

AS/NZS 4331.1:1995
ISO 7005-1:1992

Australian/New Zealand Standard

Metallic flanges

Part 1: Steel flanges

AS/NZS 4331.1:1995

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee ME/1, Pressure Equipment. It was approved on behalf of the Council of Standards Australia on 19 July 1995 and on behalf of the council of Standards New Zealand on 24 October 1995. It was published on 5 December 1995.

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Metallic flanges

Part 1: Steel flanges

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee ME/1 on Pressure Equipment. It is identical with and has been reproduced from ISO 7005-1:1992, *Metallic flanges, Part 1: Steel flanges*.

The objective of this Standard is to provide designers, manufacturers and users with an international Standard for flanges for use in pressure applications.

This Joint Standard is one of the following series that applies to metallic flanges.

AS/NZS

- 4331 Metallic flanges
- 4331.1 Part 1: Steel flanges
- 4331.2 Part 2: Cast iron flanges
- 4331.3 Part 3: Copper alloy and composite flanges

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It is not intended this Standard be a mandatory replacement for any flange Standards already in use in Australia or New Zealand. Before flanges to this Standard are used with flanges of other Standards, compatibility for bolting, strength, gasket seating and the like should be checked.

Statements expressed in mandatory terms in notes to text, tables and figures are deemed to be requirements of this Standard.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the annex to which they apply. A 'normative' annex is an integral part of a Standard, whereas an 'informative' annex is only for information and guidance.

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<i>Reference to International Standard</i>		<i>Australian Standard</i>	
ISO		AS	
7	Pipe threads where pressure-tight joints are made on the threads	1722	Pipe threads of Whitworth form
7-1:1982	Part 1: Designation, dimensions and tolerances	1722.1	Part 1: Sealing pipe threads
7-2:1982	Part 2: Verification by means of limit gauges	1722.1	Part 1: Sealing pipe threads
261:1973	ISO general purpose metric screw threads—General plan	1721	General purpose metric screw threads
887*	Plain washers for metric bolts, screws and nuts for general purposes—General plan	—	

* To be published (Revision of ISO 887:1983).

ISO		AS
6708:1980	Pipe components— Definition of nominal size	—
7268:1983	Pipe components— Definition of nominal pressure	—
7483:1991	Dimensions of gaskets for use with flanges to ISO 7005	—
ANSI/ASME		—
B1.20.1:1983	Pipe threads, general purpose (inch)	

Equivalent National Material Standards may be substituted for those specified in this Standard.

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AUSTRALIAN/NEW ZEALAND STANDARD

Metallic flanges —

Part 1: Steel flanges

Section 1: General

1.1 Scope

This part of ISO 7005 for a single system of flanges specifies requirements for circular steel flanges in the following PN designations:

Series 1 ^{*)}	Series 2 ^{*)}
PN 10	PN 2,5
PN 16	PN 6
PN 20	PN 25
PN 50	PN 40
PN 110	
PN 150	
PN 260	
PN 420	

It specifies the types of steel flanges and their facings, dimensions, tolerances, threading, bolt sizes, flange face surface finish, marking, testing and inspection.

It does not specify pressure/temperature ratings or materials for steel flanges. However, annex D gives guidance on selected materials and annex E gives guidance on the pressure/temperature ratings for some flanges made from the materials listed in annex D.

This part of ISO 7005 does not apply to flanges made from bar stock by turning.

Nor does it apply to flanges of types 11, 12, 13, 14 and 15 made from plate material.

The various gasket types, dimensions, design characteristics and materials used are not within the scope of this part of ISO 7005.

NOTE — Dimensions of gaskets are given in ISO 7483.

1.2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 7005. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 7005 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 7-1 : 1982, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Designation, dimensions and tolerances.*

ISO 7-2 : 1982, *Pipe threads where pressure-tight joints are made on the threads — Part 2: Verification by means of limit gauges.*

ISO 261 : 1973, *ISO general purpose metric screw threads — General plan.*

ISO 887: — ¹⁾, *Plain washers for metric bolts, screws and nuts for general purposes — General plan.*

ISO 6708 : 1980, *Pipe components — Definition of nominal size.*

ISO 7268 : 1983, *Pipe components — Definition of nominal pressure.*

ISO 7483 : 1991, *Dimensions of gaskets for use with flanges to ISO 7005.*

ANSI/ASME B1.20.1 : 1983, *Pipe threads, general purpose (inch).*

*) Series 1 flanges are the basic flanges; series 2 flanges may have a limited application in the future.

1) To be published. (Revision of ISO 887 : 1983.)

1.3 Definitions

For the purposes of this part of ISO 7005, the definitions of nominal size (DN) as given in ISO 6708, and nominal pressure (PN) as given in ISO 7268 and the following definition apply.

1.3.1 pipeline: Cross-country fluid transmission line, e.g. for oil or gas.

1.4 Designation of types, components and facings

Figures 1 to 4 illustrate flanges and flanged components grouped according to type and figure 5 illustrates facing types.

Figure 1: Flanges — Types 01 to 05 inclusive, comprising flanges generally manufactured from plate materials.

NOTE — Types 02 and 03 are identical; it is their ancillary components which differ (see figure 4).

Figure 2: Flanges — Types 11 to 15 inclusive, comprising flanges generally manufactured from forgings or castings.

Figure 3: Flange — Type 21 integral flange, as part of some other equipment or component.

Figure 4: Ancillary components for flanges — Types 32 to 34 inclusive, comprising parts or components for use with flange types 02, 03 and 04.

Figure 5: Facings — Types A to J inclusive, comprising the various types of flange facings which may be used where applicable in conjunction with the groups of flanges or flanged components in figures 1 to 4.

NOTE — Type numbers are not consecutive to permit possible future additions to any particular group.

Section 2: General requirements

2.1 Pressure/temperature ratings

Guidance on pressure/temperature ratings of flanges forming the subject of this part of ISO 7005 is given in annex E for some flanges made from the materials listed in annex D.

2.2 Materials and bolting

2.2.1 Range of materials

Guidance on selected materials is given in annex D.

2.2.2 Gaskets

See the note in 1.1.

2.2.3 Bolting

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

For PN 20, PN 50, PN 110, PN 150, PN 260 and PN 420 flanges up to and including bolt size M45, coarse series bolts to ISO 261 shall be used; from bolt size M48 upwards, the fine series having a uniform 4 mm pitch shall be used.

2.3 Repairs

2.3.1 Where not otherwise prohibited by the applicable material standard, repairs by welding are permitted when there is a proven method. All welding shall be in accordance with a written procedure.

2.3.2 Any filler rod used for weld repairs shall be such as to produce a weld having characteristics similar to those of the parent metal. Flanges shall be heat treated after repair welding when the material specification requires such treatment.

2.4 Dimensions

2.4.1 Range of nominal sizes

The range of nominal sizes applicable to each flange type and each nominal pressure shall be as specified in table 3.

2.4.2 Tables giving dimensions

Dimensions of flanges shall be in accordance with the following tables, as appropriate.

Tables 4, 5, 6 and 7: Dimensions of flange facings

Series 1 flanges

Table 10: Dimensions of PN 10 flanges

Table 11: Dimensions of PN 16 flanges

Table 12: Dimensions of PN 20 flanges

Table 15: Dimensions of PN 50 flanges

Table 16: Dimensions of PN 110 flanges

Table 17: Dimensions of PN 150 flanges

Table 18: Dimensions of PN 260 flanges

Table 19: Dimensions of PN 420 flanges

Series 2 flanges

Table 8: Dimensions of PN 2,5 flanges

Table 9: Dimensions of PN 6 flanges

Table 13: Dimensions of PN 25 flanges

Table 14: Dimensions of PN 40 flanges

2.4.3 Threads for threaded flanges

2.4.3.1 The threads shall be taper or parallel threads in accordance with ISO 7-1 or taper threads in accordance with ANSI/ASME B1.20.1 as appropriate.

NOTE — Unless otherwise specified, parallel threads in accordance with ISO 7-1 will be supplied for flanges PN 2,5, PN 6, PN 10, PN 16, PN 25 and PN 40 and taper threads in accordance with ANSI/ASME B1.20.1 for flanges PN 20, PN 50, PN 110, PN 150, PN 260 and PN 420.

2.4.3.2 The threads shall be concentric with the axes of the flanges and variations in alignment shall not exceed 5 mm/m. Flanges up to and including PN 40 shall be manufactured without a counterbore. The threads shall be chamfered approximately to the major diameter of the threads at the back of the flanges at an angle of approximately 45° with the axes of the threads. The chamfers shall be concentric with the threads and permitted to be included in the measurement of the thread lengths provided that the chamfers do not exceed one pitch in length.

Flanges PN 50 and above shall be provided with a counterbore at the back. The threads shall be chamfered to the diameters of the counterbores at an angle of approximately 45° with the axes of the threads. The counterbores and chamfers shall be concentric with the threads.

2.4.3.3 Gauging shall be in accordance with ISO 7-2 or ANSI/ASME B1.20.1 as appropriate.

2.4.4 Hubs — General applications

2.4.4.1 The hub of threaded (type 13), slip-on (type 12), socket weld (type 14) and lapped (type 15) flanges shall be cylindrical or alternatively shall have a draft of not more than 7° on the outside surface for forging or casting purposes. For the limiting profile of weld neck hubs, see annex A.

2.4.4.2 The hub dimensions of threaded (type 13) and slip-on (type 12) flanges having a reduced bore shall be at least as large as those of the standard flange of the size to which the reduction is being made. For welding neck (type 11) flanges having a reduced bore, the hub dimensions shall be the same as those of the standard flange of the size to which the reduction is being made.

2.4.5 Hubs — Pipeline applications

2.4.5.1 The hub diameter and wall thickness at the welding end shall be determined as specified in 2.4.5.1.1 to 2.4.5.1.3 as appropriate.

2.4.5.1.1 When the minimum yield strength of the hub portion of any flange or its representative test specimen is the same as that of the mating pipe, the minimum thickness at the welding end shall be the same as that of the mating pipe.

2.4.5.1.2 When the minimum yield strength of the hub portion of any flange or its representative test specimen is less than that specified for the pipe to be matched, the minimum thickness of the hub at the welding end shall be such that the product of its thickness times its yield strength (at the welding end) shall at least equal the product of the specified wall thickness and the minimum specified yield strength of the pipe to be matched.

2.4.5.1.3 When the hub thickness at the welding end is greater than the wall thickness of the adjoining pipe, the joint design shall be as shown in any of the three sketches in figure B.1.

2.4.5.2 The minimum hub outside diameter at the point of weld shall be determined by adding twice the minimum wall thickness determined in 2.4.5.1.1 or 2.4.5.1.2 to the bore specified by the customer.

2.4.5.3 For sizes DN 300 to DN 600, when the mechanical (minimum yield strength) properties of all sections of the flanges are equal to or higher than those of the pipe to be matched, the hub dimensions are permitted to be the same as those of the general flanges as indicated in annex A.

2.4.6 Welding end preparation

For welding type 11 flanges to pipe, the typical end preparation of the flange shall be as shown in annex A. When PN 20, PN 50, PN 110 and PN 150 flanges are used in pipeline applications the typical welding end preparations are as shown in annex C.

NOTE — Other welding end preparations agreed between manufacturer and purchaser do not invalidate compliance with this part of ISO 7005.

2.5 Facings

2.5.1 Range of facings

The range of flange facings and flange face designations shall be as given in figure 5. Dimensions of facings according to the PN designation shall be in accordance with figures 6 and 7 and tables 4, 5, 6 and 7, as appropriate.

NOTES

1 For types B (as shown in figure 6 only), D, F, G and J the transition from the raised face diameter to the flange face is at the option of the manufacturer.

2 For PN 20 and PN 50 to PN 420 there are large and small versions of C, D, E and F types of facing. In such cases two sets of dimensions have been given in the related tables. For small male and female joints care should be taken to ensure that the inside diameter of the pipe is small enough to permit sufficient bearing surface.

3 The type B raised face on steel flanges may be removed when bolted to cast iron or copper alloy flanges for designations up to and including PN 50 in order to provide full-face gasketing if such be required. On a flanged component or fitting this will reduce the thickness and the overall length accordingly.

2.5.2 Facing height/depth

For PN 2,5, PN 6, PN 10, PN 16, PN 25 and PN 40 flanges all facing heights shall be included in the minimum flange thickness and are measured from the face of the flange. The same requirement applies for PN 20 and PN 50 flanges when they have the (type B1) raised face. For PN 20, PN 50, PN 110, PN 150, PN 260 and PN 420 flanges with other facings, e.g. type B2, spigot and recess, tongue and groove, the height or depth shall be added to the minimum flange thickness. For PN 110 to PN 420 flanges all facings shall be added to the minimum flange thickness. Special requirements apply to ring-joint facings (see 2.5.3).

2.5.3 Ring-joint facings

The bottom of the ring-joint groove shall not encroach below the plane of the flange edge of the appropriate minimum thickness flange. Where the depth of the ring-type joint groove would violate this requirement, sufficient metal shall be added to the flange thickness or raised face height so that the bottom of the groove shall be in the same plane as the flange edge of a minimum thickness flange.

2.5.4 Lapped joints

For type 33 ancillary components for flanges, the finished height of the facing shall be not less than the pipe thickness used. If a tongue, groove or ring-joint face is required, the thickness of the lap remaining after machining the facing shall not be less than the specified thickness of the pipe used.

