |
| 3 800       | —                                    | —       | 1 309   | —       | —       | —       |
| 4 000       | —                                    | —       | 1 441   | —       | —       | —       |

Table C.2 — Masses of flanges PN 6

Masses in kilograms

| DN    | Type 01 | Type 02 | Type 05 | Type 11 | Type 12 | Type 32 | Type 35 | Type 36 | Type 37 |
|-------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 10    | 0,356   | 0,345   | 0,380   | 0,353   | 0,326   | 0,056   | 0,08    | 0,05    | 0,02    |
| 15    | 0,402   | 0,388   | 0,438   | 0,408   | 0,373   | 0,069   | 0,09    | 0,06    | 0,03    |
| 20    | 0,592   | 0,568   | 0,657   | 0,621   | 0,584   | 0,108   | 0,17    | 0,10    | 0,06    |
| 25    | 0,719   | 0,688   | 0,821   | 0,762   | 0,729   | 0,149   | 0,26    | 0,15    | 0,08    |
| 32    | 1,16    | 1,12    | 1,18    | 1,11    | 1,04    | 0,185   | 0,36    | 0,26    | 0,10    |
| 40    | 1,35    | 1,29    | 1,39    | 1,26    | 1,20    | 0,244   | 0,45    | 0,31    | 0,13    |
| 50    | 1,48    | 1,42    | 1,62    | 1,43    | 1,34    | 0,319   | 0,53    | 0,36    | 0,18    |
| 65    | 1,86    | 1,76    | 2,14    | 1,77    | 1,83    | 0,451   | 0,70    | 0,47    | 0,24    |
| 80    | 2,95    | 2,84    | 3,43    | 2,88    | 2,75    | 0,606   | 1,0     | 0,57    | 0,42    |
| 100   | 3,26    | 3,10    | 4,22    | 3,41    | 3,01    | 0,729   | 1,3     | 0,73    | 0,49    |
| 125   | 4,31    | 4,12    | 6,10    | 4,65    | 4,30    | 1,00    | 1,9     | 1,20    | 0,62    |
| 150   | 4,76    | 4,53    | 7,51    | 5,50    | 4,63    | 1,01    | 2,4     | 1,40    | 0,71    |
| 200   | 6,88    | 6,51    | 12,3    | 8,60    | 6,97    | 1,73    | 3,9     | 2,03    | 1,10    |
| 250   | 8,92    | 8,32    | 18,5    | 11,7    | 9,13    | 2,32    | 5,8     | 2,65    | —       |
| 300   | 11,9    | 11,1    | 25,5    | 15,3    | 12,4    | 2,88    | 6,8     | 3,12    | —       |
| 350   | 16,8    | 15,9    | 31,8    | 20,3    | —       | 4,77    | 9,5     | 4,00    | —       |
| 400   | 19,8    | 18,8    | 38,5    | 23,1    | —       | 5,83    | 11,6    | 4,73    | —       |
| 450   | 24,6    | 23,3    | 51,2    | 27,0    | —       | 7,02    | 15,0    | 5,30    | —       |
| 500   | 26,4    | 24,9    | 60,1    | 30,8    | —       | 8,30    | 15,9    | 6,10    | —       |
| 600   | 34,8    | 33,0    | 103     | 44,0    | —       | 9,34    | 23,0    | —       | —       |
| 700   | —       | —       | 178     | 53,7    | —       | —       | 30,9    | —       | —       |
| 800   | —       | —       | 252     | 64,4    | —       | —       | 41,5    | —       | —       |
| 900   | —       | —       | 336     | 79,2    | —       | —       | 50,0    | —       | —       |
| 1 000 | —       | —       | 435     | 98,6    | —       | —       | 58,9    | —       | —       |
| 1 200 | —       | —       | 717     | 152     | —       | —       | 93,2    | —       | —       |
| 1 400 | —       | —       | 1 094   | 246     | —       | —       | —       | —       | —       |
| 1 600 | —       | —       | 1 545   | 309     | —       | —       | —       | —       | —       |
| 1 800 | —       | —       | 2 131   | 400     | —       | —       | —       | —       | —       |
| 2 000 | —       | —       | 2 862   | 516     | —       | —       | —       | —       | —       |
| 2 200 | —       | —       | —       | 645     | —       | —       | —       | —       | —       |
| 2 400 | —       | —       | —       | 786     | —       | —       | —       | —       | —       |
| 2 600 | —       | —       | —       | 1 021   | —       | —       | —       | —       | —       |
| 2 800 | —       | —       | —       | 1 256   | —       | —       | —       | —       | —       |
| 3 000 | —       | —       | —       | 1 404   | —       | —       | —       | —       | —       |
| 3 200 | —       | —       | —       | 1 617   | —       | —       | —       | —       | —       |
| 3 400 | —       | —       | —       | 1 877   | —       | —       | —       | —       | —       |
| 3 600 | —       | —       | —       | 2 366   | —       | —       | —       | —       | —       |

Table C.3 — Masses of flanges PN 10

Masses in kilograms

| DN    | Type 01           | Type 02           | Type 04           | Type 05           | Type 11           | Type 12           | Type 32 | Type 34 | Type 35 | Type 36 | Type 37 |
|-------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|---------|---------|---------|---------|---------|
| 10    | 0,604             | 0,591             | 0,549             | 0,722             | 0,678             | 0,646             | 0,094   | 0,148   | 0,08    | 0,05    | 0,02    |
| 15    | 0,670             | 0,654             | 0,606             | 0,813             | 0,768             | 0,722             | 0,114   | 0,189   | 0,09    | 0,06    | 0,03    |
| 20    | 0,936             | 0,909             | 0,836             | 1,14              | 1,09              | 1,04              | 0,225   | 0,340   | 0,17    | 0,10    | 0,06    |
| 25    | 1,11              | 1,08              | 0,990             | 1,38              | 1,30              | 1,25              | 0,296   | 0,444   | 0,26    | 0,15    | 0,08    |
| 32    | 1,82              | 1,77              | 1,65              | 2,03              | 1,91              | 1,81              | 0,362   | 0,572   | 0,36    | 0,26    | 0,10    |
| 40    | 2,08              | 2,02              | 1,85              | 2,35              | 2,15              | 2,06              | 0,457   | 0,734   | 0,45    | 0,31    | 0,13    |
| 50    | 2,73              | 2,52              | 2,34              | 2,88              | 2,53              | 2,39              | 0,653   | 0,974   | 0,53    | 0,36    | 0,18    |
| 65    | 3,16 <sup>a</sup> | 3,05 <sup>a</sup> | 2,76 <sup>a</sup> | 3,51 <sup>a</sup> | 3,03 <sup>a</sup> | 2,97 <sup>a</sup> | 0,876   | 1,29    | 0,70    | 0,47    | 0,24    |
| 80    | 3,60              | 3,48              | 3,17              | 4,61              | 3,92              | 3,78              | 1,07    | 1,67    | 1,0     | 0,57    | 0,42    |
| 100   | 4,39              | 4,20              | 3,78              | 5,65              | 4,62              | 4,38              | 1,28    | 2,12    | 1,3     | 0,73    | 0,49    |
| 125   | 5,41              | 5,21              | 4,57              | 8,13              | 6,30              | 6,07              | 1,70    | 2,88    | 1,9     | 1,20    | 0,62    |
| 150   | 7,14              | 6,89              | 6,22              | 10,5              | 7,81              | 7,24              | 1,96    | 3,46    | 2,4     | 1,40    | 0,71    |
| 200   | 9,27              | 8,87              | 7,90              | 16,5              | 11,6              | 10,1              | 2,81    | 5,49    | 3,9     | 2,03    | 1,10    |
| 250   | 11,8              | 11,2              | 9,99              | 24,1              | 15,8              | 12,8              | 3,52    | 7,53    | 5,8     | 2,65    | —       |
| 300   | 13,6              | 12,8              | 11,1              | 30,8              | 18,3              | 14,5              | 4,02    | 9,11    | 6,8     | 3,12    | —       |
| 350   | 20,4              | 19,4              | 14,7              | 39,6              | 25,3              | 22,7              | 7,55    | 14,1    | 9,5     | 4,00    | —       |
| 400   | 27,5              | 26,4              | 20,5              | 49,4              | 30,6              | 28,0              | 9,38    | 17,8    | 11,6    | 4,73    | —       |
| 450   | 33,6              | 32,2              | 25,5              | 63,0              | 35,1              | 32,3              | 10,3    | 19,6    | 15,0    | —       | —       |
| 500   | 40,2              | 38,5              | 30,7              | 75,2              | 40,5              | 38,7              | 12,6    | 23,7    | 15,9    | —       | —       |
| 600   | 54,5              | 52,2              | 43,0              | 124               | 52,9              | 48,9              | 14,3    | 28,9    | 23,0    | —       | —       |
| 700   | —                 | 79,4              | —                 | 183               | 75,8              | —                 | —       | —       | 30,9    | —       | —       |
| 800   | —                 | 112               | —                 | 297               | 102               | —                 | —       | —       | 41,5    | —       | —       |
| 900   | —                 | 135               | —                 | 374               | 121               | —                 | —       | —       | 50,0    | —       | —       |
| 1 000 | —                 | 180               | —                 | 492               | 161               | —                 | —       | —       | 58,9    | —       | —       |
| 1 200 | —                 | 278               | —                 | 842               | 258               | —                 | —       | —       | 93,2    | —       | —       |
| 1 400 | —                 | —                 | —                 | —                 | 371               | —                 | —       | —       | —       | —       | —       |
| 1 600 | —                 | —                 | —                 | —                 | 547               | —                 | —       | —       | —       | —       | —       |
| 1 800 | —                 | —                 | —                 | —                 | 691               | —                 | —       | —       | —       | —       | —       |
| 2 000 | —                 | —                 | —                 | —                 | 830               | —                 | —       | —       | —       | —       | —       |
| 2 200 | —                 | —                 | —                 | —                 | 1 073             | —                 | —       | —       | —       | —       | —       |
| 2 400 | —                 | —                 | —                 | —                 | 1 329             | —                 | —       | —       | —       | —       | —       |
| 2 600 | —                 | —                 | —                 | —                 | 1 574             | —                 | —       | —       | —       | —       | —       |
| 2 800 | —                 | —                 | —                 | —                 | 1 987             | —                 | —       | —       | —       | —       | —       |
| 3 000 | —                 | —                 | —                 | —                 | 2 476             | —                 | —       | —       | —       | —       | —       |

<sup>a</sup> With 8 bolt holes.

Table C.4 — Masses of flanges PN 16

Masses in kilograms

| DN    | Type 01           | Type 02           | Type 04           | Type 05           | Type 11           | Type 12           | Type 32 | Type 34 | Type 35 | Type 36 | Type 37 |
|-------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|---------|---------|---------|---------|---------|
| 10    | 0,604             | 0,591             | 0,549             | 0,722             | 0,678             | 0,646             | 0,094   | 0,148   | 0,08    | 0,05    | 0,02    |
| 15    | 0,670             | 0,654             | 0,606             | 0,813             | 0,768             | 0,722             | 0,114   | 0,189   | 0,09    | 0,06    | 0,03    |
| 20    | 0,936             | 0,909             | 0,836             | 1,14              | 1,09              | 1,04              | 0,225   | 0,340   | 0,17    | 0,10    | 0,06    |
| 25    | 1,11              | 1,08              | 0,990             | 1,38              | 1,30              | 1,25              | 0,296   | 0,444   | 0,26    | 0,15    | 0,08    |
| 32    | 1,82              | 1,77              | 1,65              | 2,03              | 1,91              | 1,81              | 0,362   | 0,572   | 0,36    | 0,26    | 0,10    |
| 40    | 2,08              | 2,02              | 1,85              | 2,35              | 2,15              | 2,06              | 0,457   | 0,734   | 0,45    | 0,31    | 0,13    |
| 50    | 2,73              | 2,52              | 2,34              | 2,88              | 2,53              | 2,39              | 0,653   | 0,974   | 0,53    | 0,36    | 0,18    |
| 65    | 3,16 <sup>a</sup> | 3,05 <sup>a</sup> | 2,76 <sup>a</sup> | 3,51 <sup>a</sup> | 3,03 <sup>a</sup> | 2,97 <sup>a</sup> | 0,876   | 1,29    | 0,70    | 0,47    | 0,24    |
| 80    | 3,60              | 3,48              | 3,17              | 4,61              | 3,92              | 3,78              | 1,07    | 1,67    | 1,0     | 0,57    | 0,42    |
| 100   | 4,39              | 4,20              | 3,78              | 5,65              | 4,62              | 4,38              | 1,28    | 2,12    | 1,3     | 0,73    | 0,49    |
| 125   | 5,41              | 5,21              | 4,57              | 8,13              | 6,30              | 6,07              | 1,70    | 2,88    | 1,9     | 1,20    | 0,62    |
| 150   | 7,14              | 6,89              | 6,22              | 10,5              | 7,81              | 7,24              | 1,96    | 3,46    | 2,4     | 1,40    | 0,71    |
| 200   | 9,73              | 9,31              | 8,37              | 16,2              | 11,5              | 9,80              | 2,81    | 5,55    | 3,9     | 2,03    | 1,10    |
| 250   | 14,2              | 13,5              | 12,4              | 25,0              | 16,7              | 13,6              | 3,52    | 7,71    | 5,8     | —       | —       |
| 300   | 19,0              | 18,0              | 16,3              | 35,1              | 22,1              | 17,2              | 5,27    | 11,4    | 9,5     | —       | —       |
| 350   | 28,2              | 27,0              | 21,5              | 48,0              | 32,8              | 27,9              | 10,1    | 19,2    | 15,2    | —       | —       |
| 400   | 35,9              | 34,6              | 27,1              | 63,5              | 41,1              | 35,7              | 12,3    | 23,7    | 18,7    | —       | —       |
| 450   | 46,1              | 44,6              | 36,7              | 96,6              | 50,6              | 45,0              | 16,5    | 28,2    | 24,4    | —       | —       |
| 500   | 64,0              | 62,0              | 51,1              | 133               | 66,2              | 60,4              | 21,4    | 35,5    | 29,1    | —       | —       |
| 600   | 102               | 98,8              | 78,3              | 226               | 104               | 94,0              | 28,7    | 47,9    | 40,3    | —       | —       |
| 700   | —                 | 107               | —                 | 285               | 96,5              | —                 | —       | —       | 45,2    | —       | —       |
| 800   | —                 | 152               | —                 | 388               | 122               | —                 | —       | —       | 59,9    | —       | —       |
| 900   | —                 | 184               | —                 | 483               | 155               | —                 | —       | —       | 75,6    | —       | —       |
| 1 000 | —                 | 257               | —                 | 640               | 233               | —                 | —       | —       | 106,46  | —       | —       |
| 1 200 | —                 | —                 | —                 | —                 | 390               | —                 | —       | —       | —       | —       | —       |
| 1 400 | —                 | —                 | —                 | —                 | 495               | —                 | —       | —       | —       | —       | —       |
| 1 600 | —                 | —                 | —                 | —                 | 760               | —                 | —       | —       | —       | —       | —       |
| 1 800 | —                 | —                 | —                 | —                 | 929               | —                 | —       | —       | —       | —       | —       |
| 2 000 | —                 | —                 | —                 | —                 | 1 185             | —                 | —       | —       | —       | —       | —       |

<sup>a</sup> With 8 bolt holes.

Table C.5 — Masses of flanges PN 25

Masses in kilograms

| DN    | Type 01 | Type 02 | Type 04 | Type 05 | Type 11 | Type 12 | Type 32 | Type 34 | Type 35 |
|-------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 200   | 14,3    | 13,8    | 11,6    | 22,5    | 17,1    | 14,9    | 4,52    | 9,07    | 6,6     |
| 250   | 20,1    | 19,4    | 17,0    | 33,5    | 24,3    | 20,9    | 5,73    | 12,7    | 10,0    |
| 300   | 26,6    | 25,5    | 22,0    | 46,3    | 31,8    | 27,3    | 8,42    | 18,0    | 15,3    |
| 350   | 41,8    | 40,5    | 32,1    | 68,1    | 48,8    | 45,1    | 14,5    | 27,8    | 20,8    |
| 400   | 57,6    | 56,1    | 44,5    | 89,7    | 63,3    | 57,7    | 18,0    | 36,3    | 28,6    |
| 450   | 69,8    | 67,8    | 54,2    | 130     | 76,0    | 69,6    | 21,0    | 40,9    | 34,4    |
| 500   | 87,0    | 84,6    | 65,9    | 159     | 97,0    | 87,0    | 26,8    | 55,7    | 45,8    |
| 600   | 127     | 124     | 98,4    | 278     | 121     | 111     | 34,1    | 70,5    | 61,0    |
| 700   | —       | 188     | —       | —       | 155     | —       | —       | —       | —       |
| 800   | —       | 259     | —       | —       | 205     | —       | —       | —       | —       |
| 900   | —       | —       | —       | —       | 249     | —       | —       | —       | —       |
| 1 000 | —       | —       | —       | —       | 338     | —       | —       | —       | —       |

Table C.6 — Masses of flanges PN 40

Masses in kilograms

| DN  | Type 01 | Type 02 | Type 04 | Type 05 | Type 11 | Type 12 | Type 32 | Type 34 | Type 35 |
|-----|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 10  | 0,604   | 0,591   | 0,549   | 0,722   | 0,678   | 0,646   | 0,094   | 0,148   | 0,08    |
| 15  | 0,670   | 0,654   | 0,606   | 0,813   | 0,768   | 0,722   | 0,114   | 0,189   | 0,09    |
| 20  | 0,936   | 0,909   | 0,836   | 1,14    | 1,09    | 1,04    | 0,225   | 0,340   | 0,17    |
| 25  | 1,11    | 1,08    | 0,990   | 1,38    | 1,30    | 1,25    | 0,296   | 0,444   | 0,26    |
| 32  | 1,82    | 1,77    | 1,65    | 2,03    | 1,91    | 1,81    | 0,362   | 0,572   | 0,36    |
| 40  | 2,08    | 2,02    | 1,85    | 2,35    | 2,15    | 2,06    | 0,457   | 0,734   | 0,45    |
| 50  | 2,73    | 2,65    | 2,47    | 3,20    | 2,85    | 2,74    | 0,653   | 1,02    | 0,69    |
| 65  | 3,48    | 3,36    | 3,04    | 4,29    | 3,68    | 3,65    | 0,876   | 1,36    | 1,1     |
| 80  | 4,32    | 4,18    | 3,61    | 5,54    | 4,78    | 4,59    | 1,20    | 1,90    | 1,6     |
| 100 | 6,07    | 5,87    | 5,18    | 7,60    | 6,46    | 6,10    | 1,58    | 2,77    | 2,4     |
| 125 | 8,19    | 7,95    | 6,89    | 10,8    | 8,86    | 8,22    | 2,08    | 3,78    | 3,2     |
| 150 | 10,3    | 9,97    | 8,69    | 14,6    | 11,7    | 10,6    | 2,73    | 5,25    | 4,6     |
| 200 | 17,9    | 17,4    | 14,9    | 28,8    | 21,0    | 18,3    | 5,55    | 10,2    | 8,8     |
| 250 | 29,3    | 28,4    | 23,8    | 44,4    | 34,2    | 28,3    | 7,87    | 16,4    | 14,4    |
| 300 | 45,1    | 43,6    | 36,0    | 64,2    | 47,6    | 40,4    | 12,8    | 25,4    | 20,7    |
| 350 | 66,7    | 64,9    | 50,4    | 89,5    | 69,3    | 58,8    | 19,3    | 37,8    | 30,7    |
| 400 | 97,1    | 95,1    | 75,5    | 127     | 98      | 82,1    | 30,4    | 56,4    | 45,4    |
| 450 | —       | —       | —       | 154     | 105     | 86,2    | 28,4    | 56,4    | —       |
| 500 | —       | —       | —       | 188     | 130     | 105     | 35,3    | 72,9    | —       |
| 600 | —       | —       | —       | 331     | 209     | 172     | 53,3    | 106,000 | —       |

**Table C.7 — Masses of flanges PN 63**

Masses in kilograms

| DN  | Type 01 | Type 05 | Type 11 | Type 12 |
|-----|---------|---------|---------|---------|
| 50  | 4,99    | 4,52    | 4,51    | 4,20    |
| 65  | 4,73    | 5,69    | 5,58    | 5,30    |
| 80  | 5,90    | 6,89    | 6,68    | 6,25    |
| 100 | 8,05    | 10,0    | 9,27    | 8,81    |
| 125 | 11,7    | 15,9    | 14,5    | 13,6    |
| 150 | 16,9    | 23,3    | 21,4    | 19,5    |
| 200 | 30,5    | 39,2    | 34,1    | —       |
| 250 | 42,1    | 56,7    | 48,3    | —       |
| 300 | 59,1    | 81,2    | 67,5    | —       |
| 350 | 88,7    | 113     | 97,8    | —       |
| 400 | 121     | 152     | 129     | —       |

**Table C.8 — Masses of flanges PN 100**

Masses in kilograms

| DN  | Type 01 | Type 05 | Type 11 | Type 12 |
|-----|---------|---------|---------|---------|
| 10  | 1,00    | 1,04    | 1,09    | 1,07    |
| 15  | 1,10    | 1,16    | 1,20    | 1,17    |
| 20  | 1,86    | 1,97    | 2,02    | 1,96    |
| 25  | 2,37    | 2,54    | 2,63    | 2,49    |
| 32  | 2,79    | 3,07    | 3,20    | 2,95    |
| 40  | 3,58    | 3,97    | 4,07    | 3,80    |
| 50  | 4,99    | 5,64    | 5,82    | 5,28    |
| 65  | 6,33    | 7,44    | 7,57    | 6,84    |
| 80  | 7,72    | 8,85    | 8,82    | 7,94    |
| 100 | 10,3    | 13,3    | 13,1    | 11,5    |
| 125 | 17,2    | 21,3    | 21,0    | 17,9    |
| 150 | 23,6    | 29,4    | 28,3    | 23,8    |
| 200 | 42,9    | 52,7    | 50,2    | —       |
| 250 | 69,0    | 85,4    | 81,4    | —       |
| 300 | 104     | 128     | 118     | —       |
| 350 | 150     | 175     | 169     | —       |
| 400 | —       | —       | —       | —       |
| 500 | —       | —       | —       | —       |

**Table C.9 — Masses of flanges PN 160**

Masses in kilograms

| DN  | Type 11 |
|-----|---------|
| 10  | 1,10    |
| 15  | 1,20    |
| 25  | 2,64    |
| 40  | 4,42    |
| 50  | 6,38    |
| 65  | 8,75    |
| 80  | 10,3    |
| 100 | 15,3    |
| 125 | 24,4    |
| 150 | 34,4    |
| 200 | 60,7    |
| 250 | 97,6    |
| 300 | 140     |

**Table C.10 — Masses of flanges PN 250**

Masses in kilograms

| DN  | Type 11 |
|-----|---------|
| 10  | —       |
| 15  | 2,51    |
| 25  | 3,58    |
| 40  | 6,72    |
| 50  | 8,22    |
| 65  | 12,8    |
| 80  | 16,5    |
| 100 | 27,2    |
| 125 | 39,0    |
| 150 | 59,6    |
| 200 | 110     |
| 250 | 190     |
| 300 | —       |

**Table C.11 — Masses of flanges PN 320**

Masses in kilograms

| DN  | Type 11 |
|-----|---------|
| 10  | 2,14    |
| 15  | 2,53    |
| 25  | 5,18    |
| 40  | 8,65    |
| 50  | 10,7    |
| 65  | 19,5    |
| 80  | 25,2    |
| 100 | 42,5    |
| 125 | 63,6    |
| 150 | 91,5    |
| 200 | 172     |
| 250 | 312     |

**Table C.12 — Masses of flanges PN 400**

Masses in kilograms

| DN  | Type 11 |
|-----|---------|
| 10  | 2,55    |
| 15  | 3,62    |
| 25  | 7,45    |
| 40  | 14,1    |
| 50  | 16,7    |
| 65  | 31,6    |
| 80  | 38,4    |
| 100 | 67,3    |
| 125 | 94,5    |
| 150 | 145     |
| 200 | 270     |

## Annex D (informative)

### Additional materials

Table D.1 lists, in addition to Table 9, materials which are widely in use, but which are not listed in EN standards. These materials do not have any presumption of conformity if used in pressure equipment under jurisdiction of

Directive 97/23/EC (Pressure Equipment Directive). These materials may be used in pressure equipment according to article 3.3 of the PED (sound engineering practice) or in applications that are not covered by the PED. If they are used in pressure equipment according to categories I to IV according to the PED, they shall have either a

- European Approval of Material (EAM), or
- be covered by a Particular Material Appraisal (PMA).