2.5.5 Surface finish of flanges

2.5.5.1 All flange jointing faces shall be finished in accordance with table 1 or table 2, as appropriate. The surface finishes of the faces shall be compared by visual or tactile means with reference specimens which conform to the R_a and R_z values given in tables 1 and 2.

Table 1 — Surface finish for facings types A, B and E/F (large)

Method of machining	Approximate depth of serration mm	Approximate radius of tool nose mm	Approximate pitch of serration mm	$R_z^{(1)}$ μm		$R_a^{(1)}$ μm	
				min.	max.	min.	max.
Turning ²⁾	0,05	1,6	0,8	12,5	50,0	3,2	12,5
Other than turning	—	—	—	12,5	25,0	3,2	6,3

1) R_a and R_z are defined in ISO 468.

2) The term "turning" includes any method of machine operation producing either serrated concentric or serrated spiral grooves.

NOTE — For certain applications, e.g. for searching media such as low temperature gases, and for flanges of PN 150 and above, it may be necessary to stipulate closer control on the surface finish.

NOTES

1 It is not intended that instrument measurements are taken on the flange faces, and the R_a and R_z values as defined in ISO 468 relate to the reference specimens.

2 Other finishes may be agreed between the manufacturer and purchaser.

2.5.5.2 The dimensions given for facings (particularly tongue and groove types) in this part of ISO 7005 apply to flanges in the condition as delivered.

When special coatings or finishes are required this should be stated in the order so that an appropriate allowance may be incorporated in the machining of any relevant mating dimensions.

2.5.5.3 Flat face, raised face and large spigot/recess facings [i.e. types A, B and E/F (large)] shall be turned. Turning shall be carried out with a round-nosed tool in accordance with table 1.

2.5.5.4 For tongue/groove, small spigot/recess, "O"-ring recess/groove and ring-joint facings [i.e. types C/D, E/F (small), G/H and J] the gasket surfaces shall be machined in accordance with the values shown in table 2.

Table 2 — Surface finish values for facings types C/D, E/F (small), G/H and J

Facing type	$R_z^{(1)}$ μm		$R_a^{(1)}$ μm	
	min.	max.	min.	max.
Tongue/groove (C/D) and small spigot/recess (E/F)	3,2	12,5	0,8	3,2
Ring-joint (J) (including side walls) and "O"-ring recess/groove (G/H)	1,6	6,3	0,4	1,6

1) R_a and R_z are defined in ISO 468.

2.6 Spot-facing or back-facing

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

When spot-facing is used, the diameter shall be large enough to accommodate the outside diameter of the equivalent normal series of ISO washers complying with ISO 887 for the metric bolt size being fitted. When a flange is back-faced, it is permissible for the fillet radius to be reduced but it shall not be eliminated entirely. The bearing surfaces for the bolting shall be parallel to the flange face within the limits shown in table 20.

When a flange is back-faced a minimum fillet radius at the hub, R_{\min} (see figure 8), shall be maintained as given in table 21.

2.7 Tolerances

Flange dimensions shall comply with the tolerances specified in table 20.

2.8 Marking**2.8.1 Flanges other than integral flanges**

Flanges other than integral flanges shall be marked with the following information:

- the number of this part of ISO 7005 (i.e. ISO 7005-1);
- the nominal size (DN) and the PN designation;
- the material designation (see 2.8.2);
- the manufacturer's name or trade-mark;
- the thread identification where appropriate (see 2.8.3);
- the heat (cast) number or suitable quality control number traceable to the heat number.

NOTES

1 Additionally, flange facing designations may be given (see also 2.8.4).

2 Where a flange is subsequently used to form an integral part of a component and the component has a lower pressure rating than that of the flange, the lower rating should be clearly marked on the component.

2.8.2 Material designation

The material designation shall be as specified in 2.8.2.1, 2.8.2.2 and 2.8.2.3, as appropriate.

2.8.2.1 The material designation shall be the minimum information required to identify the material, e.g. the grade identification, preceded by the specification (standard) number where necessary.

EXAMPLES (for materials in tables D.1 and D.2)

- a) 16Mo3
- b) C26-52H
- c) X7 CrNiNb 18 10

2.8.2.2 For flanges of nominal size DN 300 and greater, manufactured specifically for pipeline applications, the material designation shall be the material group and grade identification number in accordance with table D.3.

EXAMPLE

4.A.250

2.8.2.3 For flanges manufactured in accordance with 2.4.5.1.2, the material designation shall comprise the material group and grade identification number for the flange and the strength grade of the pipe for which the flange has been made, presented as shown in the following example.

EXAMPLE

4.A.290/XXX

where XXX is the strength grade of the pipe, taken from the appropriate steel tube standard.

2.8.3 Identification of internally threaded flanges

Internally threaded flanges shall be marked to indicate the type of thread used.

Threads to ISO 7-1 shall be designated by the letter symbols Rc or Rp, as appropriate, in accordance with ISO 7-1 followed by the nominal size, e.g. Rc 3/4. Threads to ANSI/ASME B1.20.1 shall be designated by the nominal size, number of threads per inch and the letters NPT, e.g. 3/4-14NPT.

2.8.4 Groove number

Flanges grooved for standard ring-joints shall be marked with the letter "R" and the corresponding ring number.

2.8.5 Stamping

Where steel stamps are used, the marking shall be applied to the rim of the flange.

2.9 Inspection and test

NOTES

1 The PN 20, PN 50, PN 110, PN 150, PN 260 and PN 420 flanges specified are designed to be interchangeable with Class rated flanges to ANSI/ASME B16.5 and MSS 5P44, but they are not identical in all respects; for inspection purposes, it is recommended that the dimensions of PN 20, PN 50, PN 110, PN 150, PN 260 and PN 420 flanges are deemed to comply with the dimensions specified in ANSI/ASME B16.5 or MSS 5P44 as appropriate.

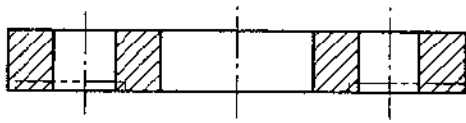
2 This part of ISO 7005 does not make provision for routine inspection or pressure testing of separate flanges. However, flanges may be required to be pressure tested after attachment of a pipe or other equipment or when forming an integral part of such equipment. The test pressure is then dependent on the requirements of the appropriate standard or code of practice in accordance with which the equipment has been manufactured. Any test pressures should not exceed 1,5 times the maximum allowable working pressure at 20°C rounded off to the next higher 1 bar¹⁾ increment.

2.10 Information to be supplied by the purchaser

The following information should be supplied by the purchaser in the enquiry and/or order:

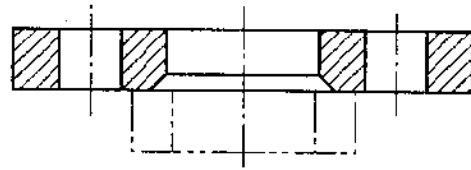
- a) the number of this part of ISO 7005 (i.e. ISO 7005-1);
- b) the nominal size — DN followed by the appropriate number (see 1.3);
- c) the PN designation — PN followed by the appropriate number (see 1.3);
- d) the flange type number (see 1.4), together with reference to the ancillary component type number if appropriate;
- e) the facing type letter (see 1.4);
- f) the material designation by reference to a national standard or International Standard and grade of steel (see 2.8.2), if appropriate;
- g) the internal thread designation (see 2.4.3);
- h) the external diameter and thickness of pipe;
- i) material certification requirements;
- j) details of special coatings (see 2.5.5.2);
- k) the neck thickness *S* where appropriate;
- i) the bore diameter *B* where appropriate;
- m) the bore diameter for welding neck (type 11) or socket weld (type 14) flanges, if different from those specified in this part of ISO 7005;
- n) for pipeline flanges, the mating pipe wall thickness and yield strength (see 2.4.5.1.3) and weld preparation (see annex B);
- o) the bolting material when bolts are ordered with the flange(s).

1) 1 bar = 10⁵ Pa

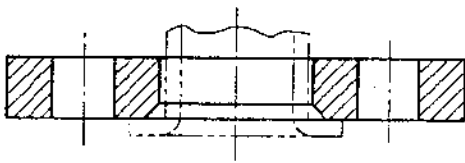


Type 01

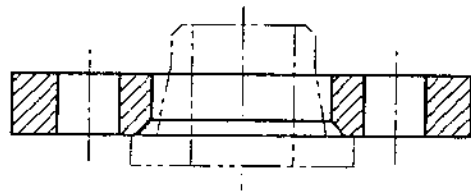
Plate flange for welding



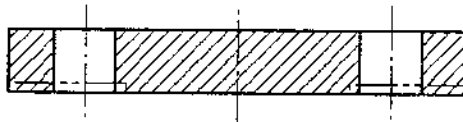
Type 02

Loose plate flange with weld-on plate collar
(see type 32)

Type 03

Loose plate flange with lapped pipe end
(see type 33)

Type 04

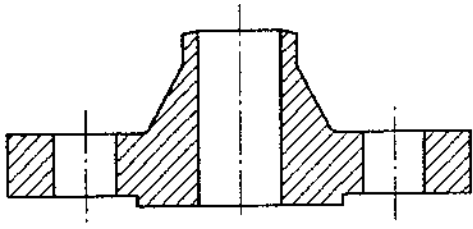
Loose flange with welding neck collar
(see type 34)

Type 05

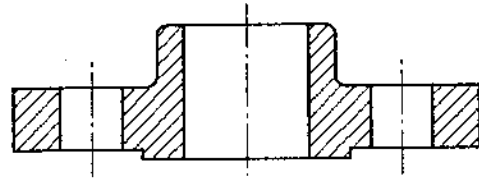
Blank flange

NOTE — These sketches are diagrammatic only.

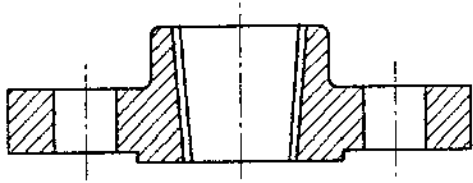
Figure 1 — Flanges — Types 01 to 05



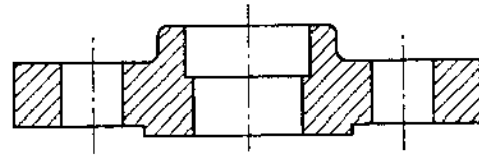
Type 11
Welding neck flange



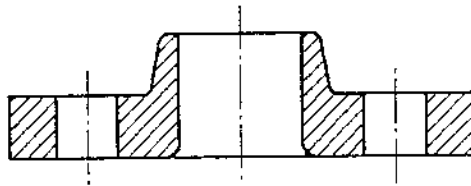
Type 12
Hubbed slip-on flange for welding



Type 13
Hubbed threaded flange



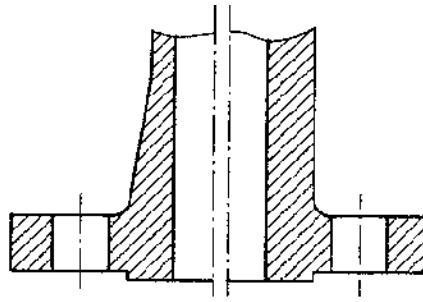
Type 14
Hubbed socket welding flange



Type 15
Loose hubbed flange for lapped pipe end

NOTE — These sketches are diagrammatic only.

Figure 2 — Flanges — Types 11 to 15

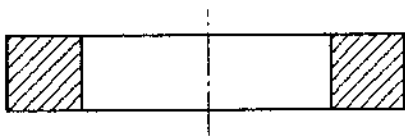


Type 21

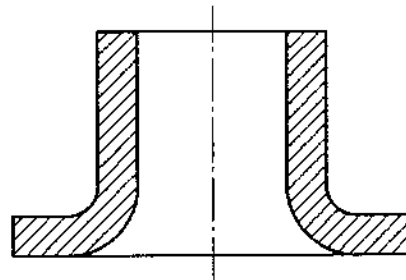
Integral flange, showing alternative forms

NOTE — This sketch is diagrammatic only.

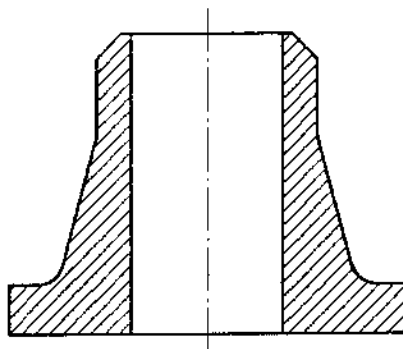
Figure 3 — Flange — Type 21

Type 32¹⁾

Weld-on plate collar

Type 33²⁾

Lapped pipe end

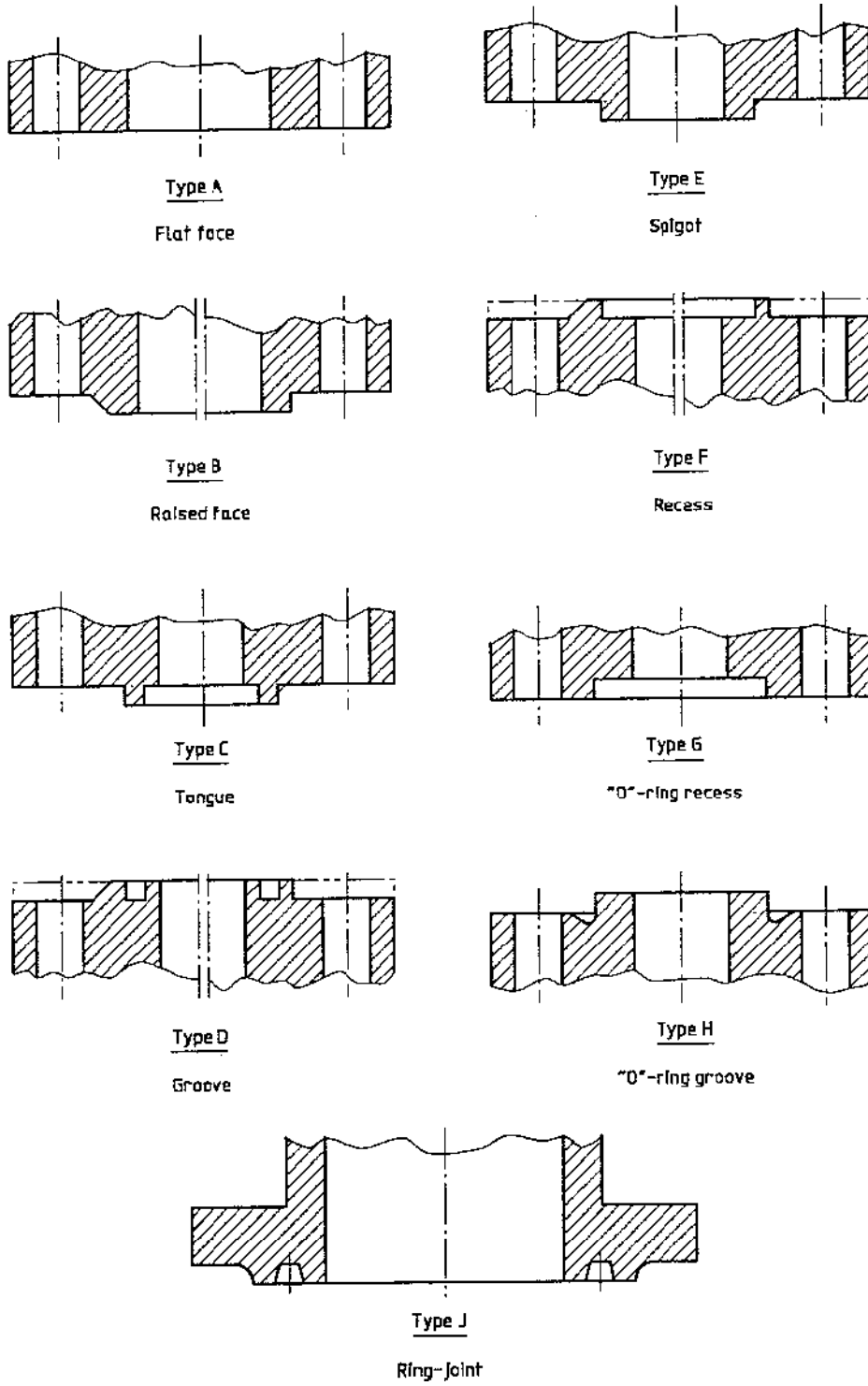
Type 34³⁾

Welding neck collar

NOTE — These sketches are diagrammatic only.

- 1) Type 32 corresponds to type 02 flange.
- 2) Type 33 corresponds to type 03 flange.
- 3) Type 34 corresponds to type 04 flange.

Figure 4 — Ancillary components for flanges — Types 32 to 34



NOTE — These sketches are diagrammatic only.

Figure 5 — Illustration of flange facings (types A to J)

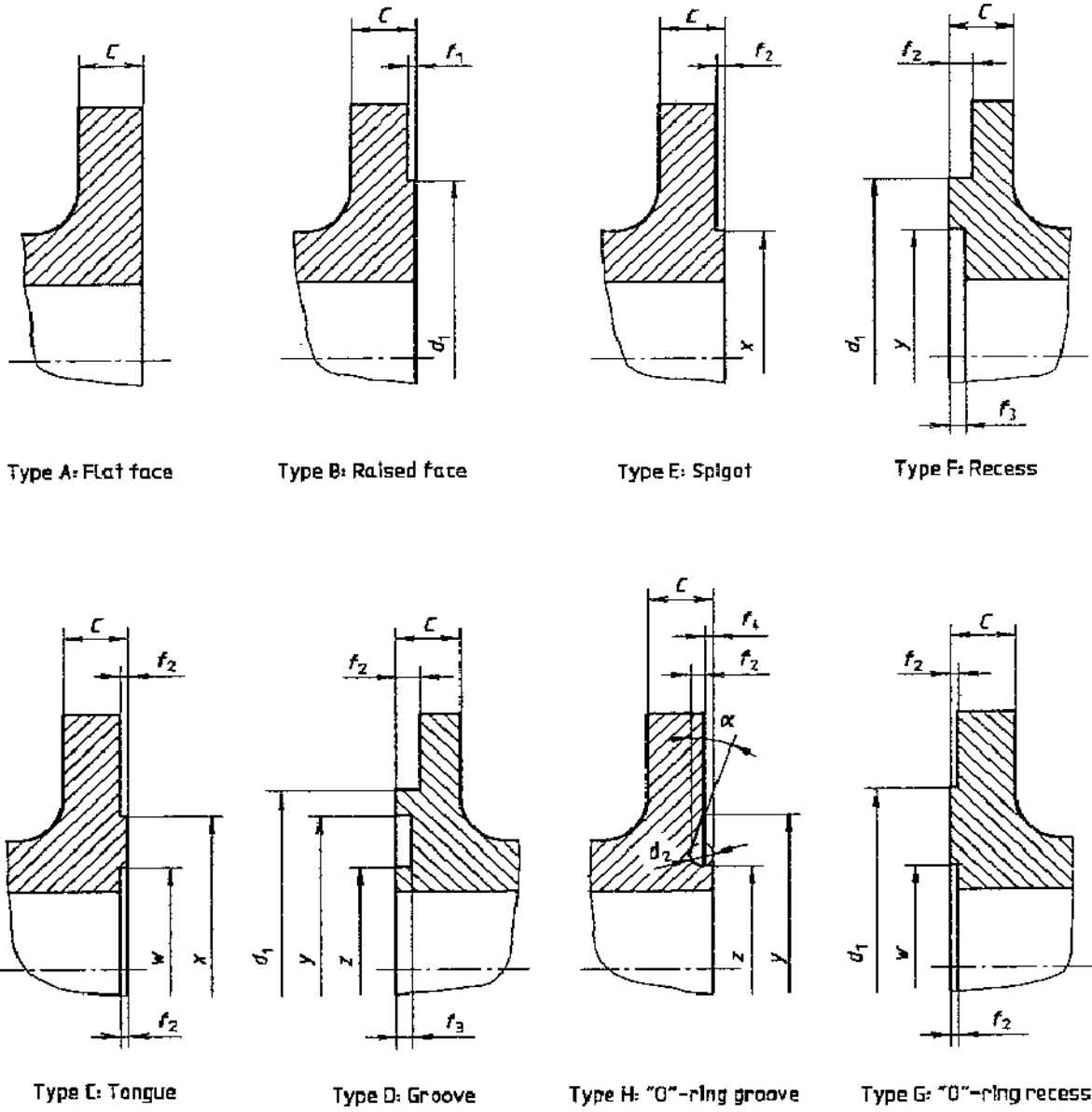
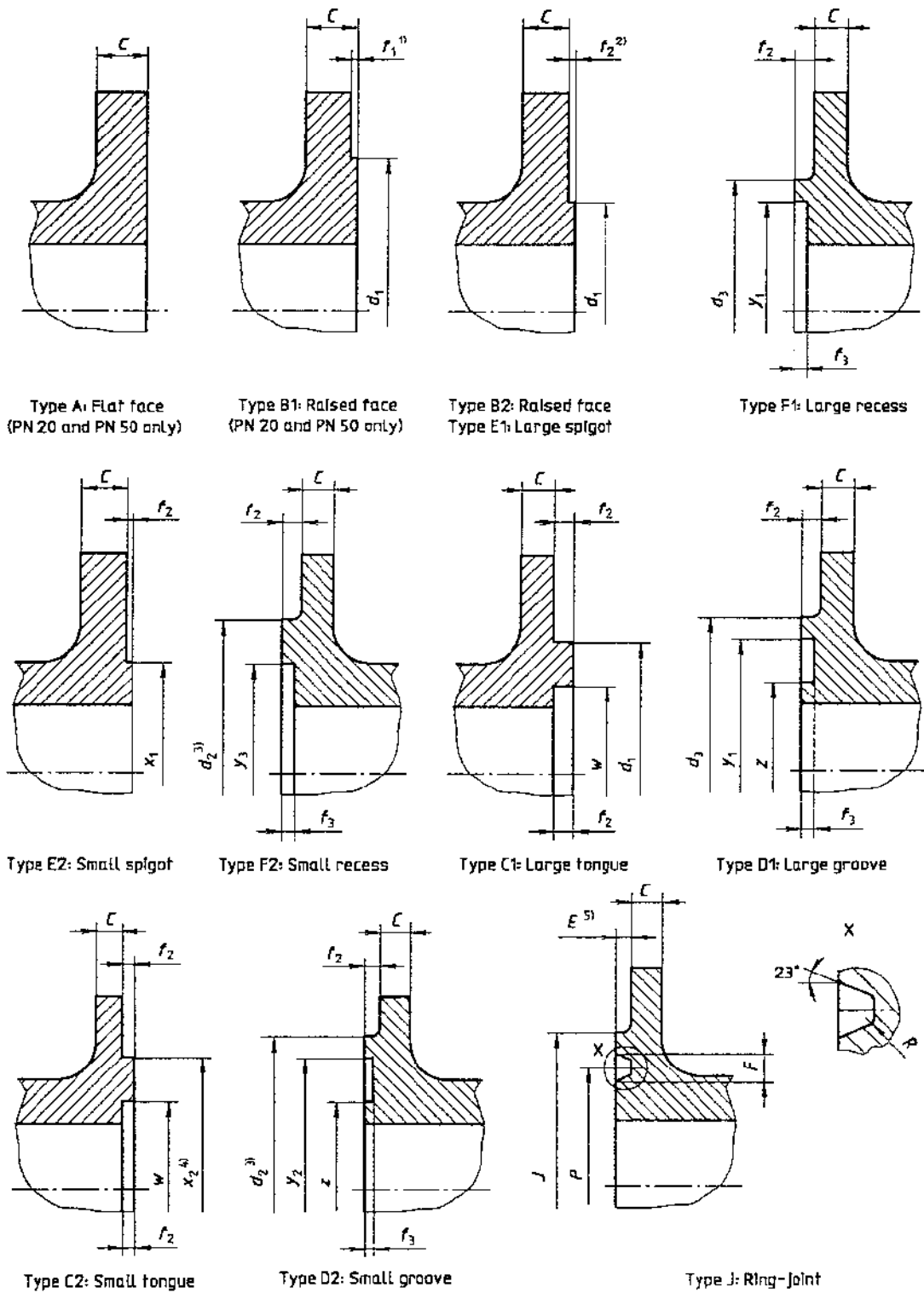


Figure 6 — PN 2,5, PN 6, PN 10, PN 16, PN 25 and PN 40 flange facing dimensions

Table 4 — Dimensions of flange facings for PN 2,5, PN 6, PN 10, PN 16, PN 25 and PN 40 (see figure 6)

Dimensions in millimetres

Nominal size DN	d_1						f_1	f_2	f_3	f_4	w	x	y	z	α	d_2
	PN 2,5	PN 6	PN 10	PN 16	PN 25	PN 40										
10		33					41				24	34	35	23	—	5
15		38					46				29	39	40	28		
20		48					56				36	50	51	35		
25		58					65				43	57	58	42		
32		69					76	4	3	2	51	65	66	50		
40		78	Use PN 40				84				61	75	76	60	41°16'	
50		88					99				73	87	88	72		
65		108					118				95	109	110	94		
80		124					132				106	120	121	105		
100		144					156	2			129	149	150	128		
125		174					184				156	175	176	154		
150		199					211				183	203	204	182		
200		254	266	266	274	284	4,5	3,5	2,5	239	259	260	238	32°15'	6	
250		309	319	319	330	345				292	312	313	291			
300	Use PN 6	363	370	370	389	409				343	363	364	342			
350		413	429	429	448	465				395	421	422	394			
400		463	480	480	503	535				447	473	474	446			
450		518	530	548	548	560				497	523	524	496			
500		568	582	609	609	615				549	575	576	548			
600		667	682	720	720	735		5	4	3	649	675	676	648		27°24'
700		772	794	794	820	—				751	777	778	750			
800		878	901	901	928	—				856	882	883	855			
900	978	1 001	1 001	1 028	—				961	987	988	960				
1 000		1 078	1 112	1 112	1 140	—				1 062	1 092	1 094	1 060			
1 200		1 295	1 328	1 328	1 350	—	5			1 262	1 292	1 294	1 260			
1 400		1 510	1 530	1 530	1 560	—				1 462	1 492	1 494	1 460			
1 600		1 710	1 750	1 750	1 780	—	6	5	4	1 662	1 692	1 694	1 660	28°39'		
1 800		1 918	1 950	1 950	1 985	—				1 862	1 892	1 894	1 860			
2 000		2 125	2 150	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	—	—	—	—	6	—	—	—	—	—	—	—		
3 400	3 510	3 580	—	—	—	—										
3 600	3 720	3 790	—	—	—	—										
3 800	3 920	—	—	—	—	—										
4 000	4 120	—	—	—	—	—										



- 1) f_1 applies to PN 20 and PN 50 and is included in flange thickness C .
- 2) f_2 applies to PN 110, PN 150, PN 260 and PN 420, and is additional to flange thickness C .
- 3) d_2 is larger than d_1 for DN 15, DN 20, DN 25 and DN 32; otherwise d_2 is equal to d_1 .
- 4) x_2 is equal to d_1 for DN 15 and DN 20.
- 5) Height of raised portion E is equal to groove depth E but is not subject to tolerance (see 2.5.3).