PMA shall be made by the pressure equipment manufacturer and in categories III and IV it shall have appraisal of the notified body that is responsible for the conformity assessment of the equipment. In the PMA it shall be proved, that the material fulfils the essential safety requirements of the PED.

**Table D.1 — Additional materials**

| Material group <sup>b</sup> | Specification, grade, symbol and material number <sup>a</sup>                            |                                       |                          |                                  |                                     |                                       |
|-----------------------------|------------------------------------------------------------------------------------------|---------------------------------------|--------------------------|----------------------------------|-------------------------------------|---------------------------------------|
|                             | Castings <sup>c</sup> /<br>seamless tubes <sup>c</sup> /<br>welded pipes <sup>c, d</sup> |                                       | Forgings <sup>c, e</sup> |                                  | Flat steel products <sup>c, e</sup> |                                       |
|                             | Standard                                                                                 | Grade/symbol/<br>material num-<br>ber | Standard                 | Grade/symbol/<br>material number | Standard                            | Grade/symbol/<br>material num-<br>ber |
| 1E0                         | DIN 1681                                                                                 | GS-38                                 | VdTÜV 399/3 <sup>f</sup> | C 21/1.0432                      | VdTÜV 399/1 <sup>f</sup>            | C 21/1.0432                           |
| 1E1                         | -                                                                                        | -                                     | EN 10025-2 <sup>h</sup>  | S235JR/1.0038                    | EN 10025-2                          | S235JR/1.0038                         |
| 3E0                         | -                                                                                        | -                                     | VdTÜV 350/3 <sup>f</sup> | C 22.8/1.0460                    | VdTÜV 350/1 <sup>f</sup>            | C 22.8/1.0460                         |
|                             |                                                                                          |                                       | EN 10222-2               | P 250 GH/1.0460                  | -                                   | -                                     |
| 7E0                         | -                                                                                        | -                                     | DIN 17103 <sup>g</sup>   | TSTE 285/1.0488                  | DIN 17102 <sup>g</sup>              | TSTE 285/1.0488                       |
| 7E1                         | DIN 17245                                                                                | GS-10 Ni 19                           | DIN 17103 <sup>g</sup>   | TSTE 355/1.0566                  | DIN 17102 <sup>g</sup>              | TSTE 355/1.0566                       |
| -                           | -                                                                                        | -                                     | DIN 17103 <sup>g</sup>   | TSTE 420/1.8912                  | DIN 17102 <sup>g</sup>              | TSTE 420/1.8912                       |
| 1E0                         | ASME SA 106                                                                              | B                                     | -                        | -                                | -                                   | -                                     |
| 3E0                         | -                                                                                        | -                                     | ASME SA 105              | -                                | -                                   | -                                     |
| 3E1                         | ASME SA 216                                                                              | WCB                                   | -                        | -                                | ASME SA 515                         | 70                                    |
|                             | ASME SA 216                                                                              | WCC                                   |                          |                                  | ASME SA 516                         | 70                                    |
|                             | ASME SA 333                                                                              | 6                                     |                          |                                  | ASME SA 537                         | CL 1                                  |
| 4E0                         | ASME SA 217                                                                              | WC 1                                  | ASME SA 182              | F1                               | ASME SA 204                         | A                                     |
|                             |                                                                                          |                                       |                          |                                  | ASME SA 204                         | B                                     |
| 5E0                         | ASME SA 217                                                                              | WC 6                                  | ASME SA 182              | F11 Cl 1, 2 and<br>Cl 3          | ASME SA 387                         | 11                                    |
|                             | ASME SA 217                                                                              | C 5                                   |                          | F12 Cl 1 and 2                   |                                     | 12                                    |
|                             | ASME SA 335                                                                              | P 12                                  |                          |                                  |                                     |                                       |
| 6E0                         | ASME SA 217                                                                              | C 12                                  | ASME SA 182              | F 5                              | ASME SA 387                         | 5                                     |
|                             | ASME SA 335                                                                              | P 5 and P9                            |                          | F 9                              |                                     | 9                                     |
|                             | ASME SA 335                                                                              | P 22                                  |                          | F 22 Cl 1 and 3                  |                                     | 22                                    |

Table D.1 (continued)

| Material group <sup>b</sup> | Specification, grade, symbol and material number <sup>a</sup>                            |                                     |                          |                                  |                                     |                                     |         |       |
|-----------------------------|------------------------------------------------------------------------------------------|-------------------------------------|--------------------------|----------------------------------|-------------------------------------|-------------------------------------|---------|-------|
|                             | Castings <sup>c</sup> /<br>seamless tubes <sup>c</sup> /<br>welded pipes <sup>c, d</sup> |                                     | Forgings <sup>c, e</sup> |                                  | Flat steel products <sup>c, e</sup> |                                     |         |       |
|                             | Standard                                                                                 | Grade/symbol/<br>material<br>number | Standard                 | Grade/symbol/<br>material number | Standard                            | Grade/symbol/<br>material<br>number |         |       |
| 7E3                         | ASME SA 352                                                                              | LC 2, LC 3 and<br>LC 8              | ASME SA 350              | LF 3                             | ASME SA 203                         | A                                   |         |       |
|                             |                                                                                          |                                     |                          |                                  |                                     | E                                   |         |       |
| 8E2                         | -                                                                                        | -                                   | ASME SA 350              | LF 2 CI 1 / CI 2                 | -                                   | -                                   |         |       |
| 10E0                        | ASME SA 351                                                                              | CF 8                                | ASME SA 182              | F 304                            | ASME SA 240                         | 304                                 |         |       |
|                             | ASME SA 312                                                                              | TP 304 L                            |                          | F 304 L                          |                                     | 304 L                               |         |       |
|                             |                                                                                          | TP 304                              |                          |                                  |                                     |                                     | F 304 H | 304 H |
|                             |                                                                                          | TP 304 H                            |                          |                                  |                                     |                                     |         |       |
| 12E0                        | ASME SA 312                                                                              | TP 321                              | ASME SA 182              | F 321 and 321 H                  | ASME SA 240                         | -                                   |         |       |
|                             |                                                                                          | TP 321 H                            |                          |                                  |                                     |                                     |         |       |
| 14E0                        | ASME SA 351                                                                              | CF 8 M                              | ASME SA 182              | F 316                            | ASME SA 240                         | 316                                 |         |       |
|                             | ASME SA 312                                                                              | TP 316                              |                          | F 316 L                          |                                     | 316 L                               |         |       |
|                             |                                                                                          | TP 316 L                            |                          |                                  |                                     |                                     | F 316 H | 316 H |
|                             |                                                                                          | TP 316 H                            |                          |                                  |                                     |                                     |         |       |
| 15E0                        | -                                                                                        | -                                   | -                        | -                                | ASME SA 240                         | 316 Ti                              |         |       |
| 16E0                        | -                                                                                        | -                                   | ASME SA 182              | F 51                             | -                                   | -                                   |         |       |

<sup>a</sup> Material for bars in all Groups are identical with the material for forgings, ASME Materials see additionally. <sup>b</sup>

<sup>b</sup> The specification of ASME Materials may not be equivalent in all details to the material groups and therefore may not be equally for all applications.

<sup>c</sup> Starting material for the manufacture of flanges. The properties of the resulting flanges may differ from starting material and require to be taken into consideration, so that the resulting flange has adequate properties.

<sup>d</sup> Base material see flat steel products.

<sup>e</sup> Impact properties for RT or low temperature service and guaranteed elevated temperature properties for high temperature service have to be considered.

<sup>f</sup> Material Data Sheet by VdTÜV.

<sup>g</sup> This DIN-materials are listed in particular upon the EN 10222-4 has been revised and provide the corresponding NL-Grades.

<sup>h</sup> Use as forging with the requirements for chemical and mechanical properties of EN 10025-2, hot-rolled structural steel.

## Annex E (normative)

### Basis of flange calculation

#### E.1 General

The calculation of flange union (pair of flanges, bolts and a gasket) according to this standard and the determination of p/t ratings have been carried out as follows:

#### E.2 Calculation method

According to EN 1591-1. Correction for EN 13445-3:2002, Annex G has been applied to Equation (A.1).

#### E.3 Basic rules for calculation of flange connection

##### E.3.1 General

Calculation temperature for all load cases i.e. assembly, testing and operation to determine the standard flange geometrics for the different type of flanges is 20 °C.

To assure that the requirements regarding permissible general membrane stress of the PED are met, flanges have been calculated using the values specified in Annex F, Table F.2.4-1.

NOTE 1 For nominal design stresses higher than the time-independent design conditions the regulations of the applied design code such as EN 13445 or EN 13480 need to be considered. In any case attention needs to be paid to the effects of temperature.

External loads have been considered. These external loads are calculated by using the following equations

Flange type 01, type 11, type 04 with type 34:

$$F_{R1} = 15 \cdot \pi \cdot (A \cdot S - S^2) / 1000 \quad \text{dimensions } A, S \text{ in mm, } F_{R1} \text{ in kN}$$

$$F_{R2} = \text{Min} (\text{DN}; 10 \cdot \sqrt{\text{DN}}) \quad F_{R2} \text{ in kN}$$

$$F_R = \text{Max} (F_{R1}; F_{R2})$$

Flange types 32, 35, 36 and 37:

$$F_{R1} = \text{PN} \cdot \pi \cdot (\text{DN}^2) / 40\,000 \quad \text{dimensions in mm, } F_{R1} \text{ in kN}$$

$$F_{R2} = 5 \cdot \sqrt{\text{DN}} \quad F_{R2} \text{ in kN}$$

$$F_R = \text{Min} (F_{R1}; F_{R2})$$

##### E.3.2 Flanges

###### E.3.2.1 Flanges type 11, type 04 with type 34, type 05

- Flange facing: Raised face.
- Height of raised face according to Table 8, depending on DN.
- Corrosions allowance (inner surface): 1,0 mm, for carbon steel, 0,0 mm for stainless steel.

- Tolerances for flange thickness according to Table 22, for machined on front face only.
- Flange material.
- Nominal design stress:
  - at operation 140 MPa;
  - at assembly and testing 200 MPa ( $P_{\text{test}} = 1,43 \times PN$ ).

NOTE That is close to the values of P245GH (forged steel, normally annealed (NG) and 1.4404 (forged steel, solution treated (AT).

- E-Modulus: 212 000 MPa.
- Mean coefficient of thermal expansion  $\alpha$  ( $10^{-6}/K$ ) = 11,9.

#### E.3.2.2 Flanges types 35, 36 and 37 with type 02

Material values have been similar according to E.3.2.1, but for austenitic steel:

- e-modulus 200 000 MPa;
- mean coefficient of thermal expansion  $\alpha$  ( $10^{-6}/K$ ) = 15,3;
- no corrosion allowance;
- flange facing and tolerances according to E.3.2.1.

#### E.3.2.3 Flanges type 01

- Material values have been similar according to E.3.2.1.
- Pipe nominal thickness has been chosen either according to Table A.1 or to Table A.2.
- Corrosion allowance has been 1 mm to pipe inner surface.

#### E.3.3 Pipes

- Dimensional series for the pipe: EN 10216-2, EN 10216-5 and EN 10217-7.
- Pipe wall thickness  $T$  = Mating wall thickness of flange  $S_p$ .
- Consideration of elasticity of the hub especially for large DN.
- Nominal design stress:
  - at operation 140 MPa;
  - at assembly and testing 200 MPa ( $P_{\text{test}} = 1,43 \times PN$ ).
- E-modulus: 212 000 MPa for Carbon steel and 200 000 MPa for Austenitic steel.
- Mean coefficient of thermal expansion  $\alpha$  ( $10^{-6}/K$ ) = 11,9 (CS) and 15,3 (AS).

NOTE The values indicated above are close to those given for P235GH respectively X2CrNiMo17-12-2.

#### E.3.4 Bolting/Tightening

- Bolts: Fully threaded screw (Hexagon head bolt) according to EN 4014 with one nut, smooth and lubricated friction coefficient 0,2.

— Bolt material:

≤ M39: nominal design stress at operation 200 MPa, at assembly and testing 285,7 MPa;

NOTE That is close to the values of 5.6-bolt

> M39: nominal design stress at operation 250 MPa, at assembly and testing 419 MPa.

NOTE That is close to the values of 25CrMo4.

— E-modulus: 212 000 MPa.

— Wrenching up to and including M20, torque wrench above M20.

— Scatter value for one single bolt max M20:  $\pm 0,4$  and for bolts larger than M20:  $\pm 0,2$ .

— Allowed slope of flange plate:  $1,0^\circ$ .

— Bolting strength category acc. EN 1515-2: medium strength.

— Minimum bolt pre-tension rate: Minimum load ratio 0,3.

— Number of assemblies/re-assemblies during lifetime: 20.

— Integral coefficient of thermal expansion  $\alpha$  ( $10^{-6}/K$ ) = 11,9.

### E.3.5 Gasket

— Up to and incl. PN 63: Non-metallic flat gasket, larger DN of PN 63 and higher PN: Spiral wound gasket.

— Gasket dimensions and factors:

|            | Non-metallic flat gasket             | Spiral wound gasket     |
|------------|--------------------------------------|-------------------------|
| Dimensions | EN 1514-1                            | EN 1514-2 <sup>1)</sup> |
| Thickness  | ≤ DN 300: = 2 mm<br>> DN 300: = 3 mm | = 4,5 mm                |
| $Q_{min}$  | = 25 MPa                             | = 50 MPa                |
| $Q_{max}$  | = 100 MPa                            | = 300 MPa               |
| $E_0$      | = 8 000 MPa                          | = 10 000 MPa            |
| $K_1$      | = 20                                 | = 20                    |
| $c_1$      | = 0                                  | = 0                     |
| $g_c$      | = 0,9                                | = 0,9                   |
| Q/P (m)    | = 1,6                                | = 1,6                   |

NOTE 1 The  $Q_{min}$  /  $Q_{max}$  values have only been fixed for the geometrical calculation of the flanges, other values may be used.

NOTE 2 Leakage classes are not considered.

<sup>1)</sup> Dimensions of spiral wound gaskets for flanges type 11 larger than PN 160: Similar to EN 1514-2.

## Annex F (normative)

### Determination of p/t-ratings

#### F.1 General

##### F.1.1 Reference temperature (RT)

A maximum allowable pressure related to the PN number (see 3.2) given in this standard is applicable at the Reference Temperature (RT).

RT is defined as the temperature range from -10 °C up to and including 50 °C.

Up to and including 50 °C all flange types are suitable for the given PN. The flanges may be used for temperatures above 50 °C. For this higher temperature the p/t-rating needs to be calculated.

Down to and including -10 °C all materials listed in Table 9 are suitable for a maximum allowable pressure related to the PN number without any further testing than the testing specified in the EN material standard. The materials may be used for lower temperatures. Considerations for prevention of low temperature brittle fracture may be necessary depending on the temperature, the material and heat treatment condition.

NOTE The EN product standards (e.g. EN 13445, EN 13480, EN 13458) specify guidance regarding the prevention of low temperature brittle fracture.

##### F.1.2 Application limits and equations

For flanges designated in accordance with 4.2 of this European Standard, the maximum allowable pressure PS calculated at temperature shall not exceed a maximum allowable pressure related to the PN number.

$$PS \leq PN \quad (F.1.2.-1)$$

#### F.2 Symbols, descriptions and units

##### F.2.1 General

For this annex the following symbols are used (see EN 13480-3 for further definition).

**Table F.2-1 — Additional symbols for the application of this Annex**

| Symbols     | Description                              | Unit                     |
|-------------|------------------------------------------|--------------------------|
| $f_t$       | Nominal design stress at temperature     | MPa (N/mm <sup>2</sup> ) |
| $f_{CR}$    | Nominal design stress at the creep range | MPa (N/mm <sup>2</sup> ) |
| $S_{R\ Tt}$ | Mean value of creep rupture strength     | MPa (N/mm <sup>2</sup> ) |
| $SF_{CR}$   | Safety factor which depends on time      | -                        |
| $V_R$       | Reference value for thickness            | mm                       |

### F.2.2 p/t-Ratings for materials with time independent nominal design stress

The maximum allowable pressure at temperature is depending on the nominal design stress at temperature in relation to 140 MPa and shall be:

$$PS = PN \times f_t / 140 \text{ MPa} \quad (\text{F.2.2-1})$$

The nominal design stress  $f_t$  shall be determined in accordance with Table F.2.5-1 taking into account the actual value for  $v_R$ .

### F.2.3 p/t-Ratings for materials with time dependent nominal design stress

The maximum allowable pressure at temperature is depending on the lower value of the nominal design stress at temperature and the nominal design stress at creep range in relation to 140 MPa and shall be:

$$PS = PN \times \min(f_t; f_{CR}) / 140 \text{ MPa} \quad (\text{F.2.3-1})$$

The nominal design stresses  $f_t$  and  $f_{CR}$  shall be determined in accordance with Table F.2.5-1 and Table F.2.5-2 taking into account the actual value for  $v_R$ .

### F.2.4 Reference value for thickness ( $v_R$ )

EN material standards are specifying strength values depending on different ranges of product thicknesses. The thickness related material values shall be used in calculation.

$v_R$  shall be the upper thickness of each nominal thickness range for which a material strength value ( $ReH$ ,  $R_p$ ,  $R_m$  as appropriate) is given in the material standard. The calculation results of equations F.2.2-1 and F.2.3-1 shall be valid for all flanges of this European Standard provided:

- the flanges are made of material with the same or higher material values as the values used for the calculation and
- nominal flange thickness is less or equal to  $v_R$

For material with different  $v_R$ , the p/t-rating can be given for each  $v_R$ .

NOTE 1 The p/t-ratings are to be build by a comparison of a material related term ( $f_t$ ;  $f_{CR}$ ) and the value of 140 MPa to  $PN$ .  $f_t$ ;  $f_{CR}$  are a function of the material thickness for a given material. To compare the results of F.2.1-1 and F.2.2-1 with the thickness of a flange according to this European Standard,  $v_R$  is introduced in this European Standard.

NOTE 2 It is the intention of this annex to provide rules for determination of p/t-ratings on a simplified procedure. But it should also be possible to use comparable higher mechanical properties for different thicknesses of base material if this covers the majority of flanges in use.

### F.2.5 Nominal design stresses and safety factors for mean creep rupture strength

The nominal design stresses shall be based on strength values specified in the material standard. The nominal design stresses shall be calculated as shown in Table F 2.5-1. Guidance on safety factors as a function of mean creep rupture strength related to time is given in Table F 2.5-2.

Linear interpolation of strength values between two adjacent temperature values shall be applied for temperatures above 50 °C (e.g. for 80 °C between 20 °C and 100 °C; for 120 °C between 100 °C and 150 °C).

Table F.2.5-1 — Nominal design stresses

| Material group                                          | Nominal design stress at Temperature /<br>Nominal design stress at the creep range                |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| 3E0 to 9E1 and 16E0                                     | $f = \min ((R_{eHt} / 1,5 \text{ or } R_{p0,2t} / 1,5; R_m / 2,4); S_{RT} / SF_{CR})$             |
| 10E0 to 15E0 (for $30 \leq A \leq 35 \%$ ) <sup>a</sup> | $f = \min ((R_{p1,0t} / 1,5; R_m / 2,4); S_{RT} / SF_{CR})$                                       |
| 10E0 to 15E0 (for A above 35 %) <sup>a</sup>            | $f = \min ((R_{p1,0t} / 1,5) \text{ or } \min (R_{p1,0t} / 1,2; R_{mt} / 3)^b; S_{RT} / SF_{CR})$ |
| 2E0 to 4E0, 7E0, 7E1 (castings)                         | $f = \min (R_{p0,2t} / 1,9)$                                                                      |
| 5E0, 6E0, 9E0 (castings)                                | $f = \min (R_m / 3,0)$                                                                            |
| 10E0 to 15E0 (castings)                                 | $f = \min (R_{p1,0t} / 1,9)$                                                                      |
| <sup>a</sup> A = Elongation after rupture               |                                                                                                   |
| <sup>b</sup> If $R_{mt}$ is available                   |                                                                                                   |

Table F.2.5-2 — Safety factors for mean creep rupture strength

| Time T in h | Safety factor $SF_{CR}$ |
|-------------|-------------------------|
| 200 000     | 1,25                    |
| 150 000     | 1,35                    |
| 100 000     | 1,5                     |

NOTE Data of both tables are derived from EN 13480-3. See EN 13480-3 for further definition.

## F.2.6 Flanges made from steel castings

For flanges made from steel casting (types no. 21, 34) the actual dimension needs to be calculated to comply with the p/t-ratings for steel forging / flat product.

The calculation shall also be done under the rules of the component or equipment standard applicable for the component or pressure equipment of which this flange is an integral part (e.g. EN 12516 for valves).

All mating dimensions, the neck diameter (N3) and (minimum) flange wall thickness shall be as given in Tables 10 to 21.

NOTE For flanges type 21 see footnote a of Table 6 and NOTE 5 of 5.6.1.

## F.2.7 Rounding of maximum allowable pressure at temperature

The results of calculated maximum allowable pressure PS at temperature (according to F2.2-1 respectively F.2.3-1) shall be rounded downwards to the first decimal place (e.g. value of 15,09 bar rounded downwards to 15,0 bar; or 15,19 bar rounded downwards to 15,1 bar).

## Annex G (normative)

### p/t-ratings for a selection of EN materials

#### G.1 General

##### G.1.1 p/t-ratings

A range of p/t-ratings for a selection of commonly used EN materials is indicated in this annex. These p/t-ratings are prepared to support the user of this European Standard and shall not be understood either as a limitation in p/t-ratings nor materials. If the user of this European Standard has the need to determine his own p/t-rating for a certain application this can be done under consideration of the basic rules to determine a p/t-rating (see Annex F).

##### G.1.2 Basics of determination of p/t-ratings (see Annex F)

p/t-ratings are calculated by using the equations F.2.2-1 and F.2.3-2.

In compliance with Equation F.2-1, the calculated pressure values do not exceed PN.

Strength values for steel forgings, flat steel products and steel castings are taken from EN material standards considering the different range of product thickness. For provisions regarding the reference value for thickness  $v_R$  see F.2.4.

p/t-ratings are calculated by using the strength values of steel forgings depending on different range of product thickness and are verified for flat steel products of the same group.

Nominal design stresses are calculated by using the equations as defined in Table F.2.5-1.

Interpolation rules as defined in Annex F have been applied.

NOTE 1 The graduation of  $v_R$  depends from the product of material from which a flange is manufactured. For the different methods of fabrication see Table 1 of this European Standard.

NOTE 2 For flanges made from steel casting (type 21) see footnote a of Table 6 and definitions stated in F.2.6.

NOTE 3 If the flange joint consists of materials with different strength properties (excluding bolts), p/t-ratings need to be chosen in accordance with the lowest strength values.

NOTE 4 The p/t-ratings are to be build by a comparison of a material related term ( $f_i/f_{CR}$ ) and the value of 140 MPa to PN.  $f_i/f_{CR}$  are a function of the material thickness for a given material. To compare the results of F.2.2-1 and F.2.3-1 with the thickness of a flange of this European Standard  $v_R$  is introduced in this European Standard.

##### G.1.3 Application limits for creep range

Materials marked with an "X" have been calculated using 100 000 h creep rupture strength values as given in EN material standards under consideration of the safety factor  $SF_{CR}$  as indicated in Table F.2.5-2.

The application of creep range within the p/t-ratings listed is limited up to and including 600 °C. This limit should be understood as a practical application limit and not as a restriction in use. If there is a need to extend this application limit to higher temperatures than 600 °C this can be done by individual calculations provided mean creep rupture strength values are given in EN material standards.

## G.2 Non-austenitic steels

### G.2.1 General

p/t-ratings are given in Tables G.2.1-1 to G.2.1-12 for non-austenitic steels. They are calculated by using the strength values of steel forgings (see Table G.1.1-1) and are verified for flat steel products of the same group (see Table 9) up to and including 600 °C. Thickness related strength values for all thicknesses up to and including 150 mm have been considered, except for material 1.4903 where  $v_R \leq 130$  mm.

p/t-ratings are calculated by using the strength values of steel forgings and are verified for flat steel products of the same group (see notes in Table G.1.1-1).

100 000 h creep rupture strength values are considered for materials marked with 'X' in Table G.1.1-1.