Figure 7 — PN 20, PN 50, PN 110, PN 150, PN 260 and PN 420 flange facing dimensions

Table 5 — Dimensions of flange facings up to nominal size DN 900 for PN 20, PN 50, PN 110, PN 150, PN 260 and PN 420
(see figure 7)

Dimensions in millimetres

Nominal size DN	Outside diameter			Inside diameter of large and small tongue <i>w</i>	Outside diameter			Inside diameter of large and small groove <i>z</i>	Height			Depth of groove or recess <i>f₃</i>	Minimum outside diameter of raised portion	
	Raised face, Large spigot ¹⁾ , Large tongue ¹⁾	Small spigot	Small tongue		Large recess ¹⁾ , Large groove ¹⁾	Small recess	Small groove		Raised face	Large and small spigot and tongue	<i>f₃</i>		<i>d₂</i>	<i>d₃</i> ¹⁾
	<i>d₁</i>	<i>x₁</i>	<i>x₂</i>		<i>y₁</i>	<i>y₃</i>	<i>y₂</i>		<i>f₁</i> ²⁾	<i>f₂</i> ³⁾				
15	35	18,5	35	25,5	36,5	20	36,5	24	2	7	7	5	44	46
20	43	24	43	33,5	44,5	25,5	44,5	32	2	7	7	5	52	54
25	51	30,5	48	38	52,5	32	49,5	36,5	2	7	7	5	57	62
32	63,5	38	57	47,5	65	39,5	58,5	46	2	7	7	5	67	73
40	73	44,5	63,5	54	74,5	46	65	52,5	2	7	7	5	73	84
50	92	57,5	82,5	73	93,5	59	84	71,5	2	7	7	5	92	103
65	105	68,5	95,5	85,5	106,5	70	97	84	2	7	7	5	105	116
80	127	84	117,5	108	128,5	85,5	119	106,5	2	7	7	5	127	138
100	157,5	109,5	144,5	132	159	111	146	130,5	2	7	7	5	157,5	168
125	186	136,5	173	160,5	187,5	138	174,5	159	2	7	7	5	186	197
150	216	162	203,5	190,5	217,5	163,5	205	189	2	7	7	5	216	227
200	270	213	254	238	271,5	214,5	255,5	236,5	2	7	7	5	270	281
250	324	267	305	286	325,5	268,5	306,5	284,5	2	7	7	5	324	335
300	381	317,5	362	343	382,5	319	363,5	341,5	2	7	7	5	381	392
350	413	349,5	394	374,5	414,5	351	395,5	373	2	7	7	5	413	424
400	470	400	447,5	425,5	471,5	401,5	449	424	2	7	7	5	470	481
450	533,5	451	511,5	489	535	452,5	513	487,5	2	7	7	5	533,5	544
500	584,5	501,5	559	533,5	586	503	560,5	532	2	7	7	5	584,5	595
550	641								2	7				
600	692,5	603	667	641,5	694	605	668,5	640	2	7	7	5	692,5	703,5
650	749								2	7				
700	800								2	7				
750	857								2	7				
800	914								2	7				
850	965								2	7				
900	1022								2	7				

1) Large spigot and recess faces and large tongue and groove are not applicable to PN 20 because of potential dimensional conflicts.

2) f_1 applies to PN 20 and PN 50, and is included in the minimum flange thickness.

3) f_2 applies to PN 110, PN 150, PN 260 and PN 420, and is additional to the minimum flange thickness.

NOTE — For small spigot and recess joints care should be taken in the use of these dimensions to ensure that the inside diameter of the fitting or pipe is small enough to ensure sufficient bearing surfaces.

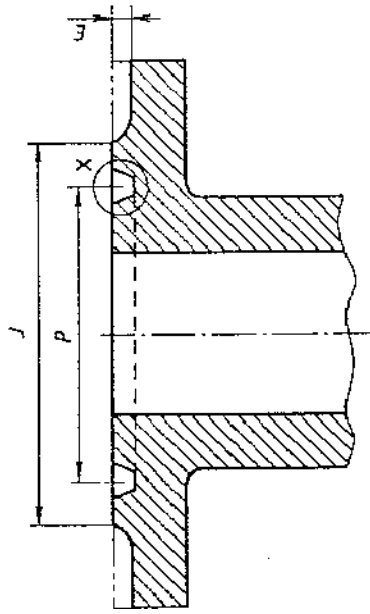
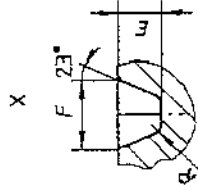
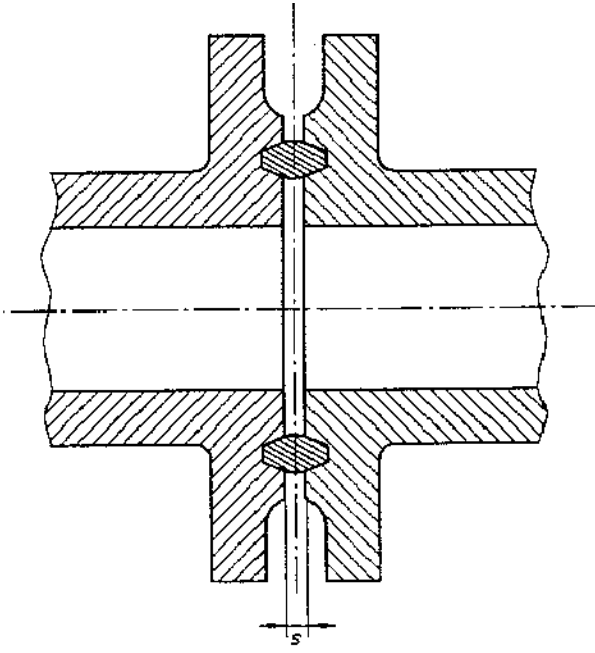
Table 6 — Dimensions of flange facings for nominal sizes DN 950 to DN 1 500 for PN 20, PN 50, PN 110 and PN 150

Dimensions in millimetres

Nominal size DN	Outside diameter of raised face <i>d₁</i>				Height of raised face	
	PN 20	PN 50	PN 110	PN 150	f_1 ¹⁾	f_2 ²⁾
950	1 073	1 029	1 054	1 099	2	7
1 000	1 124	1 086	1 111	1 162	2	7
1 050	1 194	1 137	1 168	1 213	2	7
1 100	1 245	1 194	1 226	1 270	2	7
1 150	1 295	1 245	1 276	1 334	2	7
1 200	1 359	1 308	1 334	1 384	2	7
1 250	1 410	1 359	1 384		2	7
1 300	1 460	1 410	1 435		2	7
1 350	1 511	1 467	1 492		2	7
1 400	1 575	1 518	1 543		2	7
1 450	1 626	1 575	1 600		2	7
1 500	1 676	1 625	1 657		2	7

1) f_1 applies to PN 20 and PN 50.

2) f_2 applies to PN 110 and PN 150.



See table 7.

Table 7 — Dimensions of ring-joint facings^{1), 2), 3), 4)}

Dimensions in millimetres

Pipe nominal size DN						Groove dimensions				Diameter of raised portion <i>J</i> min.					Approximate distance between flanges <i>s</i>					
PN 20	PN 50	PN 110	PN 150 ⁵⁾	PN 260	PN 420	Pitch diameter P $\pm 0,13$	Depth ⁶⁾ E $+ 0,4$ O	Width F $\pm 0,2$	Radius at bottom R max.	PN 20	PN 50 and PN 110	PN 150	PN 260	PN 420	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420
—	15	—	—	—	—	34,14	5,56	7,14	0,8	—	51	—	—	—	—	3	3	—	—	—
—	—	20	—	15	—	39,67	6,35	8,74	0,8	—	—	—	60,5	—	—	4	—	—	4	—
—	—	—	—	—	15	42,88	6,35	8,74	0,8	—	63,5	—	—	65	—	—	4	—	—	4
—	—	—	—	20	—	44,45	6,35	8,74	0,8	—	—	—	66,5	—	—	—	—	—	4	—
25	—	—	—	—	—	47,62	6,35	8,74	0,8	63,5	—	—	—	—	4	—	—	—	—	—
—	25	25	—	25	20	50,8	6,35	8,74	0,8	—	70	—	71,5	73	—	4	4	—	4	4
32	32	32	—	32	25	57,15	6,35	8,74	0,8	73	—	—	81	82,5	—	4	—	—	4	4
40	—	—	—	—	—	60,32	6,35	8,74	0,8	—	79,5	—	—	—	4	4	—	—	4	—
—	40	40	—	40	—	65,07	6,35	8,74	0,8	82,5	—	—	—	—	4	—	—	—	—	—
—	—	—	—	—	—	68,28	6,35	8,74	0,8	—	90,5	—	92	—	—	4	—	—	4	—
—	—	—	—	—	32	72,24	7,92	11,91	0,8	—	—	—	—	102	—	—	—	—	—	3
50	—	—	—	—	—	82,55	6,35	8,74	0,8	102	—	—	—	—	4	—	—	—	—	—
—	50	50	—	50	40	82,55	7,92	11,91	0,8	108	—	—	124	114	—	6	5	—	—	3
—	—	—	—	—	—	95,25	7,92	11,91	0,8	—	—	—	—	—	—	—	—	—	—	—
65	—	—	—	—	—	101,6	6,35	8,74	0,8	121	—	—	—	—	4	—	—	—	—	—
—	65	65	—	65	50	101,6	7,92	11,91	0,8	—	127	—	—	133	—	6	5	—	—	—
—	—	—	—	—	—	107,95	7,92	11,91	0,8	—	—	—	137	—	—	—	—	—	3	—
—	—	—	—	—	65	111,12	9,52	13,49	1,5	—	—	—	—	149	—	—	—	—	—	3
80	—	—	—	—	—	114,3	6,35	8,74	0,8	133	—	—	—	—	4	—	—	—	—	—
—	—	—	—	—	—	117,48	7,92	11,91	0,8	—	—	—	—	—	—	—	—	—	—	—
—	80 ⁷⁾	80 ⁷⁾	80	—	—	123,82	7,92	11,91	0,8	—	146	—	168	—	—	6	5	4	—	—
—	—	—	—	—	80	127	9,52	13,49	1,5	—	—	—	—	168	—	—	—	—	—	3
—	—	—	—	—	—	131,78	6,35	8,74	0,8	154	—	—	—	—	4	—	—	—	—	—
—	—	—	—	80	—	131,78	7,92	11,91	0,8	—	159	—	168	—	—	6	5	—	3	—
—	—	—	—	—	—	136,52	7,92	11,91	0,8	—	—	—	—	—	—	—	—	—	—	—
100	—	—	—	—	—	149,22	6,35	8,74	0,8	171	—	—	—	—	4	—	—	—	—	—
—	100	100	—	—	—	149,22	7,92	11,91	0,8	—	—	181	—	—	—	6	5	4	—	—
—	—	—	100	—	100	157,18	11,13	16,66	1,5	—	175	—	—	203	—	—	—	—	—	4
—	—	—	—	100	—	161,92	7,92	11,91	0,8	—	—	—	194	—	—	—	—	—	—	—
125	—	—	—	—	—	171,45	6,35	8,74	0,8	194	—	—	—	—	4	—	—	—	3	—
—	—	—	—	—	—	180,98	7,92	11,91	0,8	—	210	—	—	—	—	—	—	—	—	—
—	125	125	125	—	125	180,98	12,7	19,84	1,5	—	219	—	—	241	—	6	5	4	—	4
150	—	—	—	—	—	190,5	6,35	8,74	0,8	219	—	—	—	—	4	—	—	—	—	—
—	—	—	—	125	—	193,68	7,92	11,91	0,8	—	—	—	229	—	—	—	—	—	3	—
—	—	150	150	—	—	193,68	7,92	11,91	0,8	—	241	—	—	—	—	6	5	4	—	—
—	150	—	—	—	—	211,12	7,92	11,91	0,8	—	—	241	—	—	—	—	—	—	—	—

Table 7 (continued)