Maximum allowable pressures at temperatures for which 100 000 h creep have been considered are indicated in italic letters in Tables G.2.1-1 to G.2.1-12.

For flanges made from steel castings (type 21; material selection see Table 9) the p/t-ratings shall be the same as for the corresponding steel forgings respectively flat steel products (see Table 9). The wall thicknesses need to be verified (see provisions made in F.2.5).

NOTE For nominal design stress values of steel castings it may be necessary to consider the provisions given in applicable component or equipment standards (e.g. EN 12516).

## G.2.2 List of materials

Table G.1.1-1 — Non-austenitic materials

| Group | Material              | Material No.     | EN      | R <sub>p</sub> /R <sub>e</sub> | Creep | Notes   |
|-------|-----------------------|------------------|---------|--------------------------------|-------|---------|
| 3E0   | P245GH                | 1.0352           | 10222-2 | R <sub>p0,2 t</sub>            | X     |         |
| 3E1   | P280GH                | 1.0426           | 10222-2 | R <sub>p0,2 t</sub>            | X     |         |
| 4E0   | 16Mo3                 | 1.5415           | 10222-2 | R <sub>p0,2 t</sub>            | X     |         |
| 5E0   | 13CrMo4-5             | 1.7335           | 10222-2 | R <sub>p0,2 t</sub>            | X     |         |
| 6E0   | 11CrMo9-10            | 1.7383           | 10222-2 | R <sub>p0,2 t</sub>            | X     |         |
| 6E1   | X16CrMo5-1+NT         | 1.7366           | 10222-2 | R <sub>p0,2 t</sub>            | X     |         |
| 7E0   | 13MnNi6-3             | 1.6217           | 10222-3 | R <sub>p0,2 t</sub>            | —     | f       |
| 7E1   | P355 NL1,<br>P355 NL2 | 1.0566<br>1.1106 | 10028-3 | R <sub>p0,2 t</sub>            | —     | a, g    |
| 7E2   | 15NiMn6               | 1.6228           | 10222-3 | R <sub>p0,2 t</sub>            | —     | f       |
| 7E3   | 12Ni14                | 1.5637           | 10222-3 | R <sub>p0,2 t</sub>            | —     | f       |
| 7E2   | X8Ni9                 | 1.5662           | 10222-3 | R <sub>p0,2 t</sub>            | —     | f       |
| 8E2   | P285NH                | 1.0487           | 10222-4 | R <sub>p0,2 t</sub>            | —     | c, d    |
| 8E3   | P355NH                | 1.0565           | 10222-4 | R <sub>p0,2 t</sub>            | —     | b, d, e |
| 9E0   | X20CrMoV11-1          | 1.4922           | 10222-2 | R <sub>p0,2 t</sub>            | X     |         |
| 9E1   | X10CrMoVNb9-1         | 1.4903           | 10222-2 | R <sub>p0,2 t</sub>            | X     |         |

NOTE Table contains a selection of commonly used non-austenitic materials.

<sup>a</sup> Refer to Annex D for steel forgings corresponding to this low-temperature-tough fine-grain steel.

<sup>b</sup> p/t-ratings can also be used for material group 7E1 under conditions (see EN 10028-3).

<sup>c</sup> For all thicknesses of up to and including 70 mm the strength values for temperatures above 50 °C for a thickness range  $35 < v_R \leq 70$  have been used for calculation of p/t-ratings.

<sup>d</sup> For all thicknesses up to and including 150 mm for strength values for temperatures above 50 °C lower strength values either of EN 10028-3 or EN 10222-4 has been used.

<sup>e</sup> For all thicknesses of up to and including 100 mm the strength values for temperatures above 50 °C for a thickness range  $50 < v_R \leq 100$  have been used for calculation of p/t-ratings.

<sup>f</sup> Material groups 7E0, 7E2; no separate p/t-ratings are listed, because of the reason that no strength values for temperatures above 50 °C are given by the related EN standards EN 10222-3 and EN 10028-4.

<sup>g</sup> No separate p/t-ratings are listed, since the strength values are the same as for the NH-grade.

**EN 1092-1:2007 (E)****G.2.3 p/t-Ratings****Table G.2.1-1 — PN 2,5**

| PN  | Group | v <sub>R</sub> (mm)        | max. allowable temperature TS °C |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |
|-----|-------|----------------------------|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|--|
|     |       |                            | RT                               | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 460 | 470 | 480 | 490 | 500 | 510 | 520 | 530 | 540 | 550 | 560 | 570 | 580 | 590 | 600 |  |  |
|     |       |                            | max. allowable pressure PS bar   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |
| 2,5 | 3E0   | ≤ 50                       | 2,5                              | 2,3 | 2,2 | 2,0 | 1,9 | 1,7 | 1,6 | 1,4 | 0,8 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |
|     | 3E0   | 50 < v <sub>R</sub> ≤ 150  | 2,5                              | 2,1 | 2,0 | 1,9 | 1,7 | 1,6 | 1,5 | 1,4 | 0,8 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |
|     | 3E1   | ≤ 50                       | 2,5                              | 2,5 | 2,5 | 2,5 | 2,4 | 2,2 | 2,0 | 1,8 | 1,0 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |
|     | 3E1   | 50< v <sub>R</sub> ≤ 150   | 2,5                              | 2,5 | 2,3 | 2,2 | 2,0 | 1,9 | 1,7 | 1,6 | 1,0 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |
|     | 4E0   | ≤ 60                       | 2,5                              | 2,5 | 2,5 | 2,5 | 2,4 | 2,1 | 2,0 | 1,8 | 1,7 | 1,6 | 1,4 | 1,3 | 1,2 | 1,1 | 0,8 | 0,7 | 0,5 |     |     |     |     |     |     |     |  |  |
|     | 4E0   | 60 < v <sub>R</sub> ≤ 90   | 2,5                              | 2,5 | 2,5 | 2,5 | 2,3 | 2,0 | 1,9 | 1,7 | 1,6 | 1,5 | 1,4 | 1,3 | 1,2 | 1,1 | 0,8 | 0,7 | 0,5 |     |     |     |     |     |     |     |  |  |
|     | 4E0   | 90 < v <sub>R</sub> ≤ 150  | 2,5                              | 2,5 | 2,5 | 2,3 | 2,1 | 1,9 | 1,7 | 1,5 | 1,4 | 1,4 | 1,3 | 1,2 | 1,1 | 1,1 | 0,8 | 0,7 | 0,5 |     |     |     |     |     |     |     |  |  |
|     | 5E0   | ≤ 60                       | 2,5                              | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,3 | 2,2 | 2,1 | 2   | 1,9 | 1,8 | 1,7 | 1,6 | 1,3 | 1,1 | 0,9 | 0,7 | 0,5 | 0,4 | 0,3 |     |     |     |  |  |
|     | 5E0   | 60 < v <sub>R</sub> ≤ 90   | 2,5                              | 2,5 | 2,5 | 2,5 | 2,5 | 2,4 | 2,2 | 2,0 | 1,9 | 1,8 | 1,8 | 1,7 | 1,6 | 1,6 | 1,3 | 1,1 | 0,9 | 0,7 | 0,5 | 0,4 | 0,3 |     |     |     |  |  |
|     | 5E0   | 90 < v <sub>R</sub> ≤ 150  | 2,5                              | 2,5 | 2,5 | 2,5 | 2,5 | 2,2 | 2,1 | 1,9 | 1,8 | 1,7 | 1,7 | 1,6 | 1,6 | 1,6 | 1,3 | 1,1 | 0,9 | 0,7 | 0,5 | 0,4 | 0,3 |     |     |     |  |  |
|     | 6E0   | ≤ 150                      | 2,5                              | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,4 | 2,3 | 2,2 | 2,0 | 1,9 | 1,8 | 1,7 | 1,6 | 1,4 | 1,2 | 1,0 | 0,9 | 0,8 | 0,6 | 0,6 | 0,5 | 0,4 | 0,4 |  |  |
|     | 6E1   | ≤ 150                      | 2,5                              | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,1 | 1,7 | 1,3 | 1,1 | 0,9 | 0,8 | 0,7 | 0,5 | 0,5 | 0,4 |     |     |     |  |  |
|     | 8E2   | 35 < v <sub>R</sub> ≤ 70   | 2,5                              | 2,5 | 2,5 | 2,3 | 2,1 | 1,8 | 1,6 | 1,4 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |
|     | 8E2   | 70 < v <sub>R</sub> ≤ 100  | 2,5                              | 2,5 | 2,3 | 2,1 | 1,9 | 1,6 | 1,4 | 1,1 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |
|     | 8E2   | 100 < v <sub>R</sub> ≤ 150 | 2,5                              | 2,4 | 2,2 | 1,9 | 1,7 | 1,4 | 1,1 | 0,9 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |
|     | 8E3   | 50 < v <sub>R</sub> ≤ 100  | 2,5                              | 2,5 | 2,5 | 2,5 | 2,5 | 2,4 | 2,2 | 1,9 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |
|     | 8E3   | 100 < v <sub>R</sub> ≤ 150 | 2,5                              | 2,5 | 2,5 | 2,5 | 2,5 | 2,3 | 2,1 | 1,7 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |  |
|     | 9E0   | ≤ 150                      | 2,5                              | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,2 | 1,9 | 1,7 | 1,5 | 1,3 | 1,1 | 0,9 | 0,8 | 0,7 |  |  |
|     | 9E1   | ≤ 130                      | 2,5                              | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,5 | 2,3 | 2,1 | 1,9 | 1,7 | 1,5 | 1,4 | 1,2 | 1,1 |  |  |

Table G.2.1-2 — PN 6

| PN | Group | $v_R$ (mm)           | max. allowable temperature TS °C |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|----|-------|----------------------|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|    |       |                      | RT                               | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 460 | 470 | 480 | 490 | 500 | 510 | 520 | 530 | 540 | 550 | 560 | 570 | 580 | 590 | 600 |
|    |       |                      | max. allowable pressure PS bar   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 6  | 3E0   | $\leq 50$            | 6,0                              | 5,5 | 5,2 | 5   | 4,5 | 4,1 | 3,8 | 3,5 | 1,9 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|    | 3E0   | $50 < v_R \leq 150$  | 6,0                              | 5,1 | 5   | 4,6 | 4,2 | 3,8 | 3,6 | 3,4 | 1,9 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|    | 3E1   | $\leq 50$            | 6,0                              | 6,0 | 6,0 | 6,0 | 5,8 | 5,2 | 4,8 | 4,4 | 2,4 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|    | 3E1   | $50 < v_R \leq 150$  | 6,0                              | 6,0 | 5,7 | 5,4 | 5,0 | 4,6 | 4,2 | 3,8 | 2,4 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|    | 4E0   | $\leq 60$            | 6,0                              | 6,0 | 6,0 | 6,0 | 5,8 | 5,1 | 4,8 | 4,4 | 4,1 | 3,8 | 3,5 | 3,2 | 2,9 | 2,6 | 2,1 | 1,6 | 1,3 |     |     |     |     |     |     |     |
|    | 4E0   | $60 < v_R \leq 90$   | 6,0                              | 6,0 | 6,0 | 6,0 | 5,5 | 4,8 | 4,5 | 4,1 | 3,8 | 3,6 | 3,3 | 3,1 | 2,8 | 2,6 | 2,1 | 1,6 | 1,3 |     |     |     |     |     |     |     |
|    | 4E0   | $90 < v_R \leq 150$  | 6,0                              | 6,0 | 6,0 | 5,5 | 5,1 | 4,5 | 4,2 | 3,8 | 3,5 | 3,3 | 3,1 | 3,0 | 2,8 | 2,6 | 2,1 | 1,6 | 1,3 |     |     |     |     |     |     |     |
|    | 5E0   | $\leq 60$            | 6,0                              | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 5,7 | 5,4 | 5,0 | 4,8 | 4,5 | 4,3 | 4,0 | 3,9 | 3,3 | 2,6 | 2,2 | 1,7 | 1,4 | 1,1 | 0,9 |     |     |     |
|    | 5E0   | $60 < v_R \leq 90$   | 6,0                              | 6,0 | 6,0 | 6,0 | 6,0 | 5,8 | 5,4 | 5,0 | 4,7 | 4,5 | 4,3 | 4,1 | 3,9 | 3,9 | 3,3 | 2,6 | 2,2 | 1,7 | 1,4 | 1,1 | 0,9 |     |     |     |
|    | 5E0   | $90 < v_R \leq 150$  | 6,0                              | 6,0 | 6,0 | 6,0 | 6,0 | 5,5 | 5,0 | 4,7 | 4,4 | 4,2 | 4,1 | 4,0 | 3,9 | 3,9 | 3,3 | 2,6 | 2,2 | 1,7 | 1,4 | 1,1 | 0,9 |     |     |     |
|    | 6E0   | $\leq 150$           | 6,0                              | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 5,8 | 5,5 | 5,2 | 5,0 | 4,7 | 4,4 | 4,1 | 3,8 | 3,3 | 2,9 | 2,5 | 2,2 | 1,9 | 1,6 | 1,4 | 1,2 | 1,0 | 0,9 |
|    | 6E1   | $\leq 150$           | 6,0                              | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 5,0 | 4,1 | 3,2 | 2,7 | 2,3 | 2,0 | 1,6 | 1,4 | 1,2 | 1,0 |     |     |     |
|    | 8E2   | $35 < v_R \leq 70$   | 6,0                              | 6,0 | 6,0 | 5,6 | 5,1 | 4,4 | 3,9 | 3,3 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|    | 8E2   | $70 < v_R \leq 100$  | 6,0                              | 6,0 | 5,6 | 5,2 | 4,7 | 3,9 | 3,3 | 2,8 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|    | 8E2   | $100 < v_R \leq 150$ | 6,0                              | 5,8 | 5,3 | 4,7 | 4,2 | 3,3 | 2,8 | 2,2 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|    | 8E3   | $50 < v_R \leq 100$  | 6,0                              | 6,0 | 6,0 | 6,0 | 6,0 | 5,8 | 5,4 | 4,7 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|    | 8E3   | $100 < v_R \leq 150$ | 6,0                              | 6,0 | 6,0 | 6,0 | 6,0 | 5,6 | 5,0 | 4,2 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|    | 9E0   | $\leq 150$           | 6,0                              | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 5,3 | 4,7 | 4,2 | 3,6 | 3,1 | 2,7 | 2,3 | 1,9 | 1,6 |
|    | 9E1   | $\leq 130$           | 6,0                              | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 6,0 | 5,7 | 5,2 | 4,7 | 4,2 | 3,8 | 3,4 | 3,0 | 2,6 |

## EN 1092-1:2007 (E)

Table G.2.1-3 — PN 10

| PN | Group | $v_R$ (mm)           | max. allowable temperature TS °C |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |     |     |     |     |     |     |
|----|-------|----------------------|----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|
|    |       |                      | RT                               | 100  | 150  | 200  | 250  | 300  | 350  | 400  | 450  | 460  | 470  | 480  | 490  | 500  | 510  | 520  | 530 | 540 | 550 | 560 | 570 | 580 | 590 | 600 |
|    |       |                      | max. allowable pressure PS bar   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |     |     |     |     |     |     |
| 10 | 3E0   | $\leq 50$            | 10,0                             | 9,2  | 8,8  | 8,3  | 7,6  | 6,9  | 6,4  | 5,9  | 3,2  |      |      |      |      |      |      |      |     |     |     |     |     |     |     |     |
|    | 3E0   | $50 < v_R \leq 150$  | 10,0                             | 8,5  | 8,3  | 7,7  | 7,0  | 6,4  | 6,0  | 5,7  | 3,2  |      |      |      |      |      |      |      |     |     |     |     |     |     |     |     |
|    | 3E1   | $\leq 50$            | 10,0                             | 10,0 | 10,0 | 10,0 | 9,7  | 8,8  | 8,0  | 7,3  | 4,0  |      |      |      |      |      |      |      |     |     |     |     |     |     |     |     |
|    | 3E1   | $50 < v_R \leq 150$  | 10,0                             | 10,0 | 9,5  | 9,0  | 8,3  | 7,6  | 7,0  | 6,4  | 4,0  |      |      |      |      |      |      |      |     |     |     |     |     |     |     |     |
|    | 4E0   | $\leq 60$            | 10,0                             | 10,0 | 10,0 | 10,0 | 9,7  | 8,5  | 8,0  | 7,4  | 6,9  | 6,4  | 5,9  | 5,4  | 4,9  | 4,4  | 3,5  | 2,8  | 2,2 |     |     |     |     |     |     |     |
|    | 4E0   | $60 < v_R \leq 90$   | 10,0                             | 10,0 | 10,0 | 10,0 | 9,2  | 8,0  | 7,6  | 6,9  | 6,4  | 6,0  | 5,6  | 5,2  | 4,8  | 4,4  | 3,5  | 2,8  | 2,2 |     |     |     |     |     |     |     |
|    | 4E0   | $90 < v_R \leq 150$  | 10,0                             | 10,0 | 10,0 | 9,2  | 8,5  | 7,6  | 7,0  | 6,3  | 5,9  | 5,6  | 5,3  | 5,0  | 4,7  | 4,4  | 3,5  | 2,8  | 2,2 |     |     |     |     |     |     |     |
|    | 5E0   | $\leq 60$            | 10,0                             | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 9,5  | 9,0  | 8,4  | 8,0  | 7,6  | 7,2  | 6,8  | 6,5  | 5,5  | 4,4  | 3,7 | 2,9 | 2,3 | 1,9 | 1,5 |     |     |     |
|    | 5E0   | $60 < v_R \leq 90$   | 10,0                             | 10,0 | 10,0 | 10,0 | 10,0 | 9,7  | 9,0  | 8,3  | 7,8  | 7,5  | 7,2  | 6,9  | 6,6  | 6,5  | 5,5  | 4,4  | 3,7 | 2,9 | 2,3 | 1,9 | 1,5 |     |     |     |
|    | 5E0   | $90 < v_R \leq 150$  | 10,0                             | 10,0 | 10,0 | 10,0 | 10,0 | 9,1  | 8,4  | 7,9  | 7,3  | 7,1  | 6,9  | 6,7  | 6,5  | 6,5  | 5,5  | 4,4  | 3,7 | 2,9 | 2,3 | 1,9 | 1,5 |     |     |     |
|    | 6E0   | $\leq 150$           | 10,0                             | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 9,7  | 9,2  | 8,8  | 8,3  | 7,8  | 7,3  | 6,9  | 6,4  | 5,6  | 4,9  | 4,2 | 3,7 | 3,2 | 2,7 | 2,4 | 2,0 | 1,8 | 1,6 |
|    | 6E1   | $\leq 150$           | 10,0                             | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 8,4  | 6,9  | 5,3  | 4,5  | 3,8  | 3,3 | 2,8 | 2,3 | 2,0 | 1,7 |     |     |     |
|    | 8E2   | $35 < v_R \leq 70$   | 10,0                             | 10,0 | 10,0 | 9,3  | 8,6  | 7,4  | 6,5  | 5,6  |      |      |      |      |      |      |      |      |     |     |     |     |     |     |     |     |
|    | 8E2   | $70 < v_R \leq 100$  | 10,0                             | 10,0 | 9,4  | 8,6  | 7,9  | 6,5  | 5,6  | 4,6  |      |      |      |      |      |      |      |      |     |     |     |     |     |     |     |     |
|    | 8E2   | $100 < v_R \leq 150$ | 10,0                             | 9,7  | 8,8  | 7,9  | 7,0  | 5,6  | 4,6  | 3,7  |      |      |      |      |      |      |      |      |     |     |     |     |     |     |     |     |
|    | 8E3   | $50 < v_R \leq 100$  | 10,0                             | 10,0 | 10,0 | 10,0 | 10,0 | 9,8  | 9,0  | 7,9  |      |      |      |      |      |      |      |      |     |     |     |     |     |     |     |     |
|    | 8E3   | $100 < v_R \leq 150$ | 10,0                             | 10,0 | 10,0 | 10,0 | 10,0 | 9,3  | 8,4  | 7,0  |      |      |      |      |      |      |      |      |     |     |     |     |     |     |     |     |
|    | 9E0   | $\leq 150$           | 10,0                             | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 8,9  | 7,9 | 7,0 | 6,0 | 5,2 | 4,5 | 3,8 | 3,2 | 2,8 |
|    | 9E1   | $\leq 130$           | 10,0                             | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 10,0 | 9,5 | 8,7 | 7,9 | 7,1 | 6,3 | 5,7 | 5,0 | 4,4 |

Table G.2.1-4 — PN 16

| PN | Group | $v_R$ (mm)           | max. allowable temperature TS °C |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |     |
|----|-------|----------------------|----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|
|    |       |                      | RT                               | 100  | 150  | 200  | 250  | 300  | 350  | 400  | 450  | 460  | 470  | 480  | 490  | 500  | 510  | 520  | 530  | 540  | 550  | 560  | 570  | 580 | 590 | 600 |
|    |       |                      | max. allowable pressure PS bar   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |     |
| 16 | 3E0   | $\leq 50$            | 16,0                             | 14,8 | 14   | 13,3 | 12,1 | 11   | 10,2 | 9,5  | 5,2  |      |      |      |      |      |      |      |      |      |      |      |      |     |     |     |
|    | 3E0   | $50 < v_R \leq 150$  | 16,0                             | 13,7 | 13,3 | 12,4 | 11,3 | 10,2 | 9,6  | 9,1  | 5,2  |      |      |      |      |      |      |      |      |      |      |      |      |     |     |     |
|    | 3E1   | $\leq 50$            | 16,0                             | 16,0 | 16   | 16   | 15,6 | 14   | 12,9 | 11,8 | 6,4  |      |      |      |      |      |      |      |      |      |      |      |      |     |     |     |
|    | 3E1   | $50 < v_R \leq 150$  | 16,0                             | 16,0 | 15,2 | 14,5 | 13,3 | 12,2 | 11,3 | 10,2 | 6,4  |      |      |      |      |      |      |      |      |      |      |      |      |     |     |     |
|    | 4E0   | $\leq 60$            | 16,0                             | 16,0 | 16,0 | 16,0 | 15,6 | 13,7 | 12,9 | 11,9 | 11,0 | 10,2 | 9,4  | 8,6  | 7,8  | 7,0  | 5,6  | 4,4  | 3,5  |      |      |      |      |     |     |     |
|    | 4E0   | $60 < v_R \leq 90$   | 16,0                             | 16,0 | 16,0 | 16,0 | 14,8 | 12,9 | 12,1 | 11,1 | 10,2 | 9,6  | 9,0  | 8,3  | 7,7  | 7,0  | 5,6  | 4,4  | 3,5  |      |      |      |      |     |     |     |
|    | 4E0   | $90 < v_R \leq 150$  | 16,0                             | 16,0 | 16,0 | 14,8 | 13,7 | 12,1 | 11,2 | 10,1 | 9,4  | 8,9  | 8,5  | 8,0  | 7,5  | 7,0  | 5,6  | 4,4  | 3,5  |      |      |      |      |     |     |     |
|    | 5E0   | $\leq 60$            | 16,0                             | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 15,2 | 14,4 | 13,4 | 12,8 | 12,1 | 11,5 | 10,8 | 10,4 | 8,8  | 7,1  | 5,9  | 4,6  | 3,7  | 3,0  | 2,5  |     |     |     |
|    | 5E0   | $60 < v_R \leq 90$   | 16,0                             | 16,0 | 16,0 | 16,0 | 16,0 | 15,6 | 14,4 | 13,4 | 12,5 | 12   | 11,5 | 11   | 10,5 | 10,4 | 8,8  | 7,1  | 5,9  | 4,6  | 3,7  | 3,0  | 2,5  |     |     |     |
|    | 5E0   | $90 < v_R \leq 150$  | 16,0                             | 16,0 | 16,0 | 16,0 | 16,0 | 14,7 | 13,5 | 12,7 | 11,8 | 11,4 | 11,1 | 10,7 | 10,4 | 10,4 | 8,8  | 7,1  | 5,9  | 4,6  | 3,7  | 3,0  | 2,5  |     |     |     |
|    | 6E0   | $\leq 150$           | 16,0                             | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 15,6 | 14,8 | 14,0 | 13,3 | 12,5 | 11,8 | 11,0 | 10,2 | 8,9  | 7,8  | 6,8  | 5,9  | 5,1  | 4,4  | 3,8  | 3,3 | 2,8 | 2,5 |
|    | 6E1   | $\leq 150$           | 16,0                             | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 13,5 | 11,0 | 8,6  | 7,3  | 6,1  | 5,3  | 4,4  | 3,8  | 3,2  | 2,8  |     |     |     |
|    | 8E2   | $35 < v_R \leq 70$   | 16,0                             | 16,0 | 16,0 | 15,0 | 13,7 | 11,9 | 10,4 | 8,9  |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |     |
|    | 8E2   | $70 < v_R \leq 100$  | 16,0                             | 16,0 | 15,0 | 13,8 | 12,7 | 10,4 | 8,9  | 7,4  |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |     |
|    | 8E2   | $100 < v_R \leq 150$ | 16,0                             | 15,6 | 14,1 | 12,7 | 11,2 | 8,9  | 7,4  | 5,9  |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |     |
|    | 8E3   | $50 < v_R \leq 100$  | 16,0                             | 16,0 | 16,0 | 16,0 | 16,0 | 15,6 | 14,4 | 12,7 |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |     |
|    | 8E3   | $100 < v_R \leq 150$ | 16,0                             | 16,0 | 16,0 | 16,0 | 16,0 | 14,9 | 13,4 | 11,2 |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |     |
|    | 9E0   | $\leq 150$           | 16,0                             | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 14,3 | 12,7 | 11,2 | 9,7  | 8,4  | 7,2  | 6,1 | 5,2 | 4,4 |
|    | 9E1   | $\leq 130$           | 16,0                             | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 16,0 | 15,3 | 13,9 | 12,6 | 11,4 | 10,2 | 9,1 | 8,0 | 7,1 |

## EN 1092-1:2007 (E)

Table G.2.1-5 — PN 25

| PN | Group | $v_R$ (mm)           | max. allowable temperature TS °C |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----|-------|----------------------|----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
|    |       |                      | RT                               | 100  | 150  | 200  | 250  | 300  | 350  | 400  | 450  | 460  | 470  | 480  | 490  | 500  | 510  | 520  | 530  | 540  | 550  | 560  | 570  | 580  | 590  | 600  |
|    |       |                      | max. allowable pressure PS bar   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 25 | 3E0   | $\leq 50$            | 25,0                             | 23,2 | 22,0 | 20,8 | 19,0 | 17,2 | 16,0 | 14,8 | 8,2  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|    | 3E0   | $50 < v_R \leq 150$  | 25,0                             | 21,4 | 20,8 | 19,4 | 17,7 | 16,0 | 15,1 | 14,2 | 8,2  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|    | 3E1   | $\leq 50$            | 25,0                             | 25,0 | 25,0 | 25,0 | 24,4 | 22,0 | 20,2 | 18,4 | 10,1 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|    | 3E1   | $50 < v_R \leq 150$  | 25,0                             | 25,0 | 23,8 | 22,7 | 20,8 | 19,1 | 17,7 | 16,0 | 10,1 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|    | 4E0   | $\leq 60$            | 25,0                             | 25,0 | 25,0 | 25,0 | 24,4 | 21,4 | 20,2 | 18,6 | 17,2 | 16,0 | 14,7 | 13,5 | 12,3 | 11,0 | 8,8  | 7,0  | 5,5  |      |      |      |      |      |      |      |
|    | 4E0   | $60 < v_R \leq 90$   | 25,0                             | 25,0 | 25,0 | 25,0 | 23,2 | 20,2 | 19,0 | 17,3 | 16,0 | 15,0 | 14,0 | 13,0 | 12,0 | 11,0 | 8,8  | 7,0  | 5,5  |      |      |      |      |      |      |      |
|    | 4E0   | $90 < v_R \leq 150$  | 25,0                             | 25,0 | 25,0 | 23,2 | 21,4 | 19,0 | 17,5 | 15,8 | 14,7 | 14,0 | 13,2 | 12,5 | 11,8 | 11,0 | 8,8  | 7,0  | 5,5  |      |      |      |      |      |      |      |
|    | 5E0   | $\leq 60$            | 25,0                             | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 23,8 | 22,5 | 21,0 | 20,0 | 19,0 | 18,0 | 17,0 | 16,3 | 13,8 | 11,1 | 9,2  | 7,2  | 5,8  | 4,7  | 3,9  |      |      |      |
|    | 5E0   | $60 < v_R \leq 90$   | 25,0                             | 25,0 | 25,0 | 25,0 | 25,0 | 24,4 | 22,5 | 20,9 | 19,6 | 18,8 | 18,0 | 17,2 | 16,5 | 16,3 | 13,8 | 11,1 | 9,2  | 7,2  | 5,8  | 4,7  | 3,9  |      |      |      |
|    | 5E0   | $90 < v_R \leq 150$  | 25,0                             | 25,0 | 25,0 | 25,0 | 25,0 | 22,9 | 21,1 | 19,8 | 18,4 | 17,9 | 17,3 | 16,8 | 16,2 | 16,3 | 13,8 | 11,1 | 9,2  | 7,2  | 5,8  | 4,7  | 3,9  |      |      |      |
|    | 6E0   | $\leq 150$           | 25,0                             | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 24,4 | 23,2 | 22,0 | 20,8 | 19,6 | 18,4 | 17,2 | 16,0 | 14,0 | 12,2 | 10,7 | 9,2  | 8,0  | 6,9  | 6,0  | 5,2  | 4,5  | 4,0  |
|    | 6E1   | $\leq 150$           | 25,0                             | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 21,2 | 17,3 | 13,4 | 11,4 | 9,6  | 8,3  | 7,0  | 5,9  | 5,1  | 4,4  |      |      |      |
|    | 8E2   | $35 < v_R \leq 70$   | 25,0                             | 25,0 | 25,0 | 23,4 | 21,5 | 18,6 | 16,3 | 14,0 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|    | 8E2   | $70 < v_R \leq 100$  | 25,0                             | 25,0 | 23,5 | 21,6 | 19,8 | 16,3 | 14,0 | 11,6 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|    | 8E2   | $100 < v_R \leq 150$ | 25,0                             | 24,4 | 22,1 | 19,8 | 17,5 | 14,0 | 11,6 | 9,2  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|    | 8E3   | $50 < v_R \leq 100$  | 25,0                             | 25,0 | 25,0 | 25,0 | 25,0 | 24,5 | 22,6 | 19,8 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|    | 8E3   | $100 < v_R \leq 150$ | 25,0                             | 25,0 | 25,0 | 25,0 | 25,0 | 23,3 | 21,0 | 17,5 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|    | 9E0   | $\leq 150$           | 25,0                             | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 22,3 | 19,8 | 17,5 | 15,2 | 13,2 | 11,3 | 9,6  | 8,2  | 7,0  |
|    | 9E1   | $\leq 130$           | 25,0                             | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 25,0 | 23,9 | 21,7 | 19,7 | 17,8 | 15,9 | 14,2 | 12,6 | 11,1 |

Table G.2.1-6 — PN 40

| PN | Group | v <sub>R</sub> (mm)        | max. allowable temperature TS °C |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |  |  |  |
|----|-------|----------------------------|----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--|--|--|--|
|    |       |                            | RT                               | 100  | 150  | 200  | 250  | 300  | 350  | 400  | 450  | 460  | 470  | 480  | 490  | 500  | 510  | 520  | 530  | 540  | 550  | 560  | 570  | 580  | 590  | 600  |  |  |  |  |
|    |       |                            | max. allowable pressure PS bar   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |  |  |  |
| 40 | 3E0   | ≤ 50                       | 40,0                             | 37,1 | 35,2 | 33,3 | 30,4 | 27,6 | 25,7 | 23,8 | 13,1 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |  |  |  |
|    | 3E0   | 50 < v <sub>R</sub> ≤ 150  | 40,0                             | 34,2 | 33,3 | 31,0 | 28,3 | 25,7 | 24,1 | 22,8 | 13,1 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |  |  |  |
|    | 3E1   | ≤ 50                       | 40,0                             | 40,0 | 40,0 | 40,0 | 39,0 | 35,2 | 32,3 | 29,5 | 16,1 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |  |  |  |
|    | 3E1   | 50< v <sub>R</sub> ≤ 150   | 40,0                             | 40,0 | 38,0 | 36,3 | 33,3 | 30,6 | 28,3 | 25,7 | 16,1 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |  |  |  |
|    | 4E0   | ≤ 60                       | 40,0                             | 40,0 | 40,0 | 40,0 | 39,0 | 34,2 | 32,3 | 29,9 | 27,6 | 25,6 | 23,6 | 21,6 | 19,7 | 17,7 | 14,0 | 11,2 | 8,9  |      |      |      |      |      |      |      |  |  |  |  |
|    | 4E0   | 60 < v <sub>R</sub> ≤ 90   | 40,0                             | 40,0 | 40,0 | 40,0 | 37,1 | 32,3 | 30,4 | 27,8 | 25,7 | 24,1 | 22,5 | 20,9 | 19,3 | 17,7 | 14,0 | 11,2 | 8,9  |      |      |      |      |      |      |      |  |  |  |  |
|    | 4E0   | 90 < v <sub>R</sub> ≤ 150  | 40,0                             | 40,0 | 40,0 | 37,1 | 34,2 | 30,4 | 28,0 | 25,3 | 23,6 | 22,4 | 21,2 | 20,0 | 18,9 | 17,7 | 14,0 | 11,2 | 8,9  |      |      |      |      |      |      |      |  |  |  |  |
|    | 5E0   | ≤ 60                       | 40,0                             | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 38,0 | 36,0 | 33,7 | 32,0 | 30,4 | 28,8 | 27,2 | 26,0 | 22,0 | 17,9 | 14,8 | 11,6 | 9,3  | 7,6  | 6,2  |      |      |      |  |  |  |  |
|    | 5E0   | 60 < v <sub>R</sub> ≤ 90   | 40,0                             | 40,0 | 40,0 | 40,0 | 40,0 | 39,0 | 36,0 | 33,5 | 31,4 | 30,1 | 28,9 | 27,6 | 26,4 | 26,0 | 22,0 | 17,9 | 14,8 | 11,6 | 9,3  | 7,6  | 6,2  |      |      |      |  |  |  |  |
|    | 5E0   | 90 < v <sub>R</sub> ≤ 150  | 40,0                             | 40,0 | 40,0 | 40,0 | 40,0 | 36,7 | 33,9 | 31,8 | 29,5 | 28,6 | 27,7 | 26,8 | 26,0 | 26,0 | 22,0 | 17,9 | 14,8 | 11,6 | 9,3  | 7,6  | 6,2  |      |      |      |  |  |  |  |
|    | 6E0   | ≤ 150                      | 40,0                             | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 39,0 | 37,1 | 35,2 | 33,3 | 31,4 | 29,5 | 27,6 | 25,7 | 22,4 | 19,6 | 17,1 | 14,8 | 12,9 | 11,0 | 9,7  | 8,3  | 7,2  | 6,4  |  |  |  |  |
|    | 6E1   | ≤ 150                      | 40,0                             | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 33,9 | 27,7 | 21,5 | 18,2 | 15,4 | 13,3 | 11,2 | 9,5  | 8,1  | 7,0  |      |      |  |  |  |  |
|    | 8E2   | 35 < v <sub>R</sub> ≤ 70   | 40,0                             | 40,0 | 40,0 | 37,5 | 34,4 | 29,9 | 26,0 | 22,4 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |  |  |  |
|    | 8E2   | 70 < v <sub>R</sub> ≤ 100  | 40,0                             | 40,0 | 37,7 | 34,6 | 31,8 | 26,0 | 22,4 | 18,6 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |  |  |  |
|    | 8E2   | 100 < v <sub>R</sub> ≤ 150 | 40,0                             | 39,0 | 35,4 | 31,8 | 28,0 | 22,4 | 18,6 | 14,8 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |  |  |  |
|    | 8E3   | 50 < v <sub>R</sub> ≤ 100  | 40,0                             | 40,0 | 40,0 | 40,0 | 40,0 | 39,2 | 36,1 | 31,8 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |  |  |  |
|    | 8E3   | 100 < v <sub>R</sub> ≤ 150 | 40,0                             | 40,0 | 40,0 | 40,0 | 40,0 | 37,3 | 33,7 | 28,0 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |  |  |  |  |
|    | 9E0   | ≤ 150                      | 40,0                             | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 35,8 | 31,8 | 28,0 | 24,3 | 21,1 | 18,0 | 15,4 | 13,1 | 11,2 |      |  |  |  |  |
|    | 9E1   | ≤ 130                      | 40,0                             | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 40,0 | 38,2 | 34,8 | 31,6 | 28,5 | 25,5 | 22,8 | 20,1 | 17,9 |  |  |  |  |

## EN 1092-1:2007 (E)

Table G.2.1-7 — PN 63

| PN | Group | $\nu_R$ (mm)           | max. allowable temperature TS °C |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----|-------|------------------------|----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
|    |       |                        | RT                               | 100  | 150  | 200  | 250  | 300  | 350  | 400  | 450  | 460  | 470  | 480  | 490  | 500  | 510  | 520  | 530  | 540  | 550  | 560  | 570  | 580  | 590  | 600  |
|    |       |                        | max. allowable pressure PS bar   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 63 | 3E0   | $\leq 50$              | 63,0                             | 58,5 | 55,5 | 52,5 | 48,0 | 43,5 | 40,5 | 37,5 | 20,7 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|    | 3E0   | $50 < \nu_R \leq 150$  | 63,0                             | 54,0 | 52,5 | 48,9 | 44,7 | 40,5 | 38,1 | 36,0 | 20,7 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|    | 3E1   | $\leq 50$              | 63,0                             | 63,0 | 63,0 | 63,0 | 61,5 | 55,5 | 51,0 | 46,5 | 25,5 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|    | 3E1   | $50 < \nu_R \leq 150$  | 63,0                             | 63,0 | 60,0 | 57,3 | 52,5 | 48,3 | 44,7 | 40,5 | 25,5 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|    | 4E0   | $\leq 60$              | 63,0                             | 63,0 | 63,0 | 63,0 | 61,5 | 54,0 | 51,0 | 47,1 | 43,5 | 40,3 | 37,2 | 34,1 | 31,0 | 27,9 | 22,2 | 17,7 | 14,1 |      |      |      |      |      |      |      |
|    | 4E0   | $60 < \nu_R \leq 90$   | 63,0                             | 63,0 | 63,0 | 63,0 | 58,5 | 51,0 | 48,0 | 43,8 | 40,5 | 37,9 | 35,4 | 32,9 | 30,4 | 27,9 | 22,2 | 17,7 | 14,1 |      |      |      |      |      |      |      |
|    | 4E0   | $90 < \nu_R \leq 150$  | 63,0                             | 63,0 | 63,0 | 58,5 | 54,0 | 48,0 | 44,1 | 39,9 | 37,2 | 35,3 | 33,4 | 31,6 | 29,7 | 27,9 | 22,2 | 17,7 | 14,1 |      |      |      |      |      |      |      |
|    | 5E0   | $\leq 60$              | 63,0                             | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 60,0 | 56,7 | 53,1 | 50,5 | 47,9 | 45,4 | 42,8 | 41,1 | 34,8 | 28,2 | 23,4 | 18,3 | 14,7 | 12,0 | 9,9  |      |      |      |
|    | 5E0   | $60 < \nu_R \leq 90$   | 63,0                             | 63,0 | 63,0 | 63,0 | 63,0 | 61,5 | 56,7 | 52,8 | 49,5 | 47,5 | 45,5 | 43,5 | 41,5 | 41,1 | 34,8 | 28,2 | 23,4 | 18,3 | 14,7 | 12,0 | 9,9  |      |      |      |
|    | 5E0   | $90 < \nu_R \leq 150$  | 63,0                             | 63,0 | 63,0 | 63,0 | 63,0 | 57,9 | 53,4 | 50,1 | 46,5 | 45,1 | 43,7 | 42,3 | 40,9 | 41,1 | 34,8 | 28,2 | 23,4 | 18,3 | 14,7 | 12,0 | 9,9  |      |      |      |
|    | 6E0   | $\leq 150$             | 63,0                             | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 61,5 | 58,5 | 55,5 | 52,5 | 49,5 | 46,5 | 43,5 | 40,5 | 35,4 | 30,9 | 27,0 | 23,4 | 20,4 | 17,4 | 15,3 | 13,2 | 11,4 | 10,2 |
|    | 6E1   | $\leq 150$             | 63,0                             | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 53,4 | 43,6 | 33,9 | 28,8 | 24,3 | 21,0 | 17,7 | 15,0 | 12,9 | 11,1 |      |      |      |
|    | 8E2   | $35 < \nu_R \leq 70$   | 63,0                             | 63,0 | 63,0 | 59,1 | 54,3 | 47,1 | 41,1 | 35,4 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|    | 8E2   | $70 < \nu_R \leq 100$  | 63,0                             | 63,0 | 59,4 | 54,6 | 50,1 | 41,1 | 35,4 | 29,4 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|    | 8E2   | $100 < \nu_R \leq 150$ | 63,0                             | 61,5 | 55,8 | 50,1 | 44,1 | 35,4 | 29,4 | 23,4 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|    | 8E3   | $50 < \nu_R \leq 100$  | 63,0                             | 63,0 | 63,0 | 63,0 | 63,0 | 61,8 | 57,0 | 50,1 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|    | 8E3   | $100 < \nu_R \leq 150$ | 63,0                             | 63,0 | 63,0 | 63,0 | 63,0 | 58,8 | 53,1 | 44,1 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|    | 9E0   | $\leq 150$             | 63,0                             | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 56,4 | 50,1 | 44,1 | 38,4 | 33,3 | 28,5 | 24,3 | 20,7 | 17,7 |
|    | 9E1   | $\leq 130$             | 63,0                             | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 63,0 | 60,3 | 54,9 | 49,8 | 45,0 | 40,2 | 36,0 | 31,8 | 28,2 |

Table G.2.1-8 — PN 100

| PN  | Group | v <sub>R</sub> (mm)        | max. allowable temperature TS °C |       |       |       |       |       |       |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |  |  |  |  |
|-----|-------|----------------------------|----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|------|------|------|------|------|------|------|--|--|--|--|
|     |       |                            | RT                               | 100   | 150   | 200   | 250   | 300   | 350   | 400   | 450   | 460   | 470   | 480   | 490   | 500   | 510   | 520  | 530  | 540  | 550  | 560  | 570  | 580  | 590  | 600  |  |  |  |  |
|     |       |                            | max. allowable pressure PS bar   |       |       |       |       |       |       |       |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |  |  |  |  |
| 100 | 3E0   | ≤ 50                       | 100,0                            | 92,8  | 88,0  | 83,3  | 76,1  | 69,0  | 64,2  | 59,5  | 32,8  |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |  |  |  |  |
|     | 3E0   | 50 < v <sub>R</sub> ≤ 150  | 100,0                            | 85,7  | 83,3  | 77,6  | 70,9  | 64,2  | 60,4  | 57,1  | 32,8  |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |  |  |  |  |
|     | 3E1   | ≤ 50                       | 100,0                            | 100,0 | 100,0 | 100,0 | 97,6  | 88,0  | 80,9  | 73,8  | 40,4  |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |  |  |  |  |
|     | 3E1   | 50< v <sub>R</sub> ≤ 150   | 100,0                            | 100,0 | 95,2  | 90,9  | 83,3  | 76,6  | 70,9  | 64,2  | 40,4  |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |  |  |  |  |
|     | 4E0   | ≤ 60                       | 100,0                            | 100,0 | 100,0 | 100,0 | 97,6  | 85,7  | 80,9  | 74,7  | 69,0  | 64,0  | 59,1  | 54,2  | 49,2  | 44,2  | 35,2  | 28,0 | 22,3 |      |      |      |      |      |      |      |  |  |  |  |
|     | 4E0   | 60 < v <sub>R</sub> ≤ 90   | 100,0                            | 100,0 | 100,0 | 100,0 | 92,8  | 80,9  | 76,1  | 69,5  | 64,2  | 60,2  | 56,2  | 52,2  | 48,2  | 44,2  | 35,2  | 28,0 | 22,3 |      |      |      |      |      |      |      |  |  |  |  |
|     | 4E0   | 90 < v <sub>R</sub> ≤ 150  | 100,0                            | 100,0 | 100,0 | 92,8  | 85,7  | 76,1  | 70,0  | 63,3  | 59,0  | 56,0  | 53,1  | 50,2  | 47,2  | 44,2  | 35,2  | 28,0 | 22,3 |      |      |      |      |      |      |      |  |  |  |  |
|     | 5E0   | ≤ 60                       | 100,0                            | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 95,2  | 90,0  | 84,2  | 80,2  | 76,1  | 72,0  | 68,0  | 65,2  | 55,2  | 44,7 | 37,1 | 29,0 | 23,3 | 19,0 | 15,7 |      |      |      |  |  |  |  |
|     | 5E0   | 60 < v <sub>R</sub> ≤ 90   | 100,0                            | 100,0 | 100,0 | 100,0 | 100,0 | 97,6  | 90,0  | 83,8  | 78,5  | 75,4  | 72,2  | 69,1  | 66,0  | 65,2  | 55,2  | 44,7 | 37,1 | 29,0 | 23,3 | 19,0 | 15,7 |      |      |      |  |  |  |  |
|     | 5E0   | 90 < v <sub>R</sub> ≤ 150  | 100,0                            | 100,0 | 100,0 | 100,0 | 100,0 | 91,9  | 84,7  | 79,5  | 73,8  | 71,6  | 69,4  | 67,2  | 65,0  | 65,2  | 55,2  | 44,7 | 37,1 | 29,0 | 23,3 | 19,0 | 15,7 |      |      |      |  |  |  |  |
|     | 6E0   | ≤ 150                      | 100,0                            | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 97,6  | 92,8  | 88,0  | 83,3  | 78,5  | 73,8  | 69,0  | 64,2  | 56,1  | 49,0 | 42,8 | 37,1 | 32,3 | 27,6 | 24,2 | 20,9 | 18,0 | 16,1 |  |  |  |  |
|     | 6E1   | ≤ 150                      | 100,0                            | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 84,8  | 69,3  | 53,8  | 45,7  | 38,5 | 33,3 | 28,0 | 23,8 | 20,4 | 17,6 |      |      |      |  |  |  |  |
|     | 8E2   | 35 < v <sub>R</sub> ≤ 70   | 100,0                            | 100,0 | 100,0 | 93,8  | 86,1  | 74,7  | 65,2  | 56,1  |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |  |  |  |  |
|     | 8E2   | 70 < v <sub>R</sub> ≤ 100  | 100,0                            | 100,0 | 94,2  | 86,6  | 79,5  | 65,2  | 56,1  | 46,6  |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |  |  |  |  |
|     | 8E2   | 100 < v <sub>R</sub> ≤ 150 | 100,0                            | 97,6  | 88,5  | 79,5  | 70,0  | 56,1  | 46,6  | 37,1  |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |  |  |  |  |
|     | 8E3   | 50 < v <sub>R</sub> ≤ 100  | 100,0                            | 100,0 | 100,0 | 100,0 | 100,0 | 98,0  | 90,4  | 79,5  |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |  |  |  |  |
|     | 8E3   | 100 < v <sub>R</sub> ≤ 150 | 100,0                            | 100,0 | 100,0 | 100,0 | 100,0 | 93,3  | 84,2  | 70,0  |       |       |       |       |       |       |       |      |      |      |      |      |      |      |      |      |  |  |  |  |
|     | 9E0   | ≤ 150                      | 100,0                            | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 89,5  | 79,5 | 70,0 | 60,9 | 52,8 | 45,2 | 38,5 | 32,8 | 28,0 |      |  |  |  |  |
|     | 9E1   | ≤ 130                      | 100,0                            | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | 95,7 | 87,1 | 79,0 | 71,4 | 63,8 | 57,1 | 50,4 | 44,7 |      |  |  |  |  |