Dimensions in millimetres

Pipe nominal size DN					Groove dimensions					Diameter of raised portion J					Approximate distance between flanges s							
PN 20	PN 50	PN 110	PN 150 ^{s)}	PN 260	PN 420	Groove number	Pitch diameter P $\pm 0,13$	Depth ^{e)} E $+ 0,4$ 0	Width F $\pm 0,2$	Radius at bottom R max.	PN 20	PN 50 and PN 110	PN 150	PN 260	PN 420	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420	
—	—	—	—	150	—	R46	211,12	9,52	13,49	1,5	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	150	R47	228,6	12,7	19,84	1,5	—	—	—	—	279	—	—	—	—	—	—	—
200	—	—	—	—	—	R48	247,65	6,35	8,74	0,8	273	—	—	—	—	—	—	—	—	—	—	—
—	200	—	—	—	—	R49	269,88	7,92	11,91	0,8	—	—	308	—	—	—	—	—	—	—	—	—
—	—	—	—	200	—	R50	269,88	11,13	16,66	1,5	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	200	R51	279,4	14,27	23,01	1,5	—	—	—	—	—	—	—	—	—	—	—	—
250	—	—	—	—	—	R52	304,8	6,35	8,74	0,8	330	—	—	—	—	—	—	—	—	—	—	—
—	250	—	—	—	—	R53	323,85	7,92	11,91	0,8	—	—	—	—	—	—	—	—	—	—	—	—
—	—	250	—	—	—	R54	323,85	11,13	16,66	1,5	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	250	R55	342,9	17,48	30,18	2,4	—	—	—	—	—	—	—	—	—	—	—	—
300	—	—	—	—	—	R56	381	6,35	8,74	0,8	406	—	—	—	—	—	—	—	—	—	—	—
—	300	—	—	—	—	R57	381	7,92	11,91	0,8	—	—	—	—	—	—	—	—	—	—	—	—
—	—	300	—	—	—	R58	381	14,27	23,01	1,5	—	—	—	—	—	—	—	—	—	—	—	—
350	—	—	—	—	—	R59	396,88	6,35	8,74	0,8	425	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	300	R60	406,4	17,48	33,32	2,4	—	—	—	—	—	—	—	—	—	—	—	—
—	350	—	—	—	—	R61	419,1	7,92	11,91	0,8	—	—	—	—	—	—	—	—	—	—	—	—
—	—	350	—	—	—	R62	419,1	11,13	16,66	1,5	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	R63	419,1	15,88	26,97	2,4	—	—	—	—	—	—	—	—	—	—	—	—
400	—	—	—	—	—	R64	454,02	6,35	8,74	0,8	483	—	—	—	—	—	—	—	—	—	—	—
—	400	—	—	—	—	R65	469,9	7,92	11,91	0,8	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	R66	469,9	11,13	16,66	1,5	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	R67	469,9	17,48	30,18	2,4	—	—	—	—	—	—	—	—	—	—	—	—
450	—	—	—	—	—	R68	517,52	6,35	8,74	0,8	546	—	—	—	—	—	—	—	—	—	—	—
—	450	—	—	—	—	R69	533,4	7,92	11,91	0,8	—	—	—	—	—	—	—	—	—	—	—	—
—	—	450	—	—	—	R70	533,4	12,7	19,84	1,5	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	R71	533,4	17,48	30,18	2,4	—	—	—	—	—	—	—	—	—	—	—	—
500	—	—	—	—	—	R72	558,8	6,35	8,74	0,8	597	—	—	—	—	—	—	—	—	—	—	—
—	500	—	—	—	—	R73	584,2	9,52	13,49	1,5	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	R74	584,2	12,7	19,84	1,5	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	500	R75	584,2	17,48	33,32	2,4	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	R76	673,1	6,35	8,74	0,8	711	—	—	—	—	—	—	—	—	—	—	—
600	—	—	—	—	—	R77	692,15	11,13	16,66	1,5	—	—	—	—	—	—	—	—	—	—	—	—
—	600	—	—	—	—	R78	692,15	15,88	26,97	2,4	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	600	R79	692,15	20,62	36,53	2,4	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—																	

Table 7 (concluded)

Dimensions in millimetres

Pipe nominal size DN				Groove number	Groove dimensions				Diameter of raised portion <i>J</i> min.				Approximate distance between flanges <i>s</i>								
PN 20	PN 50	PN 110	PN 150 ⁵⁾		PN 260	PN 420	Pitch diameter <i>P</i> $\pm 0,13$	Depth ⁶⁾ E $+0,4$ 0	Width <i>F</i> $\pm 0,2$	Radius at bottom <i>R</i> max.	PN 20	PN 50 and PN 110	PN 150	PN 260	PN 420	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420
—	650	—	—	—	—	749,3	12,7	19,85	2	810	—	—	—	—	—	6	—	—	—	—	—
—	—	650	—	—	—	749,3	12,7	19,85	2	810	—	—	—	—	—	—	—	5	—	—	—
—	—	—	650	—	—	749,3	17,46	30,16	2	—	832	—	—	—	—	—	—	—	8	—	—
—	700	—	—	—	—	800,1	12,7	19,85	2	860	—	—	—	—	—	6	—	—	—	—	—
—	—	700	—	—	—	800,1	12,7	19,85	2	860	—	—	—	—	—	—	—	5	—	—	—
—	—	—	700	—	—	800,1	17,46	33,34	2	—	889	—	—	—	—	—	—	—	10	—	—
—	750	—	—	—	—	857,25	12,7	19,85	2	918	—	—	—	—	—	6	—	—	—	—	—
—	—	750	—	—	—	857,25	12,7	19,85	2	918	—	—	—	—	—	—	—	5	—	—	—
—	—	—	750	—	—	857,25	17,46	33,34	2	—	946	—	—	—	—	—	—	—	10	—	—
—	800	—	—	—	—	914,4	14,3	23	2	984	—	—	—	—	—	7	—	—	—	—	—
—	—	800	—	—	—	914,4	14,3	23	2	984	—	—	—	—	—	—	—	6	—	—	—
—	—	—	800	—	—	914,4	17,46	33,34	2	—	1003	—	—	—	—	—	—	—	10	—	—
—	850	—	—	—	—	965,2	14,3	23	2	1035	—	—	—	—	—	7	—	—	—	—	—
—	—	850	—	—	—	965,2	14,3	23	2	1035	—	—	—	—	—	—	—	6	—	—	—
—	—	—	850	—	—	965,2	20,64	36,51	2	—	1067	—	—	—	—	—	—	—	11	—	—
—	900	—	—	—	—	1022,35	14,3	23	2	1092	—	—	—	—	—	7	—	—	—	—	—
—	—	900	—	—	—	1022,35	14,3	23	2	1092	—	—	—	—	—	—	—	6	—	—	—
—	—	—	900	—	—	1022,35	20,64	36,51	2	—	1124	—	—	—	—	—	—	—	11	—	—

1) For facing requirements for flanges and flanged fittings, see figure 6.

2) For facing requirements for lapped joints, see 2.5.4 and figure 6.

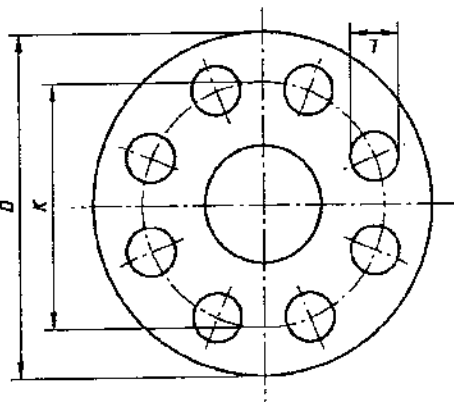
3) For ring dimensions, see ISO 7483.

4) See 2.8 for marking requirements.

5) Use PN 260 in sizes DN 15 to DN 65 for PN 150.

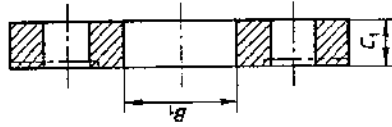
6) Height of raised portion is equal to the depth of groove *E* but is not subject to the tolerance for *E*. The former full-face contour may be used.

7) For ring joints with lapped flanges in PN 50 and PN 110, ring and groove number R30 are used instead of R31.

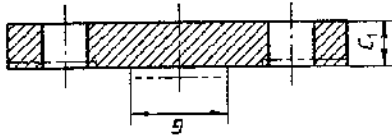


This diagram illustrates the arrangement but not necessarily the correct number of bolt holes. Refer to the column "number of bolts" in table 8 for the actual number.

Type 01



Type 05



Type 11

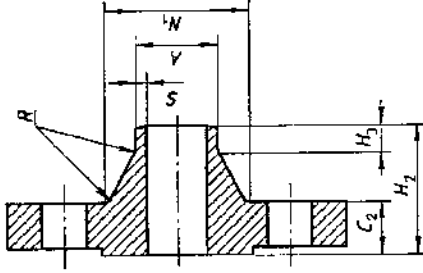


Table 8 — Dimensions of PN 2,5 flanges
(See the notes on page 46.)

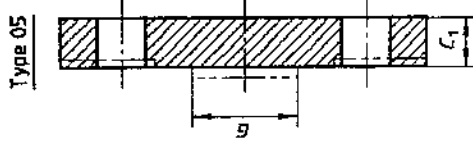
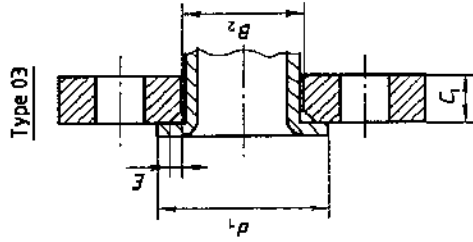
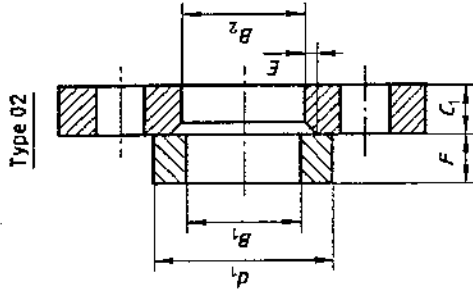
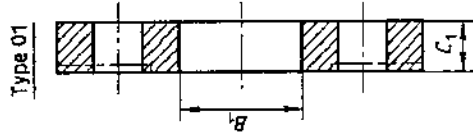
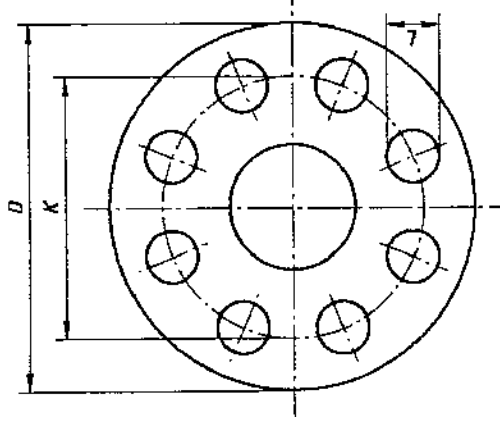
Dimensions in millimetres

Nominal size DN	Mating dimensions						Outside diameter of neck A	Bore diameter B ₁	Flange type			Length of hub H ₂ H ₃	Neck diameter N ₁	Corner radius R	Neck thickness (see note 6) S	Nominal size DN		
	Outside diameter of flange D	Diameter of bolt circle K	Diameter of bolt holes L	Bolts		Flange type			Shoulder diameter G	Neck diameter N ₁	Corner radius R						Neck thickness (see note 6) S	
				Number	Nominal size	01, 05, 11												01, 05, 11
10 to 600			01, 05, 11			11	01	01, 05, 11	05	11	11	11	11	11	10 to 600			
							Use PN 6											
700	860	810	26	24	M24	711		36	—	70	16	740	12	—	700			
800	975	920	29,5	24	M27	813		38	—	70	16	842	12	—	800			
900	1 075	1 020	29,5	24	M27	914		40	—	70	16	942	12	—	900			
1 000	1 175	1 120	29,5	28	M27	1 016		42	—	70	16	1 045	12	—	1 000			
1 200	1 375	1 320	29,5	32	M27	1 220		44	—	70	16	1 245	16	—	1 200			
1 400	1 575	1 520	29,5	36	M27	1 420		48	—	70	16	1 445	16	—	1 400			
1 600	1 790	1 730	29,5	40	M27	1 620		51	—	80	20	1 645	16	—	1 600			
1 800	1 990	1 930	29,5	44	M27	1 820		54	—	80	20	1 845	16	—	1 800			
2 000	2 190	2 130	29,5	48	M27	2 020		58	—	80	22	2 045	16	—	2 000			
2 200	2 405	2 340	32,5	52	M30	2 220		—	—	90	25	2 248	18	—	2 200			
2 400	2 605	2 540	32,5	56	M30	2 420		—	—	90	25	2 448	18	—	2 400			
2 600	2 805	2 740	32,5	60	M30	2 620		—	—	90	25	2 648	18	—	2 600			
2 800	3 030	2 960	35,5	64	M33	2 820		—	—	90	25	2 848	18	—	2 800			
3 000	3 230	3 160	35,5	68	M33	3 020		—	—	90	25	3 050	18	—	3 000			
3 200	3 430	3 360	35,5	72	M33	3 220		—	—	90	25	3 250	20	—	3 200			
3 400	3 630	3 560	35,5	76	M33	3 420		—	—	95	28	3 450	20	—	3 400			
3 600	3 840	3 770	35,5	80	M33	3 620		—	—	100	28	3 652	20	—	3 600			
3 800	4 045	3 970	39	80	M36	3 820		—	—	100	28	3 852	20	—	3 800			
4 000	4 245	4 170	39	84	M36	4 020		—	—	100	28	4 052	20	—	4 000			

To be specified by the purchaser

Use PN 16

NOTE — For facing dimensions, see table 4.



This diagram illustrates the arrangement but not necessarily the correct number of bolt holes. Refer to the column "number of bolts" in Table 9 for the actual number.