## EN 1092-1:2007 (E)

Table G.2.1-9 — PN 160

| PN  | Group | v <sub>R</sub> (mm)        | max. allowable temperature TS °C |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |      |      |      |  |  |  |  |
|-----|-------|----------------------------|----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|------|--|--|--|--|
|     |       |                            | RT                               | 100   | 150   | 200   | 250   | 300   | 350   | 400   | 450   | 460   | 470   | 480   | 490   | 500   | 510   | 520   | 530   | 540   | 550   | 560   | 570   | 580  | 590  | 600  |  |  |  |  |
|     |       |                            | max. allowable pressure PS bar   |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |      |      |      |  |  |  |  |
| 160 | 3E0   | ≤ 50                       | 160,0                            | 148,5 | 140,9 | 133,3 | 121,9 | 110,4 | 102,8 | 95,2  | 52,5  |       |       |       |       |       |       |       |       |       |       |       |       |      |      |      |  |  |  |  |
|     | 3E0   | 50 < v <sub>R</sub> ≤ 150  | 160,0                            | 137,1 | 133,3 | 124,1 | 113,5 | 102,8 | 96,7  | 91,4  | 52,5  |       |       |       |       |       |       |       |       |       |       |       |       |      |      |      |  |  |  |  |
|     | 3E1   | ≤ 50                       | 160,0                            | 160,0 | 160,0 | 160,0 | 156,1 | 140,9 | 129,5 | 118,0 | 64,7  |       |       |       |       |       |       |       |       |       |       |       |       |      |      |      |  |  |  |  |
|     | 3E1   | 50< v <sub>R</sub> ≤ 150   | 160,0                            | 160,0 | 152,3 | 145,5 | 133,3 | 122,6 | 113,5 | 102,8 | 64,7  |       |       |       |       |       |       |       |       |       |       |       |       |      |      |      |  |  |  |  |
|     | 4E0   | ≤ 60                       | 160,0                            | 160,0 | 160,0 | 160,0 | 156,1 | 137,1 | 129,5 | 119,6 | 110,4 | 102,5 | 94,6  | 86,7  | 78,8  | 70,8  | 56,3  | 44,9  | 35,8  |       |       |       |       |      |      |      |  |  |  |  |
|     | 4E0   | 60 < v <sub>R</sub> ≤ 90   | 160,0                            | 160,0 | 160,0 | 160,0 | 148,5 | 129,5 | 121,9 | 111,2 | 102,8 | 96,4  | 90,0  | 83,6  | 77,2  | 70,8  | 56,3  | 44,9  | 35,8  |       |       |       |       |      |      |      |  |  |  |  |
|     | 4E0   | 90 < v <sub>R</sub> ≤ 150  | 160,0                            | 160,0 | 160,0 | 148,5 | 137,1 | 121,9 | 112,0 | 101,3 | 94,4  | 89,7  | 85,0  | 80,3  | 75,6  | 70,8  | 56,3  | 44,9  | 35,8  |       |       |       |       |      |      |      |  |  |  |  |
|     | 5E0   | ≤ 60                       | 160,0                            | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 152,3 | 144,0 | 134,8 | 128,3 | 121,8 | 115,3 | 108,8 | 104,3 | 88,3  | 71,6  | 59,4  | 46,4  | 37,3  | 30,4  | 25,1  |      |      |      |  |  |  |  |
|     | 5E0   | 60 < v <sub>R</sub> ≤ 90   | 160,0                            | 160,0 | 160,0 | 160,0 | 160,0 | 156,1 | 144,0 | 134,0 | 125,7 | 120,6 | 115,6 | 110,6 | 105,6 | 104,3 | 88,3  | 71,6  | 59,4  | 46,4  | 37,3  | 30,4  | 25,1  |      |      |      |  |  |  |  |
|     | 5E0   | 90 < v <sub>R</sub> ≤ 150  | 160,0                            | 160,0 | 160,0 | 160,0 | 160,0 | 147,0 | 135,6 | 127,2 | 118,0 | 114,6 | 111,0 | 107,5 | 104,0 | 104,3 | 88,3  | 71,6  | 59,4  | 46,4  | 37,3  | 30,4  | 25,1  |      |      |      |  |  |  |  |
|     | 6E0   | ≤ 150                      | 160,0                            | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 156,1 | 148,5 | 140,9 | 133,3 | 125,7 | 118,0 | 110,4 | 102,8 | 89,9  | 78,4  | 68,5  | 59,4  | 51,8  | 44,1  | 38,8  | 33,5 | 28,9 | 25,9 |  |  |  |  |
|     | 6E1   | ≤ 150                      | 160,0                            | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 135,7 | 110,9 | 86,0  | 73,1  | 61,7  | 53,3  | 44,9  | 38,0  | 32,7  | 28,1 |      |      |  |  |  |  |
|     | 8E2   | 35 < v <sub>R</sub> ≤ 70   | 160,0                            | 160,0 | 160,0 | 150,0 | 137,9 | 119,6 | 104,3 | 89,9  |       |       |       |       |       |       |       |       |       |       |       |       |       |      |      |      |  |  |  |  |
|     | 8E2   | 70 < v <sub>R</sub> ≤ 100  | 160,0                            | 160,0 | 150,8 | 138,6 | 127,2 | 104,3 | 89,9  | 74,6  |       |       |       |       |       |       |       |       |       |       |       |       |       |      |      |      |  |  |  |  |
|     | 8E2   | 100 < v <sub>R</sub> ≤ 150 | 160,0                            | 156,1 | 141,7 | 127,2 | 112,0 | 89,9  | 74,6  | 59,4  |       |       |       |       |       |       |       |       |       |       |       |       |       |      |      |      |  |  |  |  |
|     | 8E3   | 50 < v <sub>R</sub> ≤ 100  | 160,0                            | 160,0 | 160,0 | 160,0 | 160,0 | 156,9 | 144,7 | 127,2 |       |       |       |       |       |       |       |       |       |       |       |       |       |      |      |      |  |  |  |  |
|     | 8E3   | 100 < v <sub>R</sub> ≤ 150 | 160,0                            | 160,0 | 160,0 | 160,0 | 160,0 | 149,3 | 134,8 | 112,0 |       |       |       |       |       |       |       |       |       |       |       |       |       |      |      |      |  |  |  |  |
|     | 9E0   | ≤ 150                      | 160,0                            | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 143,2 | 127,2 | 112,0 | 97,5  | 84,5  | 72,3  | 61,7 | 52,5 | 44,9 |  |  |  |  |
|     | 9E1   | ≤ 130                      | 160,0                            | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 160,0 | 153,1 | 139,4 | 126,4 | 114,2 | 102,0 | 91,4 | 80,7 | 71,6 |  |  |  |  |

Table G.2.1-10 — PN 250

| PN  | Group | $v_R$ (mm)           | max. allowable temperature TS °C |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|-----|-------|----------------------|----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|     |       |                      | RT                               | 100   | 150   | 200   | 250   | 300   | 350   | 400   | 450   | 460   | 470   | 480   | 490   | 500   | 510   | 520   | 530   | 540   | 550   | 560   | 570   | 580   | 590   | 600   |
|     |       |                      | max. allowable pressure PS bar   |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 250 | 3E0   | $\leq 50$            | 250,0                            | 232,1 | 220,2 | 208,3 | 190,4 | 172,6 | 160,7 | 148,8 | 82,1  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|     | 3E0   | $50 < v_R \leq 150$  | 250,0                            | 214,2 | 208,3 | 194,0 | 177,3 | 160,7 | 151,1 | 142,8 | 82,1  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|     | 3E1   | $\leq 50$            | 250,0                            | 250,0 | 250,0 | 250,0 | 244,0 | 220,2 | 202,3 | 184,5 | 101,1 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|     | 3E1   | $50 < v_R \leq 150$  | 250,0                            | 250,0 | 238,0 | 227,3 | 208,3 | 191,6 | 177,3 | 160,7 | 101,1 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|     | 4E0   | $\leq 60$            | 250,0                            | 250,0 | 250,0 | 250,0 | 244,0 | 214,2 | 202,3 | 186,9 | 172,6 | 160,1 | 147,8 | 135,5 | 123,2 | 110,7 | 88,0  | 70,2  | 55,9  |       |       |       |       |       |       |       |
|     | 4E0   | $60 < v_R \leq 90$   | 250,0                            | 250,0 | 250,0 | 250,0 | 232,1 | 202,3 | 190,4 | 173,8 | 160,7 | 150,7 | 140,7 | 130,7 | 120,7 | 110,7 | 88,0  | 70,2  | 55,9  |       |       |       |       |       |       |       |
|     | 4E0   | $90 < v_R \leq 150$  | 250,0                            | 250,0 | 250,0 | 232,1 | 214,2 | 190,4 | 175,0 | 158,3 | 147,6 | 140,1 | 132,8 | 125,5 | 118,2 | 110,7 | 88,0  | 70,2  | 55,9  |       |       |       |       |       |       |       |
|     | 5E0   | $\leq 60$            | 250,0                            | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 238,0 | 225,0 | 210,7 | 200,5 | 190,3 | 180,1 | 170,0 | 163,0 | 138,0 | 111,9 | 92,8  | 72,6  | 58,3  | 47,6  | 39,2  |       |       |       |
|     | 5E0   | $60 < v_R \leq 90$   | 250,0                            | 250,0 | 250,0 | 250,0 | 250,0 | 244,0 | 225,0 | 209,5 | 196,4 | 188,5 | 180,7 | 172,8 | 165,0 | 163,0 | 138,0 | 111,9 | 92,8  | 72,6  | 58,3  | 47,6  | 39,2  |       |       |       |
|     | 5E0   | $90 < v_R \leq 150$  | 250,0                            | 250,0 | 250,0 | 250,0 | 250,0 | 229,7 | 211,9 | 198,8 | 184,5 | 179,1 | 173,5 | 168,0 | 162,5 | 163,0 | 138,0 | 111,9 | 92,8  | 72,6  | 58,3  | 47,6  | 39,2  |       |       |       |
|     | 6E0   | $\leq 150$           | 250,0                            | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 244,0 | 232,1 | 220,2 | 208,3 | 196,4 | 184,5 | 172,6 | 160,7 | 140,4 | 122,6 | 107,1 | 92,8  | 80,9  | 69,0  | 60,7  | 52,3  | 45,2  | 40,4  |
|     | 6E1   | $\leq 150$           | 250,0                            | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 212,1 | 173,3 | 134,5 | 114,2 | 96,4  | 83,3  | 70,2  | 59,5  | 51,1  | 44,0  |       |       |       |
|     | 8E2   | $35 < v_R \leq 70$   | 250,0                            | 250,0 | 250,0 | 234,5 | 215,4 | 186,9 | 163,0 | 140,4 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|     | 8E2   | $70 < v_R \leq 100$  | 250,0                            | 250,0 | 235,7 | 216,6 | 198,8 | 163,0 | 140,4 | 116,6 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|     | 8E2   | $100 < v_R \leq 150$ | 250,0                            | 244,0 | 221,4 | 198,8 | 175,0 | 140,4 | 116,6 | 92,8  |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|     | 8E3   | $50 < v_R \leq 100$  | 250,0                            | 250,0 | 250,0 | 250,0 | 250,0 | 245,2 | 226,1 | 198,8 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|     | 8E3   | $100 < v_R \leq 150$ | 250,0                            | 250,0 | 250,0 | 250,0 | 250,0 | 233,3 | 210,7 | 175,0 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|     | 9E0   | $\leq 150$           | 250,0                            | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 223,8 | 198,8 | 175,0 | 152,3 | 132,1 | 113,0 | 96,4  | 82,1  | 70,2  |
|     | 9E1   | $\leq 130$           | 250,0                            | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 250,0 | 239,2 | 217,8 | 197,6 | 178,5 | 159,5 | 142,8 | 126,1 | 111,9 |

## EN 1092-1:2007 (E)

Table G.2.1-11 — PN 320

| PN  | Group | v <sub>R</sub> (mm)        | max. allowable temperature TS °C |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|-----|-------|----------------------------|----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|--|--|--|
|     |       |                            | RT                               | 100   | 150   | 200   | 250   | 300   | 350   | 400   | 450   | 460   | 470   | 480   | 490   | 500   | 510   | 520   | 530   | 540   | 550   | 560   | 570   | 580   | 590   | 600   |  |  |  |  |
|     |       |                            | max. allowable pressure PS bar   |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
| 320 | 3E0   | ≤ 50                       | 320,0                            | 297,1 | 281,9 | 266,6 | 243,8 | 220,9 | 205,7 | 190,4 | 105,1 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|     | 3E0   | 50 < v <sub>R</sub> ≤ 150  | 320,0                            | 274,2 | 266,6 | 248,3 | 227,0 | 205,7 | 193,5 | 182,8 | 105,1 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|     | 3E1   | ≤ 50                       | 320,0                            | 320,0 | 320,0 | 320,0 | 312,3 | 281,9 | 259,0 | 236,1 | 129,5 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|     | 3E1   | 50< v <sub>R</sub> ≤ 150   | 320,0                            | 320,0 | 304,7 | 291,0 | 266,6 | 245,3 | 227,0 | 205,7 | 129,5 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|     | 4E0   | ≤ 60                       | 320,0                            | 320,0 | 320,0 | 320,0 | 312,3 | 274,2 | 259,0 | 239,2 | 220,9 | 205,0 | 189,2 | 173,4 | 157,7 | 141,7 | 112,7 | 89,9  | 71,6  |       |       |       |       |       |       |       |  |  |  |  |
|     | 4E0   | 60 < v <sub>R</sub> ≤ 90   | 320,0                            | 320,0 | 320,0 | 320,0 | 297,1 | 259,0 | 243,8 | 222,4 | 205,7 | 192,9 | 180,1 | 167,3 | 154,5 | 141,7 | 112,7 | 89,9  | 71,6  |       |       |       |       |       |       |       |  |  |  |  |
|     | 4E0   | 90 < v <sub>R</sub> ≤ 150  | 320,0                            | 320,0 | 320,0 | 297,1 | 274,2 | 243,8 | 224,0 | 202,6 | 188,9 | 179,4 | 170,0 | 160,6 | 151,3 | 141,7 | 112,7 | 89,9  | 71,6  |       |       |       |       |       |       |       |  |  |  |  |
|     | 5E0   | ≤ 60                       | 320,0                            | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 304,7 | 288,0 | 269,7 | 256,6 | 243,6 | 230,6 | 217,6 | 208,7 | 176,7 | 143,2 | 118,8 | 92,9  | 74,6  | 60,9  | 50,2  |       |       |       |  |  |  |  |
|     | 5E0   | 60 < v <sub>R</sub> ≤ 90   | 320,0                            | 320,0 | 320,0 | 320,0 | 320,0 | 312,3 | 288,0 | 268,1 | 251,4 | 241,3 | 231,3 | 221,2 | 211,2 | 208,7 | 176,7 | 143,2 | 118,8 | 92,9  | 74,6  | 60,9  | 50,2  |       |       |       |  |  |  |  |
|     | 5E0   | 90 < v <sub>R</sub> ≤ 150  | 320,0                            | 320,0 | 320,0 | 320,0 | 320,0 | 294,0 | 271,2 | 254,4 | 236,1 | 229,2 | 222,1 | 215,0 | 208,0 | 208,7 | 176,7 | 143,2 | 118,8 | 92,9  | 74,6  | 60,9  | 50,2  |       |       |       |  |  |  |  |
|     | 6E0   | ≤ 150                      | 320,0                            | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 312,3 | 297,1 | 281,9 | 266,6 | 251,4 | 236,1 | 220,9 | 205,7 | 179,8 | 156,9 | 137,1 | 118,8 | 103,6 | 88,3  | 77,7  | 67,0  | 57,9  | 51,8  |  |  |  |  |
|     | 6E1   | ≤ 150                      | 320,0                            | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 271,5 | 221,8 | 172,1 | 146,2 | 123,4 | 106,6 | 89,9  | 76,1  | 65,5  | 56,3  |       |       |  |  |  |  |
|     | 8E2   | 35 < v <sub>R</sub> ≤ 70   | 320,0                            | 320,0 | 320,0 | 300,1 | 275,8 | 239,2 | 208,7 | 179,8 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|     | 8E2   | 70 < v <sub>R</sub> ≤ 100  | 320,0                            | 320,0 | 301,7 | 277,3 | 254,4 | 208,7 | 179,8 | 149,3 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|     | 8E2   | 100 < v <sub>R</sub> ≤ 150 | 320,0                            | 312,3 | 283,4 | 254,4 | 224,0 | 179,8 | 149,3 | 118,8 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|     | 8E3   | 50 < v <sub>R</sub> ≤ 100  | 320,0                            | 320,0 | 320,0 | 320,0 | 320,0 | 313,9 | 289,5 | 254,4 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|     | 8E3   | 100 < v <sub>R</sub> ≤ 150 | 320,0                            | 320,0 | 320,0 | 320,0 | 320,0 | 298,6 | 269,7 | 224,0 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|     | 9E0   | ≤ 150                      | 320,0                            | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 286,4 | 254,4 | 224,0 | 195,0 | 169,1 | 144,7 | 123,4 | 105,1 | 89,9  |  |  |  |  |
|     | 9E1   | ≤ 130                      | 320,0                            | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 320,0 | 306,2 | 278,8 | 252,9 | 228,5 | 204,1 | 182,8 | 161,5 | 143,2 |  |  |  |  |

Table G.2.1-12 — PN 400

| PN  | Group | v <sub>R</sub> (mm)        | max. allowable temperature TS °C |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|-----|-------|----------------------------|----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|--|--|--|
|     |       |                            | RT                               | 100   | 150   | 200   | 250   | 300   | 350   | 400   | 450   | 460   | 470   | 480   | 490   | 500   | 510   | 520   | 530   | 540   | 550   | 560   | 570   | 580   | 590   | 600   |  |  |  |  |
|     |       |                            | max. allowable pressure PS bar   |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
| 400 | 3E0   | ≤ 50                       | 400,0                            | 371,4 | 352,3 | 333,3 | 304,7 | 276,1 | 257,1 | 238,0 | 131,4 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|     | 3E0   | 50 < v <sub>R</sub> ≤ 150  | 400,0                            | 342,8 | 333,3 | 310,4 | 283,8 | 257,1 | 241,9 | 228,5 | 131,4 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|     | 3E1   | ≤ 50                       | 400,0                            | 400,0 | 400,0 | 400,0 | 390,4 | 352,3 | 323,8 | 295,2 | 161,9 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|     | 3E1   | 50< v <sub>R</sub> ≤ 150   | 400,0                            | 400,0 | 380,9 | 363,8 | 333,3 | 306,6 | 283,8 | 257,1 | 161,9 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|     | 4E0   | ≤ 60                       | 400,0                            | 400,0 | 400,0 | 400,0 | 390,4 | 342,8 | 323,8 | 299,0 | 276,1 | 256,2 | 236,5 | 216,8 | 197,1 | 177,1 | 140,9 | 112,3 | 89,5  |       |       |       |       |       |       |       |  |  |  |  |
|     | 4E0   | 60 < v <sub>R</sub> ≤ 90   | 400,0                            | 400,0 | 400,0 | 400,0 | 371,4 | 323,8 | 304,7 | 278,0 | 257,1 | 241,1 | 225,1 | 209,1 | 193,1 | 177,1 | 140,9 | 112,3 | 89,5  |       |       |       |       |       |       |       |  |  |  |  |
|     | 4E0   | 90 < v <sub>R</sub> ≤ 150  | 400,0                            | 400,0 | 400,0 | 371,4 | 342,8 | 304,7 | 280,0 | 253,3 | 236,1 | 224,2 | 212,5 | 200,8 | 189,1 | 177,1 | 140,9 | 112,3 | 89,5  |       |       |       |       |       |       |       |  |  |  |  |
|     | 5E0   | ≤ 60                       | 400,0                            | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 380,9 | 360,0 | 337,1 | 320,8 | 304,5 | 288,2 | 272,0 | 260,9 | 220,9 | 179,0 | 148,5 | 116,1 | 93,3  | 76,1  | 62,8  |       |       |       |  |  |  |  |
|     | 5E0   | 60 < v <sub>R</sub> ≤ 90   | 400,0                            | 400,0 | 400,0 | 400,0 | 400,0 | 390,4 | 360,0 | 335,2 | 314,2 | 301,7 | 289,1 | 276,5 | 264,0 | 260,9 | 220,9 | 179,0 | 148,5 | 116,1 | 93,3  | 76,1  | 62,8  |       |       |       |  |  |  |  |
|     | 5E0   | 90 < v <sub>R</sub> ≤ 150  | 400,0                            | 400,0 | 400,0 | 400,0 | 400,0 | 367,6 | 339,0 | 318,0 | 295,2 | 286,5 | 277,7 | 268,8 | 260,0 | 260,9 | 220,9 | 179,0 | 148,5 | 116,1 | 93,3  | 76,1  | 62,8  |       |       |       |  |  |  |  |
|     | 6E0   | ≤ 150                      | 400,0                            | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 390,4 | 371,4 | 352,3 | 333,3 | 314,2 | 295,2 | 276,1 | 257,1 | 224,7 | 196,1 | 171,4 | 148,5 | 129,5 | 110,4 | 97,1  | 83,8  | 72,3  | 64,7  |  |  |  |  |
|     | 6E1   | ≤ 150                      | 400,0                            | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 |  |  |  |  |
|     | 8E2   | 35 < v <sub>R</sub> ≤ 70   | 400,0                            | 400,0 | 400,0 | 375,2 | 344,7 | 299,0 | 260,9 | 224,7 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|     | 8E2   | 70 < v <sub>R</sub> ≤ 100  | 400,0                            | 400,0 | 377,1 | 346,6 | 318,0 | 260,9 | 224,7 | 186,6 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|     | 8E2   | 100 < v <sub>R</sub> ≤ 150 | 400,0                            | 390,4 | 354,2 | 318,0 | 280,0 | 224,7 | 186,6 | 148,5 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|     | 8E3   | 50 < v <sub>R</sub> ≤ 100  | 400,0                            | 400,0 | 400,0 | 400,0 | 400,0 | 392,3 | 361,9 | 318,0 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|     | 8E3   | 100 < v <sub>R</sub> ≤ 150 | 400,0                            | 400,0 | 400,0 | 400,0 | 400,0 | 373,3 | 337,1 | 280,0 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |  |
|     | 9E0   | ≤ 150                      | 400,0                            | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 358,0 | 318,0 | 280,0 | 243,8 | 211,4 | 180,9 | 154,2 | 131,4 | 112,3 |  |  |  |  |
|     | 9E1   | ≤ 130                      | 400,0                            | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 400,0 | 382,8 | 348,5 | 316,1 | 285,7 | 255,2 | 228,5 | 201,9 | 179,0 |  |  |  |  |

## G.3 Austenitic and austenitic-ferritic steels

### G.3.1 General

p/t-ratings are given in Tables G.4.1-1 to G.4.1-12 for austenitic and austenitic-ferritic steels. They are calculated by using the strength values of steel forgings (see Table G.3.1-1) and are verified for flat steel products of the same group (see Table 9) up to and incl. 600 °C. Thickness related strength values for all thicknesses up to and including 150 mm have been considered.

p/t-ratings are calculated by using the strength values of steel forgings and are verified for flat steel products of the same group.

100 000 h creep rupture strength values are considered for materials marked with 'X' in Table G.3.1-1.

Maximum allowable pressures at temperatures for which 100 000 h creep rupture strength values have been considered are indicated in italic letters in Tables G.4.1-1 to G.4.1-12.

For flanges made from steel castings (type 21; material selection see Table 9) the p/t-ratings shall be the same as for the corresponding steel forgings respectively flat steel products (see Table 9). The wall thicknesses need to be verified (see provisions made in F.2.5).

NOTE For nominal design stress values of steel castings it may be necessary to consider the provisions given in applicable component or equipment standards (e.g. EN 12516).

### G.3.2 List of materials

**Table G.3.1-1 — Austenitic and austenitic-ferritic materials**

| Group | Material          | Material No. | EN      | R <sub>p</sub> / R <sub>e</sub> | Creep | v <sub>R</sub> (mm) | A% |
|-------|-------------------|--------------|---------|---------------------------------|-------|---------------------|----|
| 10E0  | X2CrNi18-9        | 1.4307       | 10222-5 | R <sub>p1,0 t</sub>             | X     | —                   | 35 |
| 10E1  | X2CrNiN18-10      | 1.4311       | 10222-5 | R <sub>p1,0 t</sub>             | —     | —                   | 35 |
| 11E0  | X5CrNi18-10       | 1.4301       | 10222-5 | R <sub>p1,0 t</sub>             | X     | —                   | 35 |
| 12E0  | X6CrNiTi18-10     | 1.4541       | 10222-5 | R <sub>p1,0 t</sub>             | X     | —                   | 30 |
| 12E0  | X6CrNiNb18-10     | 1.4550       | 10222-5 | R <sub>p1,0 t</sub>             | —     | —                   | 30 |
| 13E0  | X2CrNiMo17-12-2   | 1.4404       | 10222-5 | R <sub>p1,0 t</sub>             | —     | —                   | 35 |
| 14E0  | X5CrNiMo17-12-2   | 1.4401       | 10222-5 | R <sub>p1,0 t</sub>             | X     | —                   | 35 |
| 15E0  | X6CrNiMoTi17-12-2 | 1.4571       | 10222-5 | R <sub>p1,0 t</sub>             | X     | —                   | 35 |
| 16E0  | X2CrNiMoN22-5-3   | 1.4462       | 10222-5 | R <sub>p0,2 t</sub>             | —     | —                   | 25 |
| 11E0  | X6CrNi18-10       | 1.4948       | 10222-5 | R <sub>p1,0 t</sub>             | X     | —                   | 35 |
| 12E0  | X6CrNiTiB18-10    | 1.4941       | 10222-5 | R <sub>p1,0 t</sub>             | X     | —                   | 30 |

NOTE Table contains a selection of commonly used austenitic and austenitic-ferritic materials.