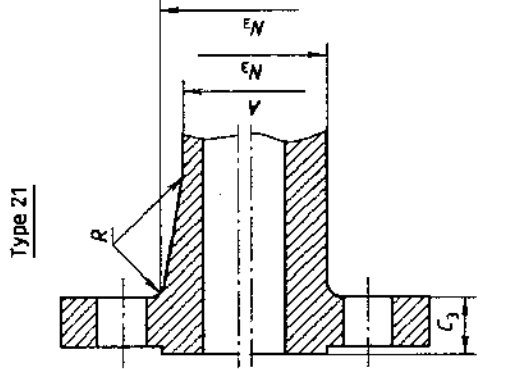
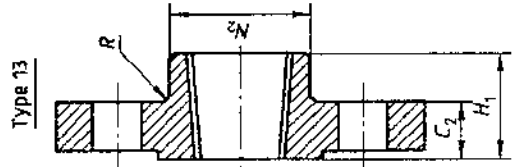
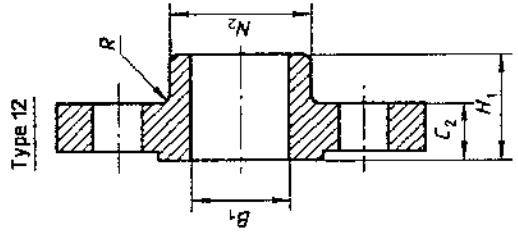
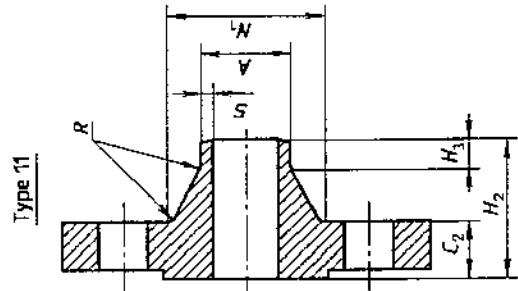


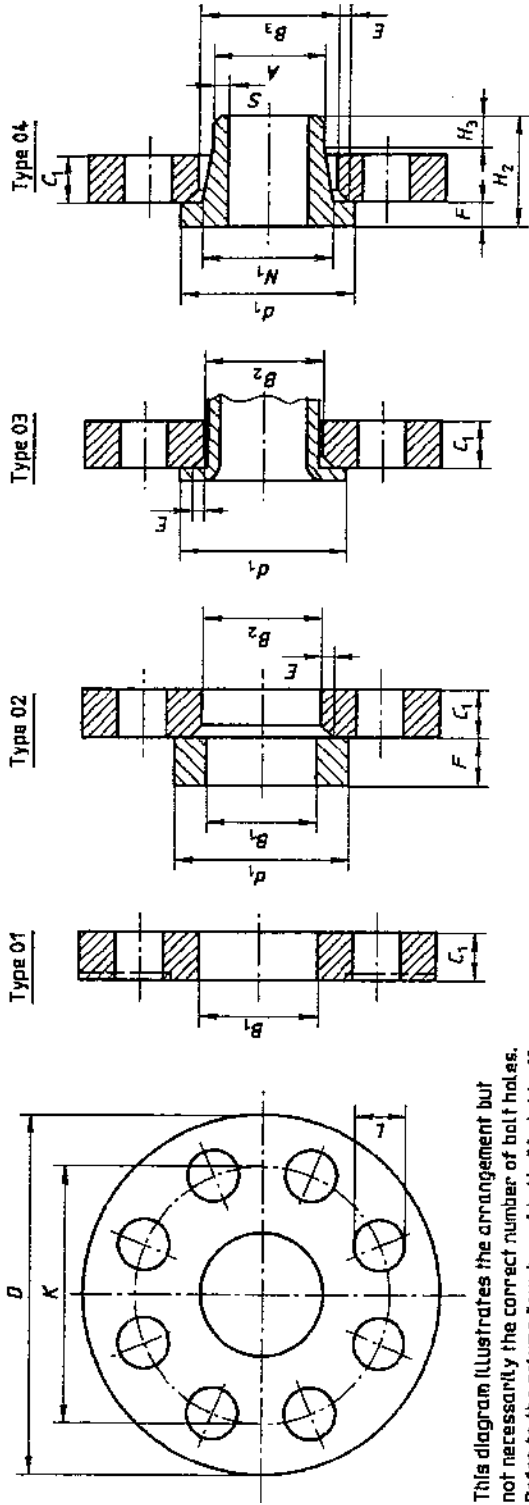
Table 9 — Dimensions of PN 6 flanges
(See the notes on page 46.)

Dimensions in millimetres

Nominal size DN	Mating dimensions			Outside diameter of neck A	Bore diameter		Flange thickness			Chamfer E	Collar thickness F	Shoulder diameter G	Length of hub			Neck diameter			Corner radius R	Neck thickness (see note 6) S	Nominal size DN			
	Outside diameter of flange D	Diameter of bolt circle K	Diameter of bolt holes L		Number	Bolts Nominal size	B ₁	B ₂	C ₁				C ₂	C ₃	H ₁	H ₂	H ₃	N ₁				N ₂	N ₃	
	Flange type																							
	01, 02, 03, 05, 11, 12, 13, 21																							
	11, 21	01, 02, 03	02, 03	01, 02, 03	01, 02, 03	11, 12, 13	02, 03	02	05	12, 13	11	11	12, 13	11	12, 13	21	11, 12, 13, 21	11						
10	75	50	11	4	M10	17,2	18	21	12	12	12	10	—	—	—	20	28	6	26	25	20	3	1,6	10
15	80	55	11	4	M10	21,3	22	25	12	12	12	10	—	—	—	20	30	6	30	30	26	3	1,8	15
20	90	65	11	4	M10	26,9	27,5	31	14	14	14	10	—	—	—	24	32	6	38	40	34	4	1,8	20
25	100	75	11	4	M10	33,7	34,5	38	14	14	14	10	—	—	—	24	35	6	42	50	44	4	2	25
32	120	90	14	4	M12	42,4	43,5	46	16	16	16	10	—	—	—	26	35	6	55	60	54	5	2,3	32
40	130	100	14	4	M12	48,3	49,5	53	16	16	16	10	—	—	—	26	38	7	62	70	64	5	2,3	40
50	140	110	14	4	M12	60,3	61,5	65	16	16	16	12	—	—	—	28	38	8	74	80	74	5	2,3	50
65	160	130	14	4	M12	76,1	77,5	81	16	16	16	12	55	55	32	38	9	88	100	94	6	2,6	65	
80	190	150	18	4	M16	88,9	90,5	94	18	18	18	12	70	70	34	42	10	102	110	110	6	2,9	80	
100	210	170	18	4	M16	114,3	116	120	18	18	18	14	90	90	40	45	10	130	130	130	6	3,2	100	
125	240	200	18	8	M16	139,7	141,5	145	20	20	20	14	115	115	44	48	10	155	160	160	6	3,6	125	
150	265	225	18	8	M16	168,3	170,5	174	20	20	20	14	140	140	44	48	12	184	185	182	8	4	150	
200	320	280	18	8	M16	219,1	221,5	226	22	22	22	16	190	190	—	55	15	236	240	238	8	4,5	200	
250	375	335	18	12	M20	273	276,5	281	24	24	24	18	235	235	60	60	15	290	295	284	10	5	250	
300	440	395	22	12	M20	323,9	327,5	333	24	24	24	18	285	285	62	62	15	342	355	342	10	5,6	300	
350	490	445	22	12	M20	355,6	359,5	365	26	24	24	18	325	325	62	62	15	385	—	392	10	5,6	350	
400	540	495	22	16	M20	406,4	411	416	28	24	24	20	375	375	65	65	15	438	—	442	10	6,3	400	
450	595	550	22	16	M20	457	462	467	30	24	24	20	425	425	65	65	15	492	—	494	12	6,3	450	
500	645	600	22	20	M20	508	513,5	519	32	26	26	22	475	475	68	68	15	538	—	544	12	6,3	500	
600	755	705	26	20	M24	610	616,5	622	36	30	30	22	575	575	70	70	16	640	—	642	12	6,3	600	
700	860	810	26	24	M24	711	—	—	40 ¹⁾	40	26	—	—	—	70	70	16	740	—	746	12	—	700	
800	975	920	29,5	24	M27	813	—	—	44 ¹⁾	44	26	—	—	—	70	70	16	842	—	850	12	—	800	
900	1 075	1 020	29,5	24	M27	914	—	—	48 ¹⁾	48	26	—	—	—	70	70	16	942	—	950	12	—	900	
1 000	1 175	1 120	29,5	28	M27	1 016	—	—	52 ¹⁾	52	26	—	—	—	70	70	16	1 045	—	1 050	12	—	1 000	
1 200	1 405	1 340	32,5	32	M30	1 220	—	—	60 ¹⁾	60	28	—	—	—	90	90	20	1 248	—	1 264	12	—	1 200	
1 400	1 630	1 560	35,5	36	M33	1 420	—	—	68 ¹⁾	68	32	—	—	—	90	90	20	1 452	—	1 480	12	—	1 400	
1 600	1 830	1 760	35,5	40	M33	1 620	—	—	76 ¹⁾	76	34	—	—	—	90	90	20	1 655	—	1 680	12	—	1 600	
1 800	2 045	1 970	39	44	M36	1 820	—	—	84 ¹⁾	84	36	—	—	—	100	100	20	1 855	—	1 878	15	—	1 800	
2 000	2 265	2 180	42	48	M39	2 020	—	—	92 ¹⁾	92	38	—	—	—	110	110	25	2 058	—	2 082	15	—	2 000	
2 200	2 475	2 390	42	52	M39	2 220	—	—	—	—	42	—	—	—	115	115	25	2 260	—	—	15	—	2 200	
2 400	2 685	2 600	42	56	M39	2 420	—	—	—	—	44	—	—	—	125	125	25	2 462	—	—	15	—	2 400	
2 600	2 905	2 810	48	60	M45	2 620	—	—	—	—	46	—	—	—	130	130	25	2 665	—	—	15	—	2 600	
2 800	3 115	3 020	48	64	M45	2 820	—	—	—	—	48	—	—	—	135	135	30	2 865	—	—	15	—	2 800	
3 000	3 315	3 220	48	68	M45	3 020	—	—	—	—	50	—	—	—	140	140	30	3 068	—	—	15	—	3 000	
3 200	3 525	3 430	48	72	M45	3 220	—	—	—	—	54	—	—	—	150	150	30	3 272	—	—	15	—	3 200	
3 400	3 735	3 640	48	76	M45	3 420	—	—	—	—	56	—	—	—	160	160	35	3 475	—	—	15	—	3 400	
3 600	3 970	3 860	55	80	M52	3 620	—	—	—	—	60	—	—	—	165	165	35	3 678	—	—	15	—	3 600	

1) For type 01 flanges only.

NOTE — For *d₁* and facing dimensions, see table 4.



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

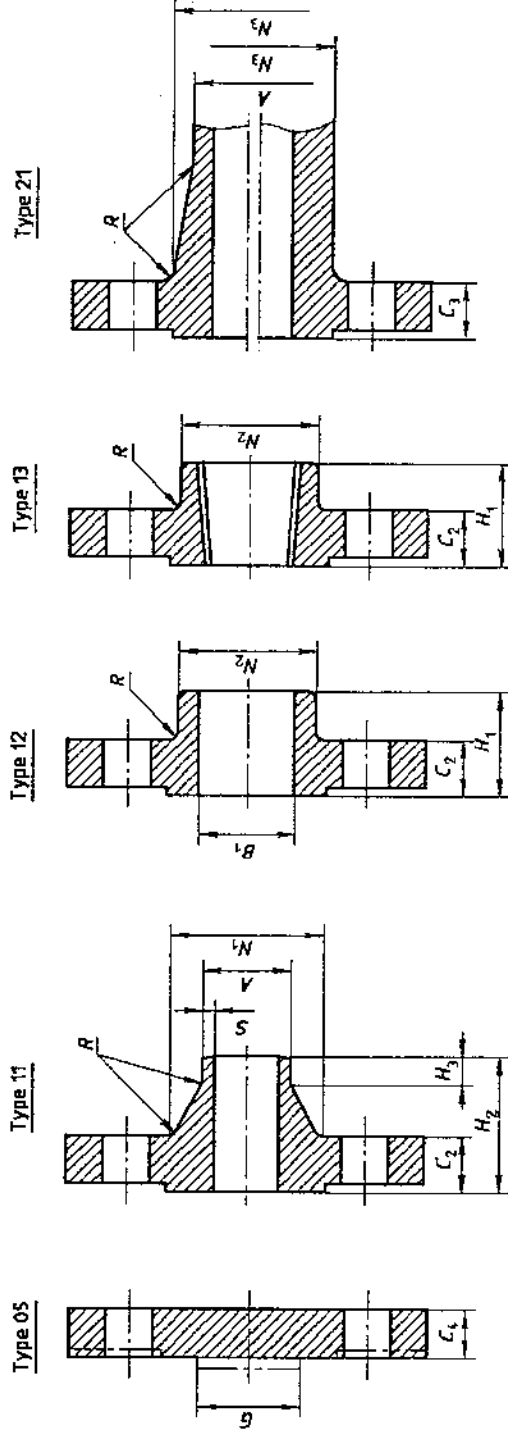


Table 10 — Dimensions of PN 10 flanges
(See the notes on page 46.)

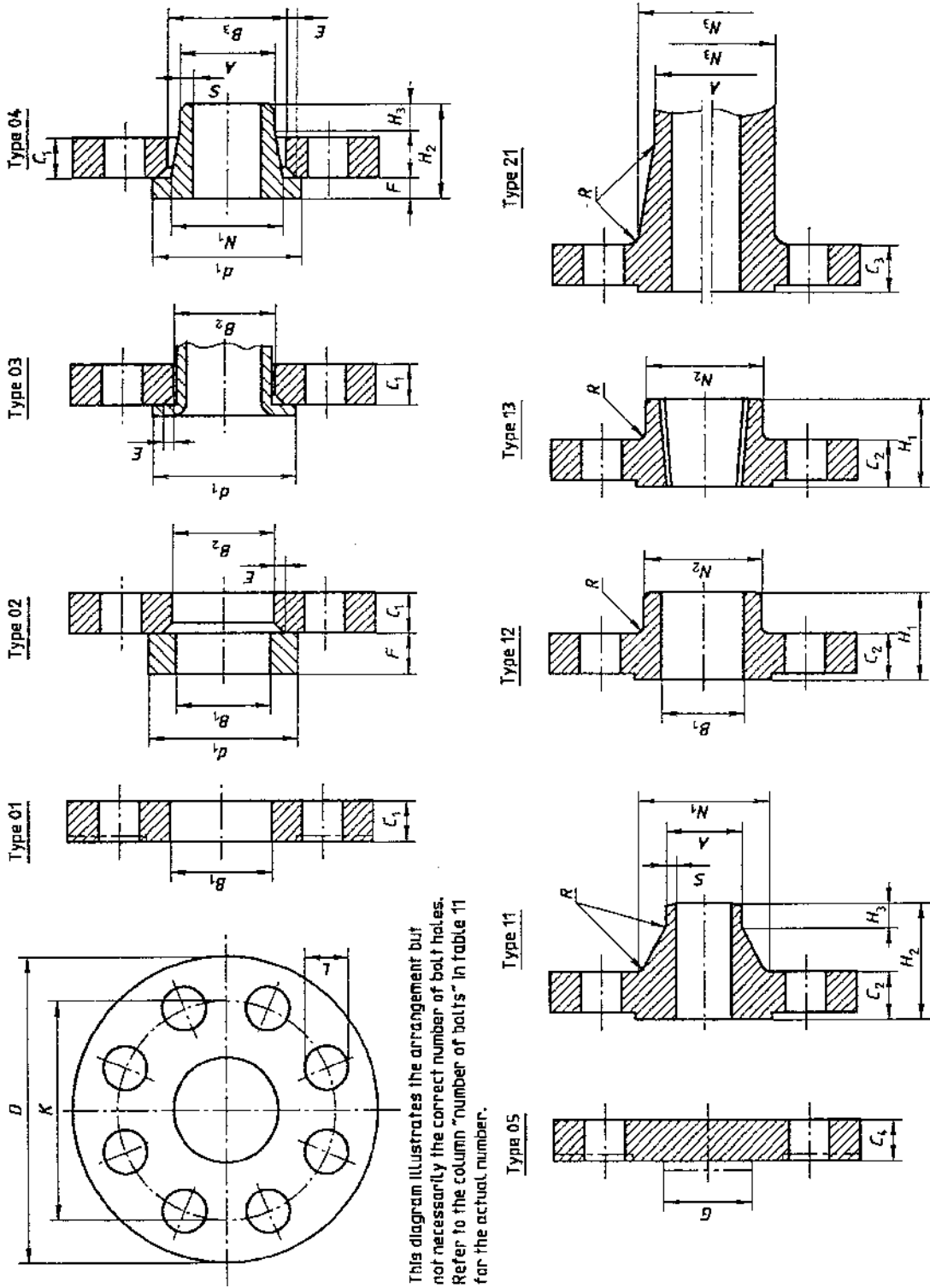
Dimensions in millimetres

Nominal size DN	Mating dimensions				Outside diameter of neck A	Bore diameter			Flange thickness			Chamfer E	Collar thickness F	Shoulder diameter G	Length of hub			Neck diameter			Corner radius R	Neck thickness (see note 6) S	Nominal size DN			
	Outside diameter of flange D	Diameter of bolt circle K	Diameter of bolt holes L	Bolts Number Nominal size		B ₁	B ₂	B ₃	C ₁	C ₂	C ₃				C ₄	H ₁	H ₂	H ₃	N ₁	N ₂				N ₃	11, 12, 13, 21	04, 11
10	340	295	22	8	221,5	226	240	24	24	24	24	6	20	190	44	62	16	234	246	246	8	6,3	200			
15	395	350	22	12	276,5	281	294	26	26	26	26	8	22	235	46	68	16	288	298	298	10	6,3	250			
20	445	400	22	12	327,5	333	348	28	28	28	28	8	22	285	46	68	16	342	350	348	10	7,1	300			
25	505	460	22	16	355,6	365	400	30	26	26	26	8	22	325	53	68	16	390	400	408	10	8	350			
32	565	515	26	16	406,4	411	416	32	28	28	28	8	24	375	57	72	16	440	456	456	10	8,8	400			
40	615	565	26	20	457	467	498	35	28	28	28	8	24	425	63	72	16	488	502	502	12	10	450			
50	670	620	26	20	508	513,5	519	38	28	28	28	8	26	475	67	75	16	540	559	559	12	11	500			
65	780	725	29,5	20	610	616,5	622	42	34	34	34	8	26	575	75	80	18	640	658	658	12	12,5	600			
80	895	840	29,5	24	711	711	711	42	34	34	38	8	—	670	—	80	18	746	—	772	12	—	700			
100	1 015	950	32,5	24	813	813	813	42	36	42	42	—	—	770	90	18	848	—	876	12	—	—	800			
125	1 115	1 050	32,5	28	914	914	914	46	34	38	46	—	—	860	95	20	948	—	976	12	—	—	900			
150	1 230	1 160	35,5	28	1 016	1 016	1 016	52	34	38	52	—	—	960	95	20	1 050	—	1 080	12	—	—	1 000			
200	1 455	1 380	39	32	1 220	1 220	1 220	60	38	44	60	—	—	1 160	115	25	1 256	—	1 292	12	—	—	1 200			
250	1 675	1 590	42	36	1 420	1 420	1 420	—	42	48	—	—	—	—	120	25	1 460	—	1 496	12	—	—	1 400			
300	1 915	1 820	48	40	1 620	1 620	1 620	—	46	52	—	—	—	—	130	25	1 666	—	1 712	12	—	—	1 600			
400	2 115	2 020	48	44	1 820	1 820	1 820	—	50	56	—	—	—	—	140	30	1 866	—	1 910	15	—	—	1 800			
500	2 325	2 230	48	48	2 020	2 020	2 020	—	54	60	—	—	—	—	150	30	2 070	—	2 120	15	—	—	2 000			
600	2 550	2 440	55	52	2 220	2 220	2 220	—	58	—	—	—	—	—	160	35	2 275	—	—	18	—	—	2 200			
800	2 760	2 650	55	56	2 420	2 420	2 420	—	62	—	—	—	—	—	170	35	2 478	—	—	18	—	—	2 400			
1 000	2 960	2 850	55	60	2 620	2 620	2 620	—	66	—	—	—	—	—	180	40	2 680	—	—	18	—	—	2 600			
1 200	3 180	3 070	55	64	2 820	2 820	2 820	—	70	—	—	—	—	—	190	40	2 882	—	—	18	—	—	2 800			
1 400	3 405	3 290	60	68	3 020	3 020	3 020	—	75	—	—	—	—	—	200	45	3 085	—	—	18	—	—	3 000			

Use PN 40

Use PN 16

NOTE — For d_i and facing dimensions, see table 4.



This diagram illustrates the arrangement but not necessarily the correct number of bolt holes. Refer to the column "number of bolts" in table 11 for the actual number.

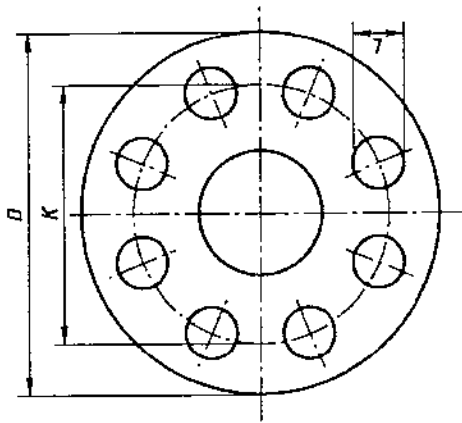
Table 11 — Dimensions of PN 16 flanges
(See the notes on page 46.)

Dimensions in millimetres

Nominal size DN	Mating dimensions					Outside diameter of neck A	Bore diameter			Flange thickness			Chamfer E	Collar thickness F	Shoulder diameter G	Length of hub			Neck diameter			Corner radius R	Neck thickness (see note 6) S	Nominal size DN			
	Outside diameter of flange D	Diameter of bolt circle K	Diameter of bolt holes L	Number of bolts	Nominal size		B ₁	B ₂	B ₃	C ₁	C ₂	C ₃				C ₄	H ₁	H ₂	H ₃	N ₁	N ₂				N ₃	11, 12, 13, 21	04, 11
10	185	145	18	8	M16	77,5	81	96	20	20	20	20	6	16	55	32	45	10	92	104	104	6	2,9	65			
15	200	160	18	8	M16	90,5	94	114	20	20	20	20	6	16	70	34	50	10	110	118	120	6	3,2	80			
20	220	180	18	8	M16	116	120	134	22	22	22	22	6	18	90	40	52	12	130	140	140	6	3,6	100			
25	250	210	18	8	M16	139,7	141,5	145	22	22	22	22	6	18	115	44	55	12	158	168	170	6	4	125			
32	285	240	22	8	M20	168,3	170,5	174	24	24	24	24	6	20	140	44	55	12	184	195	190	8	4,5	150			
40	340	295	22	12	M20	219,1	221,5	226	24	24	24	24	6	20	190	44	62	16	234	246	246	8	6,3	200			
50	405	355	26	12	M24	273	276,5	281	28	26	26	26	8	22	235	46	70	16	288	298	296	10	6,3	250			
65	460	410	26	12	M24	323,9	327,5	333	32	28	28	28	8	24	285	53	78	16	342	350	350	10	7,1	300			
80	520	470	26	16	M24	355,6	359	365	35	30	30	30	8	26	325	57	82	16	390	400	410	10	8	350			
100	580	525	29,5	16	M27	406,4	411	416	40	32	32	32	8	28	375	63	85	16	444	456	458	10	8,8	400			
125	640	585	29,5	20	M27	457	462	467	42	40	40	40	8	30	425	68	87	16	490	502	516	12	10	450			
150	715	650	32,5	20	M30	508	513,5	510	46	44	44	44	8	32	475	73	90	16	546	559	576	12	11	500			
200	840	770	35,5	20	M33	610	616,5	622	52	54	54	54	8	32	575	83	95	18	650	658	690	12	12,5	600			
250	910	840	35,5	24	M33	711	—	—	60 ¹⁾	38	40	48	—	—	670	—	100	18	750	—	760	12	—	700			
300	1 025	950	39	24	M36	813	—	—	68 ¹⁾	38	42	52	—	—	770	—	105	20	848	—	862	12	—	800			
400	1 125	1 050	39	28	M36	914	—	—	76 ¹⁾	40	44	58	—	—	860	—	110	20	948	—	962	12	—	900			
500	1 255	1 170	42	28	M39	1 016	—	—	84 ¹⁾	42	46	64	—	—	960	—	120	22	1 056	—	1 076	12	—	1 000			
600	1 485	1 390	48	32	M45	1 220	—	—	98 ¹⁾	48	52	76	—	—	1 160	—	130	30	1 260	—	1 282	12	—	1 200			
800	1 685	1 590	48	36	M45	1 420	—	—	—	52	58	—	—	—	—	—	145	30	1 465	—	1 482	12	—	1 400			
1 000	1 930	1 820	55	40	M52	1 620	—	—	—	64	64	—	—	—	—	—	160	35	1 668	—	1 696	12	—	1 600			
1 200	2 130	2 020	55	44	M52	1 820	—	—	—	68	68	—	—	—	—	—	170	35	1 870	—	1 896	15	—	1 800			
1 400	2 345	2 230	60	48	M56	2 020	—	—	—	70	70	—	—	—	—	—	190	40	2 072	—	2 100	15	—	2 000			

1) For type 01 flanges only.

NOTE — For *d*₁ and facing dimensions, see table 4.



This diagram illustrates the arrangement but not necessarily the correct number of bolt holes. Refer to the column "number of bolts" in Table 12 for the actual number.