## G.3.3 p/t-Ratings

Table G.4.1-1 — PN 2,5

| PN  | Group | Material-No. | max. allowable temperature TS °C |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-------|--------------|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|     |       |              | RT                               | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 560 | 570 | 580 | 590 | 600 |
|     |       |              | max. allowable pressure PS bar   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 2,5 | 10E0  | 1.4307       | 2,5                              | 2,1 | 1,9 | 1,7 | 1,6 | 1,5 | 1,4 | 1,3 | 1,3 | 1,2 | 1,0 | 1,0 | 0,9 | 0,8 | 0,7 | 0,7 |
|     | 10E1  | 1.4311       | 2,5                              | 2,5 | 2,5 | 2,2 | 2,0 | 1,9 | 1,9 | 1,8 | 1,8 | 1,7 |     |     |     |     |     |     |
|     | 11E0  | 1.4301       | 2,5                              | 2,2 | 2,0 | 1,8 | 1,7 | 1,6 | 1,5 | 1,4 | 1,4 | 1,4 | 1,0 | 1,0 | 0,9 | 0,8 | 0,7 | 0,7 |
|     | 12E0  | 1.4541       | 2,5                              | 2,4 | 2,3 | 2,2 | 2,1 | 1,9 | 1,9 | 1,8 | 1,8 | 1,7 | 1,6 | 1,5 | 1,4 | 1,2 | 1,1 | 1,0 |
|     | 12E0  | 1.4550       | 2,5                              | 2,5 | 2,3 | 2,2 | 2,1 | 1,9 | 1,9 | 1,8 | 1,8 | 1,7 |     |     |     |     |     |     |
|     | 13E0  | 1.4404       | 2,5                              | 2,3 | 2,1 | 1,9 | 1,8 | 1,7 | 1,6 | 1,6 | 1,5 | 1,5 |     |     |     |     |     |     |
|     | 14E0  | 1.4401       | 2,5                              | 2,5 | 2,2 | 2,1 | 1,9 | 1,8 | 1,7 | 1,7 | 1,6 | 1,6 | 1,6 | 1,6 | 1,5 | 1,5 | 1,5 | 1,4 |
|     | 15E0  | 1.4571       | 2,5                              | 2,5 | 2,4 | 2,3 | 2,2 | 2,0 | 2,0 | 1,9 | 1,9 | 1,8 | 1,8 | 1,8 | 1,8 | 1,6 | 1,5 | 1,3 |
|     | 16E0  | 1.4462       | 2,5                              | 2,5 | 2,5 | 2,5 | 2,5 |     |     |     |     |     |     |     |     |     |     |     |
|     | 11E0  | 1.4948       | 2,5                              | 2,2 | 2   | 1,8 | 1,7 | 1,6 | 1,5 | 1,5 | 1,4 | 1,4 | 1,3 | 1,3 | 1,2 | 1,2 | 1,1 | 1   |
|     | 12E0  | 1.4941       | 2,5                              | 2,3 | 2,2 | 2,1 | 2,0 | 2,0 | 1,9 | 1,9 | 1,8 | 1,8 | 1,7 | 1,7 | 1,6 | 1,5 | 1,3 | 1,2 |

**EN 1092-1:2007 (E)****Table G.4.1-2 — PN 6**

| PN   | Group  | Material-No. | max. allowable temperature TS °C |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|------|--------|--------------|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|      |        |              | RT                               | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 560 | 570 | 580 | 590 | 600 |
|      |        |              | max. allowable pressure PS bar   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 6    | 10E0   | 1.4307       | 6,0                              | 5,1 | 4,6 | 4,2 | 3,9 | 3,6 | 3,4 | 3,3 | 3,2 | 3,1 | 2,6 | 2,4 | 2,2 | 2,0 | 1,8 | 1,6 |
|      | 10E1   | 1.4311       | 6,0                              | 6,0 | 6,0 | 5,3 | 5,0 | 4,7 | 4,6 | 4,4 | 4,3 | 4,2 |     |     |     |     |     |     |
|      | 11E0   | 1.4301       | 6,0                              | 5,4 | 4,9 | 4,4 | 4,1 | 3,8 | 3,6 | 3,5 | 3,5 | 3,4 | 2,6 | 2,4 | 2,2 | 2,0 | 1,8 | 1,6 |
|      | 12E0   | 1.4541       | 6,0                              | 5,9 | 5,6 | 5,3 | 5,0 | 4,7 | 4,6 | 4,4 | 4,3 | 4,2 | 4,0 | 3,6 | 3,3 | 3,0 | 2,7 | 2,4 |
|      | 12E0   | 1.4550       | 6,0                              | 6,0 | 5,6 | 5,3 | 5,0 | 4,7 | 4,6 | 4,4 | 4,3 | 4,2 |     |     |     |     |     |     |
|      | 13E0   | 1.4404       | 6,0                              | 5,6 | 5,1 | 4,7 | 4,4 | 4,1 | 3,9 | 3,8 | 3,7 | 3,6 |     |     |     |     |     |     |
|      | 14E0   | 1.4401       | 6,0                              | 6,0 | 5,4 | 5,0 | 4,7 | 4,4 | 4,2 | 4,1 | 4,0 | 3,9 | 3,9 | 3,8 | 3,8 | 3,7 | 3,7 | 3,3 |
|      | 15E0   | 1.4571       | 6,0                              | 6,0 | 5,8 | 5,6 | 5,3 | 5,0 | 4,8 | 4,6 | 4,6 | 4,5 | 4,4 | 4,4 | 4,4 | 4,0 | 3,6 | 3,3 |
|      | 16E0   | 1.4462       | 6,0                              | 6,0 | 6,0 | 6,0 | 6,0 |     |     |     |     |     |     |     |     |     |     |     |
|      | 11E0   | 1.4948       | 6,0                              | 5,4 | 4,9 | 4,4 | 4,2 | 3,9 | 3,7 | 3,6 | 3,5 | 3,3 | 3,2 | 3,1 | 3,1 | 3,0 | 2,8 | 2,5 |
| 12E0 | 1.4941 | 6,0          | 5,7                              | 5,4 | 5,1 | 5,0 | 4,9 | 4,7 | 4,6 | 4,4 | 4,3 | 4,2 | 4,0 | 4,0 | 3,6 | 3,2 | 2,9 |     |

**Table G.4.1-3 — PN 10**

| PN | Group | Material-No. | max. allowable temperature TS °C |      |      |      |      |     |     |     |     |     |     |     |     |     |     |     |
|----|-------|--------------|----------------------------------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|    |       |              | RT                               | 100  | 150  | 200  | 250  | 300 | 350 | 400 | 450 | 500 | 550 | 560 | 570 | 580 | 590 | 600 |
|    |       |              | max. allowable pressure PS bar   |      |      |      |      |     |     |     |     |     |     |     |     |     |     |     |
| 10 | 10E0  | 1.4307       | 10,0                             | 8,6  | 7,7  | 7,0  | 6,5  | 6,0 | 5,7 | 5,5 | 5,3 | 5,1 | 4,3 | 4,0 | 3,7 | 3,4 | 3,0 | 2,8 |
|    | 10E1  | 1.4311       | 10,0                             | 10,0 | 10   | 8,9  | 8,3  | 7,9 | 7,6 | 7,4 | 7,2 | 7   |     |     |     |     |     |     |
|    | 11E0  | 1.4301       | 10,0                             | 9,0  | 8,1  | 7,4  | 6,9  | 6,4 | 6,1 | 5,9 | 5,8 | 5,7 | 4,3 | 4,0 | 3,7 | 3,4 | 3,0 | 2,8 |
|    | 12E0  | 1.4541       | 10,0                             | 9,9  | 9,3  | 8,8  | 8,4  | 7,9 | 7,6 | 7,4 | 7,2 | 7   | 6,7 | 6,1 | 5,6 | 5,0 | 4,5 | 4,0 |
|    | 12E0  | 1.4550       | 10,0                             | 10,0 | 9,3  | 8,8  | 8,4  | 7,9 | 7,6 | 7,4 | 7,2 | 7   |     |     |     |     |     |     |
|    | 13E0  | 1.4404       | 10,0                             | 9,4  | 8,6  | 7,9  | 7,4  | 6,9 | 6,6 | 6,4 | 6,2 | 6   |     |     |     |     |     |     |
|    | 14E0  | 1.4401       | 10,0                             | 10,0 | 9,0  | 8,4  | 7,9  | 7,4 | 7,1 | 6,8 | 6,7 | 6,6 | 6,5 | 6,4 | 6,3 | 6,2 | 6,1 | 5,6 |
|    | 15E0  | 1.4571       | 10,0                             | 10,0 | 9,8  | 9,3  | 8,8  | 8,3 | 8,0 | 7,8 | 7,6 | 7,5 | 7,4 | 7,4 | 7,3 | 6,7 | 6,0 | 5,5 |
|    | 16E0  | 1.4462       | 10,0                             | 10,0 | 10,0 | 10,0 | 10,0 |     |     |     |     |     |     |     |     |     |     |     |
|    | 11E0  | 1.4948       | 10,0                             | 9,0  | 8,1  | 7,4  | 7,0  | 6,5 | 6,2 | 6,0 | 5,8 | 5,6 | 5,3 | 5,2 | 5,1 | 5,0 | 4,6 | 4,2 |
|    | 12E0  | 1.4941       | 10,0                             | 9,5  | 9,0  | 8,6  | 8,3  | 8,1 | 7,9 | 7,7 | 7,4 | 7,2 | 7,0 | 6,8 | 6,6 | 6,0 | 5,4 | 4,8 |

Table G.4.1-4 — PN 16

| PN | Group | Material-No. | max. allowable temperature TS °C |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |
|----|-------|--------------|----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|
|    |       |              | RT                               | 100  | 150  | 200  | 250  | 300  | 350  | 400  | 450  | 500  | 550  | 560  | 570  | 580  | 590 | 600 |
|    |       |              | max. allowable pressure PS bar   |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |
| 16 | 10E0  | 1.4307       | 16,0                             | 13,7 | 12,3 | 11,2 | 10,4 | 9,6  | 9,2  | 8,8  | 8,5  | 8,3  | 7,0  | 6,4  | 5,9  | 5,4  | 4,9 | 4,4 |
|    | 10E1  | 1.4311       | 16,0                             | 16   | 16   | 14,2 | 13,3 | 12,7 | 12,2 | 11,8 | 11,6 | 11,3 |      |      |      |      |     |     |
|    | 11E0  | 1.4301       | 16,0                             | 14,5 | 13,1 | 11,9 | 11   | 10,2 | 9,8  | 9,5  | 9,3  | 9,1  | 7,0  | 6,4  | 5,9  | 5,4  | 4,9 | 4,4 |
|    | 12E0  | 1.4541       | 16,0                             | 15,8 | 14,9 | 14,1 | 13,4 | 12,7 | 12,2 | 11,8 | 11,6 | 11,3 | 10,8 | 9,8  | 8,9  | 8,1  | 7,3 | 6,5 |
|    | 12E0  | 1.4550       | 16,0                             | 16,0 | 14,9 | 14,1 | 13,4 | 12,7 | 12,2 | 11,8 | 11,6 | 11,3 |      |      |      |      |     |     |
|    | 13E0  | 1.4404       | 16,0                             | 15,1 | 13,7 | 12,7 | 11,9 | 11   | 10,5 | 10,2 | 10   | 9,7  |      |      |      |      |     |     |
|    | 14E0  | 1.4401       | 16,0                             | 16,0 | 14,5 | 13,4 | 12,7 | 11,8 | 11,4 | 10,9 | 10,7 | 10,5 | 10,4 | 10,3 | 10,1 | 10,0 | 9,9 | 8,9 |
|    | 15E0  | 1.4571       | 16,0                             | 16,0 | 15,6 | 14,9 | 14,1 | 13,3 | 12,8 | 12,4 | 12,2 | 12   | 11,9 | 11,8 | 11,7 | 10,7 | 9,7 | 8,8 |
|    | 16E0  | 1.4462       | 16,0                             | 16,0 | 16,0 | 16,0 | 16,0 |      |      |      |      |      |      |      |      |      |     |     |
|    | 11E0  | 1.4948       | 16,0                             | 14,5 | 13,1 | 11,9 | 11,2 | 10,4 | 10,0 | 9,6  | 9,3  | 8,9  | 8,6  | 8,4  | 8,2  | 8,1  | 7,4 | 6,7 |
|    | 12E0  | 1.4941       | 16,0                             | 15,3 | 14,5 | 13,7 | 13,4 | 13,1 | 12,7 | 12,3 | 11,9 | 11,5 | 11,2 | 10,8 | 10,6 | 9,6  | 8,6 | 7,7 |

Table G.4.1-5 — PN 25

| PN | Group | Material-No. | max. allowable temperature TS °C |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----|-------|--------------|----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
|    |       |              | RT                               | 100  | 150  | 200  | 250  | 300  | 350  | 400  | 450  | 500  | 550  | 560  | 570  | 580  | 590  | 600  |
|    |       |              | max. allowable pressure PS bar   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 25 | 10E0  | 1.4307       | 25,0                             | 21,5 | 19,2 | 17,5 | 16,3 | 15,1 | 14,4 | 13,8 | 13,3 | 12,9 | 10,9 | 10,1 | 9,2  | 8,5  | 7,7  | 7,0  |
|    | 10E1  | 1.4311       | 25,0                             | 25,0 | 25,0 | 22,2 | 20,8 | 19,8 | 19,1 | 18,5 | 18,1 | 17,7 |      |      |      |      |      |      |
|    | 11E0  | 1.4301       | 25,0                             | 22,7 | 20,4 | 18,6 | 17,2 | 16,0 | 15,3 | 14,8 | 14,5 | 14,2 | 10,9 | 10,1 | 9,2  | 8,5  | 7,7  | 7,0  |
|    | 12E0  | 1.4541       | 25,0                             | 24,7 | 23,3 | 22,1 | 21,0 | 19,8 | 19,1 | 18,5 | 18,1 | 17,7 | 16,9 | 15,3 | 14,0 | 12,7 | 11,4 | 10,2 |
|    | 12E0  | 1.4550       | 25,0                             | 25,0 | 23,3 | 22,1 | 21,0 | 19,8 | 19,1 | 18,5 | 18,1 | 17,7 |      |      |      |      |      |      |
|    | 13E0  | 1.4404       | 25,0                             | 23,6 | 21,5 | 19,8 | 18,6 | 17,2 | 16,5 | 16,0 | 15,6 | 15,2 |      |      |      |      |      |      |
|    | 14E0  | 1.4401       | 25,0                             | 25,0 | 22,7 | 21,0 | 19,8 | 18,5 | 17,8 | 17,1 | 16,8 | 16,5 | 16,3 | 16,0 | 15,8 | 15,6 | 15,4 | 14,0 |
|    | 15E0  | 1.4571       | 25,0                             | 25,0 | 24,5 | 23,3 | 22,1 | 20,8 | 20,1 | 19,5 | 19,1 | 18,8 | 18,6 | 18,5 | 18,3 | 16,7 | 15,2 | 13,8 |
|    | 16E0  | 1.4462       | 25,0                             | 25,0 | 25,0 | 25,0 | 25,0 |      |      |      |      |      |      |      |      |      |      |      |
|    | 11E0  | 1.4948       | 25,0                             | 22,7 | 20,4 | 18,6 | 17,5 | 16,3 | 15,7 | 15,1 | 14,5 | 14,0 | 13,4 | 13,1 | 12,9 | 12,7 | 11,6 | 10,5 |
|    | 12E0  | 1.4941       | 25,0                             | 23,9 | 22,7 | 21,5 | 20,9 | 20,4 | 19,8 | 19,2 | 18,6 | 18,0 | 17,5 | 17,0 | 16,6 | 15,1 | 13,5 | 12,1 |

**EN 1092-1:2007 (E)****Table G.4.1-6 — PN 40**

| PN | Group | Material-No. | max. allowable temperature TS °C |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----|-------|--------------|----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
|    |       |              | RT                               | 100  | 150  | 200  | 250  | 300  | 350  | 400  | 450  | 500  | 550  | 560  | 570  | 580  | 590  | 600  |
|    |       |              | max. allowable pressure PS bar   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 40 | 10E0  | 1.4307       | 40,0                             | 34,4 | 30,8 | 28,0 | 26,0 | 24,1 | 23,0 | 22,0 | 21,4 | 20,7 | 17,5 | 16,1 | 14,8 | 13,7 | 12,3 | 11,2 |
|    | 10E1  | 1.4311       | 40,0                             | 40,0 | 40,0 | 35,6 | 33,3 | 31,8 | 30,6 | 29,7 | 29,0 | 28,3 |      |      |      |      |      |      |
|    | 11E0  | 1.4301       | 40,0                             | 36,3 | 32,7 | 29,9 | 27,6 | 25,7 | 24,5 | 23,8 | 23,3 | 22,8 | 17,5 | 16,1 | 14,8 | 13,7 | 12,3 | 11,2 |
|    | 12E0  | 1.4541       | 40,0                             | 39,6 | 37,3 | 35,4 | 33,7 | 31,8 | 30,6 | 29,7 | 29,0 | 28,3 | 27,0 | 24,5 | 22,4 | 20,3 | 18,2 | 16,3 |
|    | 12E0  | 1.4550       | 40,0                             | 40,0 | 37,3 | 35,4 | 33,7 | 31,8 | 30,6 | 29,7 | 29,0 | 28,3 |      |      |      |      |      |      |
|    | 13E0  | 1.4404       | 40,0                             | 37,9 | 34,4 | 31,8 | 29,9 | 27,6 | 26,4 | 25,7 | 25,0 | 24,3 |      |      |      |      |      |      |
|    | 14E0  | 1.4401       | 40,0                             | 40,0 | 36,3 | 33,7 | 31,8 | 29,7 | 28,5 | 27,4 | 26,9 | 26,4 | 26,0 | 25,7 | 25,4 | 25,0 | 24,7 | 22,4 |
|    | 15E0  | 1.4571       | 40,0                             | 40,0 | 39,2 | 37,3 | 35,4 | 33,3 | 32,1 | 31,2 | 30,6 | 30,0 | 29,9 | 29,6 | 29,3 | 26,8 | 24,3 | 22,0 |
|    | 16E0  | 1.4462       | 40,0                             | 40,0 | 40,0 | 40,0 | 40,0 |      |      |      |      |      |      |      |      |      |      |      |
|    | 11E0  | 1.4948       | 40,0                             | 36,3 | 32,7 | 29,9 | 28,0 | 26,0 | 25,1 | 24,1 | 23,3 | 22,4 | 21,5 | 21,0 | 20,7 | 20,3 | 18,6 | 16,9 |
|    | 12E0  | 1.4941       | 40,0                             | 38,2 | 36,3 | 34,4 | 33,5 | 32,7 | 31,8 | 30,8 | 29,9 | 28,9 | 28,0 | 27,2 | 26,6 | 24,1 | 21,7 | 19,4 |

**Table G.4.1-7 — PN 63**

| PN | Group | Material-No. | max. allowable temperature TS °C |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----|-------|--------------|----------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
|    |       |              | RT                               | 100  | 150  | 200  | 250  | 300  | 350  | 400  | 450  | 500  | 550  | 560  | 570  | 580  | 590  | 600  |
|    |       |              | max. allowable pressure PS bar   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 63 | 10E0  | 1.4307       | 63,0                             | 54,3 | 48,6 | 44,1 | 41,1 | 38,1 | 36,3 | 34,8 | 33,7 | 32,7 | 27,6 | 25,5 | 23,4 | 21,6 | 19,5 | 17,7 |
|    | 10E1  | 1.4311       | 63,0                             | 63,0 | 63,0 | 56,1 | 52,5 | 50,1 | 48,3 | 46,8 | 45,7 | 44,7 |      |      |      |      |      |      |
|    | 11E0  | 1.4301       | 63,0                             | 57,3 | 51,6 | 47,1 | 43,5 | 40,5 | 38,7 | 37,5 | 36,7 | 36,0 | 27,6 | 25,5 | 23,4 | 21,6 | 19,5 | 17,7 |
|    | 12E0  | 1.4541       | 63,0                             | 62,4 | 58,8 | 55,8 | 53,1 | 50,1 | 48,3 | 46,8 | 45,7 | 44,7 | 42,6 | 38,7 | 35,4 | 32,1 | 28,8 | 25,8 |
|    | 12E0  | 1.4550       | 63,0                             | 63,0 | 58,8 | 55,8 | 53,1 | 50,1 | 48,3 | 46,8 | 45,7 | 44,7 |      |      |      |      |      |      |
|    | 13E0  | 1.4404       | 63,0                             | 59,7 | 54,3 | 50,1 | 47,1 | 43,5 | 41,7 | 40,5 | 39,4 | 38,4 |      |      |      |      |      |      |
|    | 14E0  | 1.4401       | 63,0                             | 63,0 | 57,3 | 53,1 | 50,1 | 46,8 | 45,0 | 43,2 | 42,4 | 41,7 | 41,1 | 40,5 | 40,0 | 39,5 | 39,0 | 35,4 |
|    | 15E0  | 1.4571       | 63,0                             | 63,0 | 61,8 | 58,8 | 55,8 | 52,5 | 50,7 | 49,2 | 48,3 | 47,4 | 47,1 | 46,6 | 46,2 | 42,3 | 38,4 | 34,8 |
|    | 16E0  | 1.4462       | 63,0                             | 63,0 | 63,0 | 63,0 | 63,0 |      |      |      |      |      |      |      |      |      |      |      |
|    | 11E0  | 1.4948       | 63,0                             | 57,3 | 51,6 | 47,1 | 44,1 | 41,1 | 39,6 | 38,1 | 36,7 | 35,4 | 33,9 | 33,0 | 32,6 | 32,1 | 29,4 | 26,7 |
|    | 12E0  | 1.4941       | 63,0                             | 60,3 | 57,3 | 54,3 | 52,8 | 51,6 | 50,1 | 48,6 | 47,1 | 45,6 | 44,1 | 42,8 | 42,0 | 38,1 | 34,2 | 30,6 |

Table G.4.1-8 — PN 100

| PN  | Group | Material-No. | max. allowable temperature TS °C |       |       |       |       |      |      |      |      |      |      |      |      |      |      |      |
|-----|-------|--------------|----------------------------------|-------|-------|-------|-------|------|------|------|------|------|------|------|------|------|------|------|
|     |       |              | RT                               | 100   | 150   | 200   | 250   | 300  | 350  | 400  | 450  | 500  | 550  | 560  | 570  | 580  | 590  | 600  |
|     |       |              | max. allowable pressure PS bar   |       |       |       |       |      |      |      |      |      |      |      |      |      |      |      |
| 100 | 10E0  | 1.4307       | 100,0                            | 86,1  | 77,1  | 70,0  | 65,2  | 60,4 | 57,6 | 55,2 | 53,5 | 51,9 | 43,8 | 40,4 | 37,1 | 34,2 | 30,9 | 28,0 |
|     | 10E1  | 1.4311       | 100,0                            | 100,0 | 100,0 | 89,0  | 83,3  | 79,5 | 76,6 | 74,2 | 72,6 | 70,9 |      |      |      |      |      |      |
|     | 11E0  | 1.4301       | 100,0                            | 90,9  | 81,9  | 74,7  | 69,0  | 64,2 | 61,4 | 59,5 | 58,3 | 57,1 | 43,8 | 40,4 | 37,1 | 34,2 | 30,9 | 28,0 |
|     | 12E0  | 1.4541       | 100,0                            | 99,0  | 93,3  | 88,5  | 84,2  | 79,5 | 76,6 | 74,2 | 72,6 | 70,9 | 67,6 | 61,4 | 56,1 | 50,9 | 45,7 | 40,9 |
|     | 12E0  | 1.4550       | 100,0                            | 100,0 | 93,3  | 88,5  | 84,2  | 79,5 | 76,6 | 74,2 | 72,6 | 70,9 |      |      |      |      |      |      |
|     | 13E0  | 1.4404       | 100,0                            | 94,7  | 86,1  | 79,5  | 74,7  | 69,0 | 66,1 | 64,2 | 62,6 | 60,9 |      |      |      |      |      |      |
|     | 14E0  | 1.4401       | 100,0                            | 100,0 | 90,9  | 84,2  | 79,5  | 74,2 | 71,4 | 68,5 | 67,3 | 66,1 | 65,2 | 64,3 | 63,5 | 62,7 | 61,9 | 56,1 |
|     | 15E0  | 1.4571       | 100,0                            | 100,0 | 98,0  | 93,3  | 88,5  | 83,3 | 80,4 | 78,0 | 76,6 | 75,2 | 74,7 | 74,0 | 73,3 | 67,1 | 60,9 | 55,2 |
|     | 16E0  | 1.4462       | 100,0                            | 100,0 | 100,0 | 100,0 | 100,0 |      |      |      |      |      |      |      |      |      |      |      |
|     | 11E0  | 1.4948       | 100,0                            | 90,9  | 81,9  | 74,7  | 70,0  | 65,2 | 62,8 | 60,4 | 58,3 | 56,1 | 53,8 | 52,5 | 51,7 | 50,9 | 46,6 | 42,3 |
|     | 12E0  | 1.4941       | 100,0                            | 95,7  | 90,9  | 86,1  | 83,8  | 81,9 | 79,5 | 77,1 | 74,7 | 72,3 | 70,0 | 68,0 | 66,6 | 60,4 | 54,2 | 48,5 |

Table G.4.1-9 — PN 160

| PN  | Group | Material-No. | max. allowable temperature TS °C |       |       |       |       |       |       |       |       |       |       |       |       |       |      |      |
|-----|-------|--------------|----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|
|     |       |              | RT                               | 100   | 150   | 200   | 250   | 300   | 350   | 400   | 450   | 500   | 550   | 560   | 570   | 580   | 590  | 600  |
|     |       |              | max. allowable pressure PS bar   |       |       |       |       |       |       |       |       |       |       |       |       |       |      |      |
| 160 | 10E0  | 1.4307       | 160,0                            | 137,9 | 123,4 | 112,0 | 104,3 | 96,7  | 92,1  | 88,3  | 85,7  | 83,0  | 70,0  | 64,7  | 59,4  | 54,8  | 49,5 | 44,9 |
|     | 10E1  | 1.4311       | 160,0                            | 160,0 | 160,0 | 142,4 | 133,3 | 127,2 | 122,6 | 118,8 | 116,1 | 113,5 |       |       |       |       |      |      |
|     | 11E0  | 1.4301       | 160,0                            | 145,5 | 131,0 | 119,6 | 110,4 | 102,8 | 98,2  | 95,2  | 93,3  | 91,4  | 70,0  | 64,7  | 59,4  | 54,8  | 49,5 | 44,9 |
|     | 12E0  | 1.4541       | 160,0                            | 158,4 | 149,3 | 141,7 | 134,8 | 127,2 | 122,6 | 118,8 | 116,1 | 113,5 | 108,1 | 98,2  | 89,9  | 81,5  | 73,1 | 65,5 |
|     | 12E0  | 1.4550       | 160,0                            | 160,0 | 149,3 | 141,7 | 134,8 | 127,2 | 122,6 | 118,8 | 116,1 | 113,5 |       |       |       |       |      |      |
|     | 13E0  | 1.4404       | 160,0                            | 151,6 | 137,9 | 127,2 | 119,6 | 110,4 | 105,9 | 102,8 | 100,1 | 97,5  |       |       |       |       |      |      |
|     | 14E0  | 1.4401       | 160,0                            | 160,0 | 145,5 | 134,8 | 127,2 | 118,8 | 114,2 | 109,7 | 107,8 | 105,9 | 104,3 | 103,0 | 101,6 | 100,3 | 99,0 | 89,9 |
|     | 15E0  | 1.4571       | 160,0                            | 160,0 | 156,9 | 149,3 | 141,7 | 133,3 | 128,7 | 124,9 | 122,6 | 120,3 | 119,6 | 118,5 | 117,3 | 107,4 | 97,5 | 88,3 |
|     | 16E0  | 1.4462       | 160,0                            | 160,0 | 160,0 | 160,0 | 160,0 |       |       |       |       |       |       |       |       |       |      |      |
|     | 11E0  | 1.4948       | 160,0                            | 145,5 | 131,0 | 119,6 | 112,0 | 104,3 | 100,5 | 96,7  | 93,3  | 89,9  | 86,0  | 84,0  | 82,8  | 81,5  | 74,6 | 67,8 |
|     | 12E0  | 1.4941       | 160,0                            | 153,1 | 145,5 | 137,9 | 134,0 | 131,0 | 127,2 | 123,4 | 119,6 | 115,8 | 112,0 | 108,9 | 106,6 | 96,7  | 86,8 | 77,7 |

**EN 1092-1:2007 (E)****Table G.4.1-10 — PN 250**

| PN  | Group | Material-No. | max. allowable temperature TS °C |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|-----|-------|--------------|----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|     |       |              | RT                               | 100   | 150   | 200   | 250   | 300   | 350   | 400   | 450   | 500   | 550   | 560   | 570   | 580   | 590   | 600   |
|     |       |              | max. allowable pressure PS bar   |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 250 | 10E0  | 1.4307       | 250,0                            | 215,4 | 192,8 | 175,0 | 163,0 | 151,1 | 144,0 | 138,0 | 133,9 | 129,7 | 109,5 | 101,1 | 92,8  | 85,7  | 77,3  | 70,2  |
|     | 10E1  | 1.4311       | 250,0                            | 250,0 | 250,0 | 222,6 | 208,3 | 198,8 | 191,6 | 185,7 | 181,5 | 177,3 |       |       |       |       |       |       |
|     | 11E0  | 1.4301       | 250,0                            | 227,3 | 204,7 | 186,9 | 172,6 | 160,7 | 153,5 | 148,8 | 145,8 | 142,8 | 109,5 | 101,1 | 92,8  | 85,7  | 77,3  | 70,2  |
|     | 12E0  | 1.4541       | 250,0                            | 247,6 | 233,3 | 221,4 | 210,7 | 198,8 | 191,6 | 185,7 | 181,5 | 177,3 | 169,0 | 153,5 | 140,4 | 127,3 | 114,2 | 102,3 |
|     | 12E0  | 1.4550       | 250,0                            | 250,0 | 233,3 | 221,4 | 210,7 | 198,8 | 191,6 | 185,7 | 181,5 | 177,3 |       |       |       |       |       |       |
|     | 13E0  | 1.4404       | 250,0                            | 236,9 | 215,4 | 198,8 | 186,9 | 172,6 | 165,4 | 160,7 | 156,5 | 152,3 |       |       |       |       |       |       |
|     | 14E0  | 1.4401       | 250,0                            | 250,0 | 227,3 | 210,7 | 198,8 | 185,7 | 178,5 | 171,4 | 168,4 | 165,4 | 163,0 | 160,9 | 158,8 | 156,7 | 154,7 | 140,4 |
|     | 15E0  | 1.4571       | 250,0                            | 250,0 | 245,2 | 233,3 | 221,4 | 208,3 | 201,1 | 195,2 | 191,6 | 188,0 | 186,9 | 185,1 | 183,3 | 167,8 | 152,3 | 138,0 |
|     | 16E0  | 1.4462       | 250,0                            | 250,0 | 250,0 | 250,0 | 250,0 |       |       |       |       |       |       |       |       |       |       |       |
|     | 11E0  | 1.4948       | 250,0                            | 227,3 | 204,7 | 186,9 | 175,0 | 163,0 | 157,1 | 151,1 | 145,8 | 140,4 | 134,5 | 131,2 | 129,4 | 127,3 | 116,6 | 105,9 |
|     | 12E0  | 1.4941       | 250,0                            | 239,2 | 227,3 | 215,4 | 209,5 | 204,7 | 198,8 | 192,8 | 186,9 | 180,9 | 175,0 | 170,1 | 166,6 | 151,1 | 135,7 | 121,4 |

**Table G.4.1-11 — PN 320**

| PN  | Group | Material-No. | max. allowable temperature TS °C |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|-----|-------|--------------|----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|     |       |              | RT                               | 100   | 150   | 200   | 250   | 300   | 350   | 400   | 450   | 500   | 550   | 560   | 570   | 580   | 590   | 600   |
|     |       |              | max. allowable pressure PS bar   |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 320 | 10E0  | 1.4307       | 320,0                            | 275,8 | 246,8 | 224,0 | 208,7 | 193,5 | 184,3 | 176,7 | 171,4 | 166,0 | 140,1 | 129,5 | 118,8 | 109,7 | 99,0  | 89,9  |
|     | 10E1  | 1.4311       | 320,0                            | 320,0 | 320,0 | 284,9 | 266,6 | 254,4 | 245,3 | 237,7 | 232,3 | 227,0 |       |       |       |       |       |       |
|     | 11E0  | 1.4301       | 320,0                            | 291,0 | 262,0 | 239,2 | 220,9 | 205,7 | 196,5 | 190,4 | 186,6 | 182,8 | 140,1 | 129,5 | 118,8 | 109,7 | 99,0  | 89,9  |
|     | 12E0  | 1.4541       | 320,0                            | 316,9 | 298,6 | 283,4 | 269,7 | 254,4 | 245,3 | 237,7 | 232,3 | 227,0 | 216,3 | 196,5 | 179,8 | 163,0 | 146,2 | 131,0 |
|     | 12E0  | 1.4550       | 320,0                            | 320,0 | 298,6 | 283,4 | 269,7 | 254,4 | 245,3 | 237,7 | 232,3 | 227,0 |       |       |       |       |       |       |
|     | 13E0  | 1.4404       | 320,0                            | 303,2 | 275,8 | 254,4 | 239,2 | 220,9 | 211,8 | 205,7 | 200,3 | 195,0 |       |       |       |       |       |       |
|     | 14E0  | 1.4401       | 320,0                            | 320,0 | 291,0 | 269,7 | 254,4 | 237,7 | 228,5 | 219,4 | 215,6 | 211,8 | 208,7 | 206,0 | 203,3 | 200,6 | 198,0 | 179,8 |
|     | 15E0  | 1.4571       | 320,0                            | 320,0 | 313,9 | 298,6 | 283,4 | 266,6 | 257,5 | 249,9 | 245,3 | 240,7 | 239,2 | 237,0 | 234,6 | 214,8 | 195,0 | 176,7 |
|     | 16E0  | 1.4462       | 320,0                            | 320,0 | 320,0 | 320,0 | 320,0 |       |       |       |       |       |       |       |       |       |       |       |
|     | 11E0  | 1.4948       | 320,0                            | 291,0 | 262,0 | 239,2 | 224,0 | 208,7 | 201,1 | 193,5 | 186,6 | 179,8 | 172,1 | 168,0 | 165,7 | 163,0 | 149,3 | 135,6 |
|     | 12E0  | 1.4941       | 320,0                            | 306,2 | 291,0 | 275,8 | 268,1 | 262,0 | 254,4 | 246,8 | 239,2 | 231,6 | 224,0 | 217,8 | 213,3 | 193,5 | 173,7 | 155,4 |

Table G.4.1-12 — PN 400

| PN  | Group | Material-No. | max. allowable temperature TS °C |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|-----|-------|--------------|----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|     |       |              | RT                               | 100   | 150   | 200   | 250   | 300   | 350   | 400   | 450   | 500   | 550   | 560   | 570   | 580   | 590   | 600   |
|     |       |              | max. allowable pressure PS bar   |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
| 400 | 10E0  | 1.4307       | 400,0                            | 344,7 | 308,5 | 280,0 | 260,9 | 241,9 | 230,4 | 220,9 | 214,2 | 207,6 | 175,2 | 161,9 | 148,5 | 137,1 | 123,8 | 112,3 |
|     | 10E1  | 1.4311       | 400,0                            | 400,0 | 400,0 | 356,1 | 333,3 | 318,0 | 306,6 | 297,1 | 290,4 | 283,8 |       |       |       |       |       |       |
|     | 11E0  | 1.4301       | 400,0                            | 363,8 | 327,6 | 299,0 | 276,1 | 257,1 | 245,7 | 238,0 | 233,3 | 228,5 | 175,2 | 161,9 | 148,5 | 137,1 | 123,8 | 112,3 |
|     | 12E0  | 1.4541       | 400,0                            | 396,1 | 373,3 | 354,2 | 337,1 | 318,0 | 306,6 | 297,1 | 290,4 | 283,8 | 270,4 | 245,7 | 224,7 | 203,8 | 182,8 | 163,8 |
|     | 12E0  | 1.4550       | 400,0                            | 400,0 | 373,3 | 354,2 | 337,1 | 318,0 | 306,6 | 297,1 | 290,4 | 283,8 |       |       |       |       |       |       |
|     | 13E0  | 1.4404       | 400,0                            | 379,0 | 344,7 | 318,0 | 299,0 | 276,1 | 264,7 | 257,1 | 250,4 | 243,8 |       |       |       |       |       |       |
|     | 14E0  | 1.4401       | 400,0                            | 400,0 | 363,8 | 337,1 | 318,0 | 297,1 | 285,7 | 274,2 | 269,5 | 264,7 | 260,9 | 257,5 | 254,1 | 250,8 | 247,6 | 224,7 |
|     | 15E0  | 1.4571       | 400,0                            | 400,0 | 392,3 | 373,3 | 354,2 | 333,3 | 321,9 | 312,3 | 306,6 | 300,9 | 299,0 | 296,2 | 293,3 | 268,5 | 243,8 | 220,9 |
|     | 16E0  | 1.4462       | 400,0                            | 400,0 | 400,0 | 400,0 | 400,0 |       |       |       |       |       |       |       |       |       |       |       |
|     | 11E0  | 1.4948       | 400,0                            | 363,8 | 327,6 | 299,0 | 280,0 | 260,9 | 251,4 | 241,9 | 233,3 | 224,7 | 215,2 | 210,0 | 207,1 | 203,8 | 186,6 | 169,5 |
|     | 12E0  | 1.4941       | 400,0                            | 382,8 | 363,8 | 344,7 | 335,2 | 327,6 | 318,0 | 308,5 | 299,0 | 289,5 | 280,0 | 272,2 | 266,6 | 241,9 | 217,1 | 194,2 |

## Annex H (informative)

### Rings for tongue and groove flanges

The rings should be manufactured from the same material as the flanges they are used with unless otherwise agreed between flange manufacturer and pressure equipment manufacturer.

$R_z = 160 \mu\text{m}$

$R_a = 40 \mu\text{m}$  turned

**Table H.1 — Rings for PN 10 to PN 100**

Dimensions in millimetres

| DN           | Inner diameter<br>+ 0,5<br>0 | Outer diameter<br>0<br>- 0,5 | Thickness<br>+ 1<br>0 |
|--------------|------------------------------|------------------------------|-----------------------|
| <b>10</b>    | 24                           | 34                           | 10                    |
| <b>15</b>    | 29                           | 39                           |                       |
| <b>20</b>    | 36                           | 50                           |                       |
| <b>25</b>    | 43                           | 57                           |                       |
| <b>32</b>    | 51                           | 65                           |                       |
| <b>40</b>    | 61                           | 75                           |                       |
| <b>50</b>    | 73                           | 87                           |                       |
| <b>65</b>    | 95                           | 109                          |                       |
| <b>80</b>    | 106                          | 120                          |                       |
| <b>100</b>   | 129                          | 149                          | 12                    |
| <b>125</b>   | 155                          | 175                          |                       |
| <b>150</b>   | 183                          | 203                          |                       |
| <b>200</b>   | 239                          | 259                          |                       |
| <b>250</b>   | 292                          | 312                          |                       |
| <b>300</b>   | 343                          | 363                          |                       |
| <b>350</b>   | 395                          | 421                          | 14                    |
| <b>400</b>   | 447                          | 473                          |                       |
| <b>500</b>   | 549                          | 575                          |                       |
| <b>600</b>   | 649                          | 675                          |                       |
| <b>700</b>   | 751                          | 777                          |                       |
| <b>800</b>   | 856                          | 882                          |                       |
| <b>900</b>   | 961                          | 987                          |                       |
| <b>1 000</b> | 1 062                        | 1 092                        | 16                    |

## Annex I (informative)

### Flanges with fixed inner diameter

#### I.1 General

The Metric pipe standard has a fixed inside diameter (ID), which differs from the EN, DIN and ISO pipe standard that has a fixed outside diameter (OD). Mating dimensions of flanges and collars of the Metric system comply with the other mating dimensions of this standard.

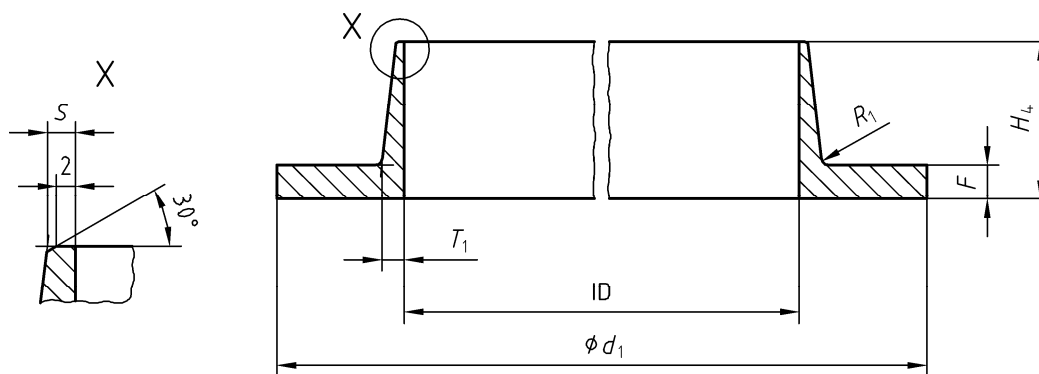
#### I.2 Scope

Annex I describes flanges and collars which are commonly used in the metric system and Tables I.1 and I.2 specify dimensions which differ from, or are missing, in Tables 12 to 15.

**Table I.1 — Dimensions for types 01M, 02M, 11M**

Dimensions in millimetres

| Nominal | Flange type |       |       |       |       |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
|---------|-------------|-------|-------|-------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----|--|
|         | 01M         | 02M   |       |       |       |                                                                                                                                                                                                                                                                                                                                                                       |  | 11M |  |
| ID      | Q           | PN 10 | PN 16 | PN 25 | PN 40 |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
|         |             | B2    | B2    | B2    | B2    |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 10      | 0,8         | 16    | 16    | 16    | 16    | All dimensions are corresponding to the Tables in this standard, except A, which is determined of the ID and the OD of the pipe. This information shall be specified by the pressure equipment manufacturer. If no A-measure is specified it is determined by the nominal ID + S x 2. Allowable external pipe force is 70% of the force in Annex E for Type 11 flange |  |     |  |
| 15      | 0,7         | 22    | 22    | 22    | 22    |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 20      | 0,6         | 30    | 30    | 30    | 30    |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 25      | 0,8         | 36    | 36    | 36    | 36    |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 32      | 1,1         | 46    | 46    | 46    | 46    |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 40      | 1,2         | 52    | 52    | 52    | 52    |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 50      | 1,2         | 64    | 64    | 64    | 64    |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 65      | 1,4         | 81    | 81    | 81    | 81    |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 80      | 1,6         | 94    | 94    | 94    | 94    |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 100     | 1,7         | 113   | 113   | 118   | 118   |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 125     | 1,8         | 140   | 140   | 140   | 140   |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 150     | 2,2         | 165   | 165   | 168   | 168   |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 200     | 2,4         | 219   | 219   | 222   | 225   |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 250     | 3,5         | 273   | 273   | 279   | 279   |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 300     | 3,6         | 324   | 324   | 329   | 336   |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 350     | 3,9         | 374   | 376   | 380   | 386   |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 400     | 4,6         | 426   | 428   | 432   | 445   |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 450     | 5,0         | 475   | 480   | 485   | 496   |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 500     | 5,5         | 525   | 530   | 540   | 546   |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 600     | 6,5         | 628   | 634   | 645   | 650   |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 700     | -           | 732   | 736   | 745   | -     |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 800     | -           | 834   | 840   | 852   | -     |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 900     | -           | 938   | 946   | 958   | -     |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 1000    | -           | 1046  | 1046  | -     | -     |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |
| 1200    | -           | 1246  | 1254  | -     | -     |                                                                                                                                                                                                                                                                                                                                                                       |  |     |  |



R1 to be decided by the flange manufacturer

Designation: Type 35M

Figure I.1 — Type 35M (weld on collar with conical hub)

Table I.2 — Dimensions for type 35M (weld on collar with conical hub)

| ID    | PN 10 |       |     |      |       | PN 16 |       |     |      |       | PN 25 |       |      |      |       | PN 40 |       |     |      |       |
|-------|-------|-------|-----|------|-------|-------|-------|-----|------|-------|-------|-------|------|------|-------|-------|-------|-----|------|-------|
|       | $d_1$ | $H_4$ | $F$ | $S$  | $T_1$ | $d_1$ | $H_4$ | $F$ | $S$  | $T_1$ | $d_1$ | $H_4$ | $F$  | $S$  | $T_1$ | $d_1$ | $H_4$ | $F$ | $S$  | $T_1$ |
| 10    | —     | —     | —   | —    | —     | —     | —     | —   | —    | —     | —     | —     | —    | —    | —     | —     | —     | —   | —    | —     |
| 20    | —     | —     | —   | —    | —     | 58    | 40    | 6   | 2,0  | 2,0   | —     | —     | —    | —    | —     | 58    | 40    | 6   | 2,5  | 3,0   |
| 25    | —     | —     | —   | —    | —     | 68    | 40    | 6   | 2,0  | 2,0   | —     | —     | —    | —    | —     | 68    | 40    | 6   | 2,5  | 3,0   |
| 32    | —     | —     | —   | —    | —     | 78    | 40    | 6   | 2,0  | 2,0   | —     | —     | —    | —    | —     | 78    | 40    | 6   | 2,5  | 3,5   |
| 40    | —     | —     | —   | —    | —     | 88    | 45    | 6   | 2,0  | 2,0   | —     | —     | —    | —    | —     | 88    | 45    | 8   | 2,5  | 3,5   |
| 50    | —     | —     | —   | —    | —     | 102   | 45    | 8   | 2,0  | 2,0   | —     | —     | —    | —    | —     | 102   | 45    | 8   | 2,5  | 4,0   |
| 65    | —     | —     | —   | —    | —     | 122   | 45    | 8   | 2,5  | 2,5   | —     | —     | —    | —    | —     | 122   | 45    | 10  | 2,5  | 4,5   |
| 80    | —     | —     | —   | —    | —     | 138   | 50    | 10  | 3,0  | 3,0   | —     | —     | —    | —    | —     | 138   | 55    | 10  | 2,5  | 4,5   |
| 100   | —     | —     | —   | —    | —     | 158   | 50    | 10  | 3,0  | 4,0   | —     | —     | —    | —    | —     | 162   | 55    | 10  | 3,0  | 5,0   |
| 125   | —     | —     | —   | —    | —     | 188   | 50    | 10  | 3,0  | 5,0   | —     | —     | —    | —    | —     | 188   | 55    | 12  | 3,5  | 6,0   |
| 150   | —     | —     | —   | —    | —     | 212   | 50    | 10  | 3,0  | 5,0   | —     | —     | —    | —    | —     | 218   | 65    | 12  | 4,0  | 7,0   |
| 200   | —     | —     | —   | —    | —     | 268   | 65    | 10  | 3,0  | 7,0   | 278   | 65    | 12,0 | 5,0  | 9,0   | 285   | 85    | 20  | 6,0  | 10,0  |
| 250   | —     | —     | —   | —    | —     | 320   | 70    | 12  | 3,5  | 10,0  | 335   | 75    | 15,0 | 6,5  | 10,0  | 345   | 100   | 22  | 8,0  | 12,0  |
| 300   | 370   | 60    | 12  | 3,0  | 8,0   | 370   | 70    | 12  | 4,0  | 10,0  | 390   | 80    | 16,0 | 7,5  | 11,5  | 410   | 110   | 24  | 9,0  | 15,0  |
| 350   | 430   | 60    | 12  | 3,5  | 8,0   | 430   | 70    | 15  | 4,5  | 10,0  | 450   | 85    | 18,0 | 5,0  | 12,0  | 465   | 120   | 30  | 10,0 | 15,0  |
| 400   | 482   | 65    | 12  | 3,5  | 8,0   | 482   | 80    | 15  | 5,0  | 12,0  | 505   | 95    | 18,0 | 6,0  | 13,5  | 535   | 130   | 30  | 12,0 | 20,0  |
| 450   | 532   | 70    | 15  | 3,5  | 8,0   | 532   | 85    | 15  | 5,0  | 12,0  | 555   | 105   | 20,0 | 8,0  | 15,0  | 560   | 135   | 30  | 12,0 | 20,0  |
| 500   | 585   | 75    | 15  | 4,0  | 9,0   | 585   | 95    | 18  | 5,0  | 12,0  | 615   | 115   | 22,0 | 8,0  | 15,0  | 615   | 140   | 35  | 15,0 | 20,0  |
| 600   | 685   | 80    | 15  | 4,0  | 10,0  | 685   | 100   | 18  | 6,0  | 14,0  | 720   | 115   | 24,0 | 12,0 | 18,0  | 735   | 150   | 40  | 15,0 | 24,0  |
| 700   | 800   | 90    | 15  | 4,5  | 12,0  | 795   | 110   | 20  | 10,0 | 14,0  | 820   | 115   | 30,0 | 15,0 | 20,0  | —     | —     | —   | —    | —     |
| 800   | 905   | 100   | 15  | 5,0  | 13,0  | 900   | 110   | 22  | 12,0 | 16,0  | 930   | 115   | 34,0 | 15,0 | 22,0  | —     | —     | —   | —    | —     |
| 900   | 1 005 | 110   | 18  | 6,0  | 15,0  | 1000  | 115   | 24  | 12,0 | 18,0  | 1 030 | 130   | 40,0 | 18,0 | 24,0  | —     | —     | —   | —    | —     |
| 1 000 | 1 110 | 120   | 18  | 8,0  | 18,0  | 1115  | 130   | 32  | 15,0 | 18,0  | —     | —     | —    | —    | —     | —     | —     | —   | —    | —     |
| 1 200 | 1 330 | 130   | 22  | 10,0 | 18,0  | 1330  | 130   | 32  | 15,0 | 22,0  | —     | —     | —    | —    | —     | —     | —     | —   | —    | —     |

Table I.3 — Dimensions for types 36M and 37M

| DN                                                                                                                               | PN 10    |      |      |                |          |      |      |                | PN 16    |      |      |                |          |      |      |                | Chamfer        |
|----------------------------------------------------------------------------------------------------------------------------------|----------|------|------|----------------|----------|------|------|----------------|----------|------|------|----------------|----------|------|------|----------------|----------------|
|                                                                                                                                  | Type 36M |      |      |                | Type 37M |      |      |                | Type 36M |      |      |                | Type 37M |      |      |                |                |
|                                                                                                                                  | Sp       | S    | F    | H <sub>4</sub> | Sp       | S    | F    | H <sub>5</sub> | Sp       | S    | F    | H <sub>4</sub> | Sp       | S    | F    | H <sub>5</sub> |                |
| 10                                                                                                                               | 2,00     | 2,00 | 2,00 | 35,00          | 2,00     | 2,00 | 2,00 | 8              | 2,00     | 2,00 | 2,00 | 35,00          | 2,00     | 2,00 | 2,50 | 8              | A <sup>a</sup> |
| 15                                                                                                                               | 2,00     | 2,00 | 2,00 | 38,00          | 2,00     | 2,00 | 2,00 | 9              | 2,00     | 2,00 | 2,00 | 38,00          | 2,00     | 2,00 | 2,50 | 9              |                |
| 20                                                                                                                               | 2,60     | 2,60 | 2,50 | 40,00          | 2,00     | 2,00 | 2,00 | 10             | 2,60     | 2,60 | 2,50 | 40,00          | 2,00     | 2,00 | 3,00 | 10             |                |
| 25                                                                                                                               | 2,60     | 2,60 | 2,50 | 40,00          | 2,00     | 2,00 | 2,00 | 12             | 2,60     | 2,60 | 2,50 | 40,00          | 2,00     | 2,00 | 3,00 | 12             |                |
| 32                                                                                                                               | 3,20     | 3,20 | 3,00 | 42,00          | 2,00     | 2,00 | 2,00 | 14             | 3,20     | 3,20 | 3,00 | 42,00          | 2,00     | 2,00 | 3,00 | 14             |                |
| 40                                                                                                                               | 3,20     | 3,20 | 3,00 | 45,00          | 2,00     | 2,00 | 2,00 | 17             | 3,20     | 3,20 | 3,00 | 45,00          | 2,00     | 2,00 | 3,00 | 17             |                |
| 50                                                                                                                               | 3,20     | 3,20 | 3,00 | 45,00          | 2,00     | 2,00 | 2,00 | 18             | 3,20     | 3,20 | 3,00 | 45,00          | 2,00     | 2,00 | 4,00 | 18             |                |
| 65                                                                                                                               | 3,20     | 3,20 | 3,00 | 45,00          | 2,00     | 2,00 | 3,00 | 20             | 3,20     | 3,20 | 3,00 | 45,00          | 2,00     | 2,00 | 4,00 | 20             |                |
| 80                                                                                                                               | 3,20     | 3,20 | 3,00 | 50,00          | 2,00     | 2,00 | 3,00 | 24             | 3,20     | 3,20 | 3,00 | 50,00          | 3,20     | 3,20 | 4,00 | 24             |                |
| 100                                                                                                                              | 3,20     | 3,20 | 4,00 | 52,00          | 3,20     | 3,20 | 4,00 | 27             |          |      |      |                |          |      |      |                | B <sup>a</sup> |
| 125                                                                                                                              | 3,20     | 4,00 | 4,00 | 55,00          | 3,20     | 4,00 | 5,00 | 27             |          |      |      |                |          |      |      |                |                |
| 150                                                                                                                              | 3,20     | 5,00 | 5,00 | 55,00          | 3,20     | 4,50 | 5,00 | 27             |          |      |      |                |          |      |      |                |                |
| 200                                                                                                                              | 3,20     | 6,00 | 6,00 | 62,00          | 3,20     | 5,00 | 6,00 | 26             |          |      |      |                |          |      |      |                |                |
| 250                                                                                                                              | 3,20     | 8,00 | 8,00 | 68,00          |          |      |      |                |          |      |      |                |          |      |      |                |                |
| 300                                                                                                                              | 3,20     | 8,00 | 8,00 | 68,00          |          |      |      |                |          |      |      |                |          |      |      |                |                |
| 350                                                                                                                              | 3,20     | 8,00 | 8,00 | 68,00          |          |      |      |                |          |      |      |                |          |      |      |                |                |
| 400                                                                                                                              | 3,20     | 8,00 | 8,00 | 72,00          |          |      |      |                |          |      |      |                |          |      |      |                |                |
|                                                                                                                                  |          |      |      |                |          |      |      |                |          |      |      |                |          |      |      |                |                |
| NOTE      Metric types, inside diameter same as DN, missing dimensions as for ISO Types 36 and 37. Loose flanges from Table I.1. |          |      |      |                |          |      |      |                |          |      |      |                |          |      |      |                |                |
| a   Chamfer A and B as for Types 36 and 37, bevel outside of collar neck.                                                        |          |      |      |                |          |      |      |                |          |      |      |                |          |      |      |                |                |

## Annex J (informative)

### Mating dimensions for flanges with higher DN

**Table J-1 — Dimensions of PN 25 flanges,  
symbols see Figure 9**

Dimensions in millimetres

| DN                                                                                                                | Mating dimensions <sup>a</sup>   |                                         |                                       |         |      | Outside diameter of neck<br><br><i>A</i> |
|-------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------------|---------------------------------------|---------|------|------------------------------------------|
|                                                                                                                   | Outside diameter<br><br><i>D</i> | Diameter of bolt circle<br><br><i>K</i> | Diameter of bolt hole<br><br><i>L</i> | Bolting |      |                                          |
|                                                                                                                   |                                  |                                         |                                       | Number  | Size |                                          |
|                                                                                                                   | Flange type                      |                                         |                                       |         |      |                                          |
|                                                                                                                   | 01, 02, 04, 05, 11, 12, 13, 21   |                                         |                                       |         |      | 11<br>21 <sup>b</sup><br>35 - 37         |
| 1 200                                                                                                             | 1 530                            | 1 420                                   | 56                                    | 32      | M52  | 1 219,0                                  |
| 1 400                                                                                                             | 1 755                            | 1 640                                   | 62                                    | 36      | M56  | 1 422,0                                  |
| 1 600                                                                                                             | 1 975                            | 1 860                                   | 62                                    | 40      | M56  | 1 626,0                                  |
| 1 800                                                                                                             | 2 195                            | 2 070                                   | 70                                    | 44      | M64  | 1 829,0                                  |
| 2 000                                                                                                             | 2 425                            | 2 300                                   | 70                                    | 48      | M64  | 2 032,0                                  |
| <sup>a</sup> Further dimensions to be specified by the purchaser.                                                 |                                  |                                         |                                       |         |      |                                          |
| <sup>b</sup> For flanges type 21 the outside hub diameter approximately corresponds to the outside pipe diameter. |                                  |                                         |                                       |         |      |                                          |

**Table J-2 — Dimensions of PN 40 flanges,  
symbols see Figure 10**

Dimensions in millimetres

| DN                                                                | Mating dimensions <sup>a</sup>      |                                               |                                             |         |      |
|-------------------------------------------------------------------|-------------------------------------|-----------------------------------------------|---------------------------------------------|---------|------|
|                                                                   | Outside<br>diameter<br><br><i>D</i> | Diameter<br>of bolt<br>circle<br><br><i>K</i> | Diameter<br>of bolt<br>hole<br><br><i>L</i> | Bolting |      |
|                                                                   |                                     |                                               |                                             | Number  | Size |
|                                                                   | Flange type                         |                                               |                                             |         |      |
|                                                                   | 01, 02, 04, 05, 11, 12, 13, 21      |                                               |                                             |         |      |
| 700                                                               | 995                                 | 900                                           | 48                                          | 24      | M45  |
| 800                                                               | 1 140                               | 1 030                                         | 56                                          | 24      | M52  |
| 900                                                               | 1 250                               | 1 140                                         | 56                                          | 28      | M52  |
| 1 000                                                             | 1 360                               | 1 250                                         | 56                                          | 28      | M52  |
| 1 200                                                             | 1 575                               | 1 460                                         | 62                                          | 32      | M56  |
| 1 400                                                             | 1 795                               | 1 680                                         | 62                                          | 36      | M56  |
| 1 600                                                             | 2 025                               | 1 900                                         | 70                                          | 40      | M64  |
| <sup>a</sup> Further dimensions to be specified by the purchaser. |                                     |                                               |                                             |         |      |

**Table J-3 — Dimensions of PN 63 flanges,  
symbols see Figure 11**

Dimensions in millimetres

| DN                                                                | Mating dimensions <sup>a</sup> |                         |                       |         |       |
|-------------------------------------------------------------------|--------------------------------|-------------------------|-----------------------|---------|-------|
|                                                                   | Outside diameter               | Diameter of bolt circle | Diameter of bolt hole | Bolting |       |
|                                                                   | <i>D</i>                       | <i>K</i>                | <i>L</i>              | Number  | Size  |
|                                                                   | Flange type                    |                         |                       |         |       |
|                                                                   | 01, 05, 11, 12, 13, 21         |                         |                       |         |       |
| 500                                                               | 800                            | 705                     | 48                    | 20      | M45   |
| 600                                                               | 930                            | 820                     | 56                    | 20      | M52   |
| 700                                                               | 1 045                          | 935                     | 56                    | 24      | M52   |
| 800                                                               | 1 165                          | 1 050                   | 62                    | 24      | M56   |
| 900                                                               | 1 285                          | 1 170                   | 62                    | 28      | M56   |
| 1 000                                                             | 1 415                          | 1 290                   | 70                    | 28      | M64   |
| 1 200                                                             | 1 665                          | 1 530                   | 78                    | 32      | M72x6 |
| <sup>a</sup> Further dimensions to be specified by the purchaser. |                                |                         |                       |         |       |

**Table J-4 — Dimensions of PN 100 flanges,  
symbols see Figure 12**

Dimensions in millimetres

| DN                                                                                                                | Mating dimensions <sup>a</sup> |                                     |                                   |         |      | Outside diameter of neck | Bore diameter         |                       |
|-------------------------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------------|-----------------------------------|---------|------|--------------------------|-----------------------|-----------------------|
|                                                                                                                   | Outside diameter<br><i>D</i>   | Diameter of bolt circle<br><i>K</i> | Diameter of bolt hole<br><i>L</i> | Bolting |      |                          |                       |                       |
|                                                                                                                   |                                |                                     |                                   | Number  | Size |                          |                       |                       |
|                                                                                                                   | Flange type                    |                                     |                                   |         |      |                          | <i>A</i>              | <i>B</i> <sub>1</sub> |
|                                                                                                                   | 01, 05, 11, 12, 13, 21         |                                     |                                   |         |      |                          | 11<br>21 <sup>b</sup> | 01<br>12              |
| 400                                                                                                               | 715                            | 620                                 | 48                                | 16      | M45  | 406,4                    | 411,0                 |                       |
| 500                                                                                                               | 870                            | 760                                 | 56                                | 20      | M52  | 508,0                    | 513,5                 |                       |
| <sup>a</sup> Further dimensions to be specified by the purchaser.                                                 |                                |                                     |                                   |         |      |                          |                       |                       |
| <sup>b</sup> For flanges type 21 the outside hub diameter approximately corresponds to the outside pipe diameter. |                                |                                     |                                   |         |      |                          |                       |                       |

## Annex ZA (normative)

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

This European Standard has been prepared under a mandate given to CEN by the European Commission to provide a means of conforming to Essential Requirements of the New Approach Directive 97/23/EC.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

**Table ZA.1 — Correspondence between this European Standard and Directive 97/23/EC**

| Clause(s)/<br>subclause(s)<br>of this<br>EN | Essential Requirements (ER's) of Directive 97/23/EC |                                                                                                                                                                                                                                                                                                                   | Qualifying<br>remarks/<br>notes |
|---------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 5.1.1<br>and<br>F.1.1                       |                                                     |                                                                                                                                                                                                                                                                                                                   | —                               |
|                                             | Annex 1,<br>Clause 4.1a)                            | Materials for pressurized parts to have appropriate properties for all operating and test conditions:<br>— to be sufficiently ductile and tough;<br>— characteristics of material to comply with ESR's at 7.5<br>— to be selected in order to prevent brittle-type fracture, or appropriate measures to be taken. | —                               |
| Annex E                                     |                                                     |                                                                                                                                                                                                                                                                                                                   | —                               |
|                                             | Annex 1,<br>Clause 2.1                              | To be designed to ensure safety throughout intended life<br>— to incorporate appropriate safety coefficients.                                                                                                                                                                                                     | —                               |
|                                             | Annex 1,<br>Clause 2.2                              | To be designed for adequate strength.                                                                                                                                                                                                                                                                             | —                               |
|                                             | Annex 1,<br>Clause 2.2.1                            | To be designed for loadings appropriate to its intended use.                                                                                                                                                                                                                                                      |                                 |
|                                             | Annex 1,<br>Clause 2.2.2                            | To be designed for appropriate strength based on a calculation method.                                                                                                                                                                                                                                            | —                               |
|                                             | Annex 1,<br>Clause 2.2.3(a)                         | Requirements to be met by applying one of the following methods<br>— design by formula.                                                                                                                                                                                                                           | —                               |
|                                             | Annex 1,<br>Clause 2.2.3(b)                         | Design calculations to establish the resistance of equipment, in particular<br>— account to be taken of combinations of temperature & pressure;<br>— maximum stresses & peak stresses to be within safe limits.                                                                                                   | —                               |

Table ZA (continued)

| Clause(s)/<br>subclause(s)<br>of this<br>EN | Essential Requirements (ER's) of Directive 97/23/EC |                                                                                                                                                                                                                          | Qualifying<br>remarks/<br>notes |
|---------------------------------------------|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| Annex E<br>and<br>Annex F,<br>Table F.2.5-1 |                                                     |                                                                                                                                                                                                                          | —                               |
|                                             | Annex 1,<br>Clause 7.1.2                            | Permissible general membrane stresses for internal pressure, for predominantly static loads and for temperatures outside the creep range not exceed the smaller of the following values, according to the material used; | —                               |
| 5.13                                        | Annex 1,<br>Clause 3.1.5                            | Traceability<br><br>Materials making up component parts to be identified by suitable means from receipt, through production, up to final test.                                                                           | —                               |

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

## Bibliography

- [1] EN 1514-1, *Flanges and their joints — Dimensions of gaskets for PN-designated flanges — Part 1: Non metallic flat gaskets with or without inserts*
- [2] EN 1514-2, *Flanges and their joints — Gaskets for PN-designated flanges — Part 2: Spiral wound gaskets for use with steel flanges*
- [3] EN 1514-3, *Flanges and their joints — Dimensions of gaskets for PN-designated flanges — Part 3: Non-metallic PTFE envelope gaskets*
- [4] EN 1514-4, *Flanges and their joints — Dimensions of gaskets for PN-designated flanges — Part 4: Corrugated, flat or grooved metallic and filled metallic gaskets for use with steel flanges*
- [5] EN 1514-6, *Flanges and their joints — Dimensions of gaskets for PN-designated flanges — Part 6: Covered serrated metal gaskets for use with steel flanges*
- [6] EN 1514-7, *Flanges and their joints — Gaskets for PN-designated flanges — Part 7: Covered metal jacketed gaskets for use with steel flanges*
- [7] EN 1514-8, *Flanges and their joints — Dimensions of gaskets for PN-designated flanges — Part 8: Polymeric O-Ring gaskets for grooved flanges*
- [8] EN 1515-1, *Flanges and their joints — Bolting — Part 1: Selection of bolting*
- [9] EN 1515-2:2001, *Flanges and their joints — Bolting — Part 2: Classification of bolt materials for steel flanges, PN designated*
- [10] EN 1591-2, *Flanges and their joints — Design rules for gasketed circular flange connections — Part 2: Gasket parameters*
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- [12] EN 10021, *General technical delivery conditions for steel products*
- [13] EN 10025 (all parts), *Hot rolled products of structural steels*
- [14] EN 10216-1:2002, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 1: Non-alloy steel tubes with specified room temperature properties*
- [15] EN 10253 (all parts), *Butt-welding pipe fittings*
- [16] EN 12516 (all parts), *Industrial valves — Shell design strength*
- [17] EN 13445 (all parts), *Unfired pressure vessels*
- [18] EN 13458 (all parts), *Cryogenic vessels — Static vacuum insulated vessels*
- [19] EN 13480 (all parts), *Metallic industrial piping*
- [20] EN ISO 3834-2:2005, *Quality requirements for fusion welding of metallic materials — Part 2: Comprehensive quality requirements (ISO 3834-2:2005)*
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- [26] DIN 17102<sup>2)</sup>, *Weldable normalized fine grain structural steels; technical delivery conditions for plate, strip, wide flats, sections and bars*
- [27] DIN 17103<sup>2)</sup>, *Weldable fine grain structural steel forgings; technical delivery conditions*
- [28] DIN 17245<sup>2)</sup>, *Ferritic steel castings with elevated temperature properties; technical delivery conditions*
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- [35] EN 1092-3, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 3: Copper alloy flanges*
- [36] EN 764-3, *Pressure equipment — Part 3: Definition of parties involved*
- [37] EN 10028-1, *Flat products made of steels for pressure purposes — Part 1: General requirements*

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<sup>2)</sup> Withdrawn.

## National Annex NA (informative) to BS EN 1092-1:2007

## NA.1 Introduction

In BS EN 1092-1:2007, the materials and material groups used in the manufacture of flanges are given in Table 9 and the Pressure/Temperature ratings of those materials and material groups are given in Annex G (normative).

Additional materials that are widely used in Europe but not listed, either as individual materials or as material groups, in Table 9, or in other EN standards, are given in Annex D (informative). The Pressure/Temperature ratings in Annex G only cover the materials and material groups listed in Table 9. As a result, EN 1092-1:2007 does not include any Pressure/Temperature information for the additional materials given in Table D.1.

In the UK, the predominant materials used in the manufacture of flanges are S235JR/1.0038 (Group 1E1 in Table D.1) and ASME SA 105 (second entry for Group 3E0 in Table D.1). As a consequence, Pressure/Temperature rating information for these two materials is of particular importance for flange manufacturers in the UK.

In order to provide some guidance for UK manufacturers, some analysis has been performed for materials S235JR/1.0038 and ASME SA 105 and the results are given in Table NA.1.

## NA.2 Pressure/Temperature ratings for materials S235JR/1.0038 and ASME SA 105

The values in Table NA.1 have been calculated using the design stresses inferred from Table 19 (for ASME SA 105) and Table F.1 (for S235JR/1.0038) of BS EN 1092-1:2001.

Table NA.1 — Pressure/Temperature (p/T) Ratings<sup>b</sup> for Flanges made of ferritic steels

| PN  | Material      | RT <sup>a</sup> | Maximum Allowable Temperature<br>°C |       |       |      |      |      |      |      |      |     |
|-----|---------------|-----------------|-------------------------------------|-------|-------|------|------|------|------|------|------|-----|
|     |               |                 | 100                                 | 150   | 200   | 250  | 300  | 350  | 375  | 400  | 425  | 450 |
|     |               |                 | Maximum Allowable Pressure<br>Bar   |       |       |      |      |      |      |      |      |     |
| 2,5 | S235JR/1.0038 | 2,5             | 2,1                                 | 2,0   | 1,8   | 1,6  | 1,3  | —    | —    | —    | —    | —   |
|     | ASME SA 105   | 2,5             | 2,5                                 | 2,5   | 2,5   | 2,4  | 2,2  | 2,1  | 2,0  | 1,8  | 1,4  | —   |
| 6   | S235JR/1.0038 | 6               | 5,1                                 | 4,8   | 4,3   | 3,8  | 3,3  | —    | —    | —    | —    | —   |
|     | ASME SA 105   | 6               | 6,0                                 | 6,0   | 6,0   | 5,7  | 5,3  | 5,1  | 5,0  | 4,3  | 3,5  | —   |
| 10  | S235JR/1.0038 | 10              | 8,5                                 | 8,0   | 7,3   | 6,4  | 5,5  | —    | —    | —    | —    | —   |
|     | ASME SA 105   | 10              | 10,0                                | 10,0  | 10,0  | 9,6  | 8,9  | 8,5  | 8,3  | 7,2  | 5,9  | —   |
| 16  | S235JR/1.0038 | 16              | 13,7                                | 12,7  | 11,7  | 10,3 | 8,8  | —    | —    | —    | —    | —   |
|     | ASME SA 105   | 16              | 16,0                                | 16,0  | 16,0  | 15,4 | 14,3 | 13,6 | 13,3 | 11,5 | 9,5  | —   |
| 25  | S235JR/1.0038 | 25              | 21,4                                | 20,0  | 18,4  | 16,1 | 13,9 | —    | —    | —    | —    | —   |
|     | ASME SA 105   | 25              | 25,0                                | 25,0  | 25,0  | 24,1 | 22,4 | 21,3 | 20,8 | 18,0 | 14,9 | —   |
| 40  | S235JR/1.0038 | 40              | 34,2                                | 32,0  | 29,5  | 25,9 | 22,2 | —    | —    | —    | —    | —   |
|     | ASME SA 105   | 40              | 40,0                                | 40,0  | 40,0  | 38,6 | 35,8 | 34,2 | 33,3 | 28,9 | 23,9 | —   |
| 63  | S235JR/1.0038 | 63              | 54,0                                | 50,3  | 46,5  | 40,8 | 35,1 | —    | —    | —    | —    | —   |
|     | ASME SA 105   | 63              | 63,0                                | 63,0  | 63,0  | 60,8 | 56,4 | 53,8 | 52,5 | 45,5 | 37,7 | —   |
| 100 | S235JR/1.0038 | 100             | 85,7                                | 80,0  | 73,8  | 64,7 | 55,7 | —    | —    | —    | —    | —   |
|     | ASME SA 105   | 100             | 100,0                               | 100,0 | 100,0 | 96,5 | 89,6 | 85,5 | 83,3 | 72,3 | 59,9 | —   |

<sup>a</sup> -10 °C to +50 °C

<sup>b</sup> The p/T ratings apply only to flange types 05,11,12,13 and 21 having nominal sizes up to and including DN 600.



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