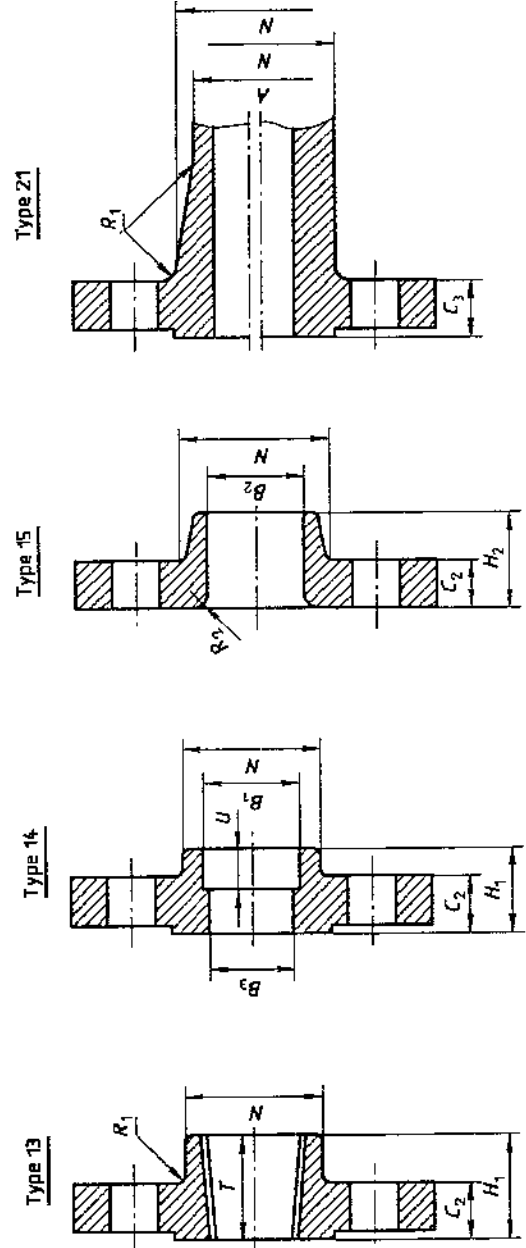
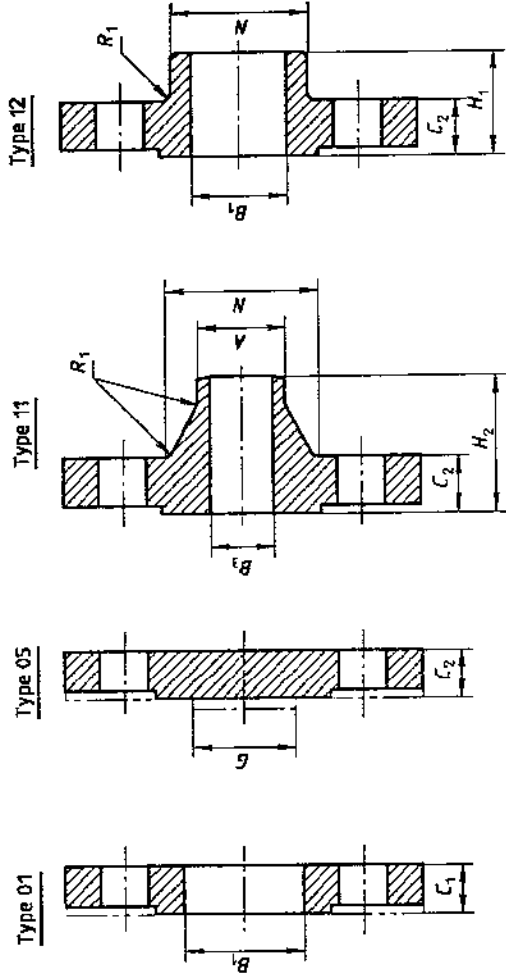
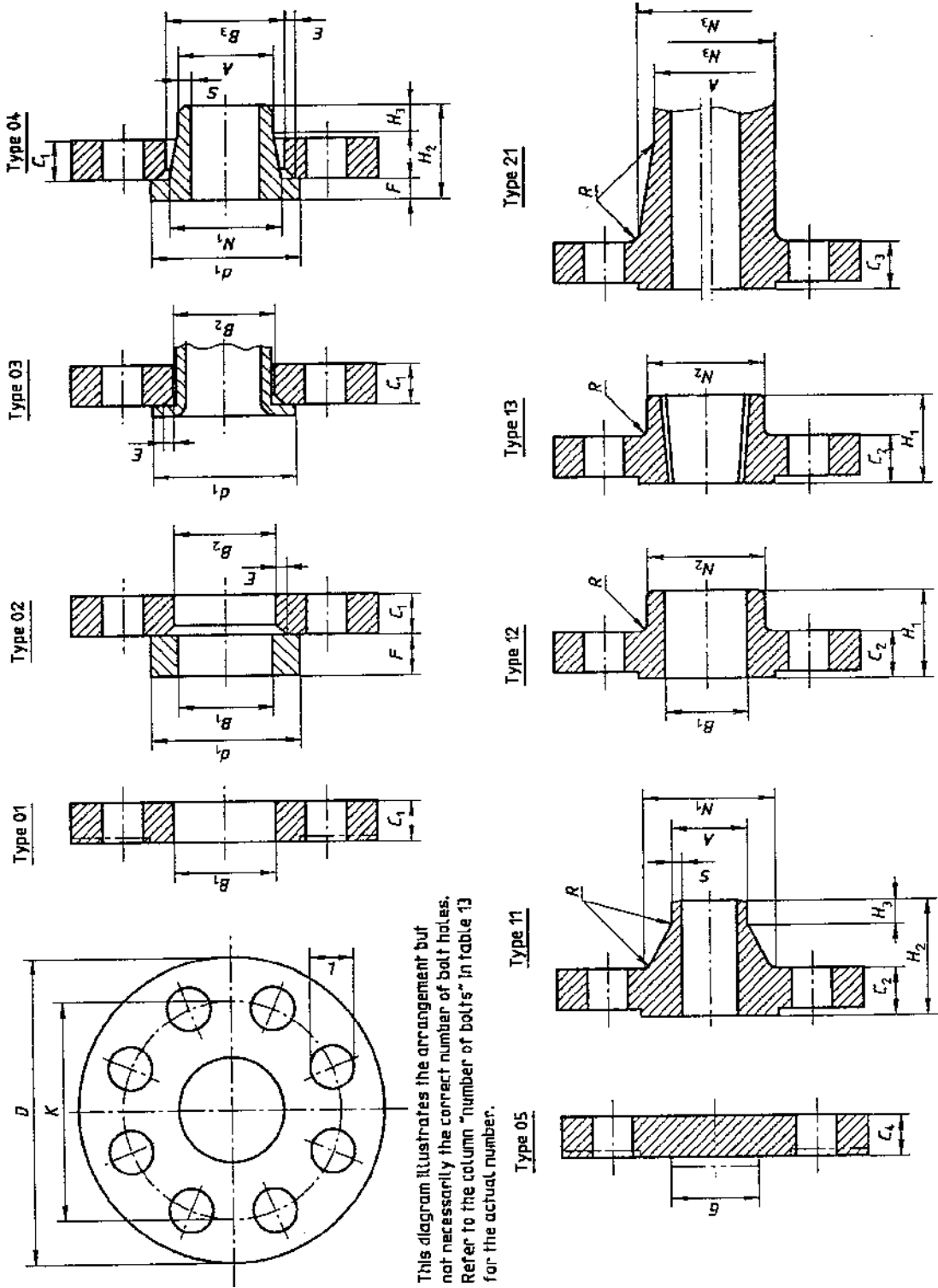


Table 12 — Dimensions of PN 20 flanges
(See the notes on page 46.)

Dimensions in millimetres

Nominal size	Mating dimensions				Bore diameter			Flange thickness			Shoulder diameter	Length of hub			Neck diameter	Corner radius		Minimum thread length of threaded flange (see note 5)	Depth of socket	Nominal size							
	DN	D	K	L	Number	Nominal size	A	B ₁	B ₂	B ₃		C ₁	C ₂	C ₃		G	H ₁				H ₂	N	R ₁	R ₂	T	U	DN
15	90	60,5	16	4	M14	21,5	22	23	16	11, 14	12	13	21	05	15	11	30	11, 12, 13, 21	15	13	13	14	15				
20	100	70	16	4	M14	26,5	28	28	21	11, 14	16	16	—	—	16	16	38	—	—	16	16	10	15	15			
25	110	79,5	16	4	M14	33,5	34,5	35	26,5	11, 14	17	17	14,5	—	17	56	49	—	—	17	17	11	15	20			
32	120	89	16	4	M14	42	43,5	43,5	35	11, 14	18	18	13	—	21	57	59	11,5	13, 21	5	21	13	15	25			
40	130	98,5	16	4	M14	48,5	49,5	50	41	11, 14	19	19	17,5	—	22	62	65	14,5	13, 21	6	22	16	15	32			
50	150	120,5	18	4	M16	60,5	62	62,5	52,5	11, 14	21	21	19,5	—	25	64	78	16	13, 21	8	25	17	15	40			
65	180	139,5	18	4	M16	73	74,5	75,5	62,5	11, 14	24	24	22,5	38	29	70	90	17,5	13, 21	8	29	19	15	50			
80	190	152,5	18	4	M16	89	90,5	91,5	78	11, 14	26	26	24	51	30	80	108	19,5	13, 21	10	30	21	15	65			
100	230	190,5	18	8	M16	114,5	117	117	102,5	11, 14	27	27	24	76	33	76	135	24	13, 21	11	33	33	15	100			
125	255	216	22	8	M20	141,5	143,5	144,5	128	11, 14	28	28	24	102	36	89	164	24	13, 21	11	36	36	15	125			
150	280	241,5	22	8	M20	168,5	170,5	171,5	154	11, 14	31	31	25,5	127	40	89	192	25,5	13, 21	13	40	40	15	150			
200	345	298,5	22	8	M20	219	221,5	222	202,5	11, 14	34	34	29	200	44	102	246	29	13, 21	13	44	44	15	200			
250	405	362	26	12	M24	273	276	277,5	254,5	11, 14	38	38	30,5	225	49	102	305	30,5	13, 21	13	49	49	15	250			
300	485	432	26	12	M24	324	327	328	305	11, 14	42	42	32	279	56	114	365	32	13, 21	13	56	56	15	300			
350	535	476	29,5	12	M27	355,5	359	360	328	11, 14	43	43	35	311	57	127	400	35	13, 21	13	57	57	15	350			
400	600	540	29,5	16	M27	406,5	410,5	411	—	11, 14	48	48	37	362	64	127	457	37	13, 21	13	64	64	15	400			
450	635	578	32,5	16	M30	457	462	462,5	—	11, 14	52	52	40	413	68	140	505	40	13, 21	13	68	68	15	450			
500	700	635	32,5	20	M30	508	513	514,5	—	11, 14	56	56	43	463	73	103	559	43	13, 21	13	73	73	15	500			
550	750	692	35,5	20	M33	—	—	—	—	11, 14	62	62	46	—	—	149	610	46	13, 21	13	—	—	15	550			
600	815	749,5	35,5	20	M33	609,5	616	616	—	11, 14	62	62	48	565	83	152	664	48	13, 21	13	83	83	15	600			
Flange types affected for DN 650 and above are types 05 and 11 only.																											
650	870	806	35,5	24	M33	—	—	—	—	11, 14	68,5	68,5	—	—	—	121	675	—	13, 21	13	—	—	15	650			
700	925	863	35,5	28	M33	—	—	—	—	11, 14	71,5	71,5	—	—	—	137	725	—	13, 21	13	—	—	15	700			
750	985	914	35,5	28	M33	—	—	—	—	11, 14	74,5	74,5	—	—	—	144	780	—	13, 21	13	—	—	15	750			
800	1 060	978	42	28	M39	—	—	—	—	11, 14	81	81	—	—	—	149	830	—	13, 21	13	—	—	15	800			
850	1 110	1 029	42	32	M39	—	—	—	—	11, 14	82,5	82,5	—	—	—	157	880	—	13, 21	13	—	—	15	850			
900	1 170	1 086	42	32	M39	—	—	—	—	11, 14	90,5	90,5	—	—	—	157	935	—	13, 21	13	—	—	15	900			
950	1 240	1 150	42	32	M39	—	—	—	—	11, 14	87,5	87,5	—	—	—	164	990	—	13, 21	13	—	—	15	950			
1 000	1 290	1 200	42	36	M39	—	—	—	—	11, 14	90,5	90,5	—	—	—	171	1 040	—	13, 21	13	—	—	15	1 000			
1 050	1 345	1 257	42	36	M39	—	—	—	—	11, 14	97,5	97,5	—	—	—	178	1 090	—	13, 21	13	—	—	15	1 050			
1 100	1 405	1 314	42	40	M39	—	—	—	—	11, 14	102	102	—	—	—	186	1 145	—	13, 21	13	—	—	15	1 100			
1 150	1 455	1 365	42	40	M39	—	—	—	—	11, 14	103	103	—	—	—	188	1 195	—	13, 21	13	—	—	15	1 150			
1 200	1 510	1 422	42	44	M39	—	—	—	—	11, 14	108	108	—	—	—	192	1 250	—	13, 21	13	—	—	15	1 200			
1 300	1 570	1 480	48	44	M45	—	—	—	—	11, 14	111	111	—	—	—	203	1 300	—	13, 21	13	—	—	15	1 300			
1 350	1 625	1 537	48	44	M45	—	—	—	—	11, 14	116	116	—	—	—	210	1 355	—	13, 21	13	—	—	15	1 350			
1 400	1 685	1 594	48	44	M45	—	—	—	—	11, 14	121	121	—	—	—	216	1 405	—	13, 21	13	—	—	15	1 400			
1 450	1 745	1 651	48	48	M45	—	—	—	—	11, 14	124	124	—	—	—	229	1 455	—	13, 21	13	—	—	15	1 450			
1 500	1 805	1 708	48	48	M45	—	—	—	—	11, 14	129	129	—	—	—	235	1 510	—	13, 21	13	—	—	15	1 500			
1 500	1 855	1 759	48	52	M45	—	—	—	—	11, 14	132	132	—	—	—	240	1 560	—	13, 21	13	—	—	15	1 500			

NOTE — For facing dimensions, see tables 5, 6 and 7.



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

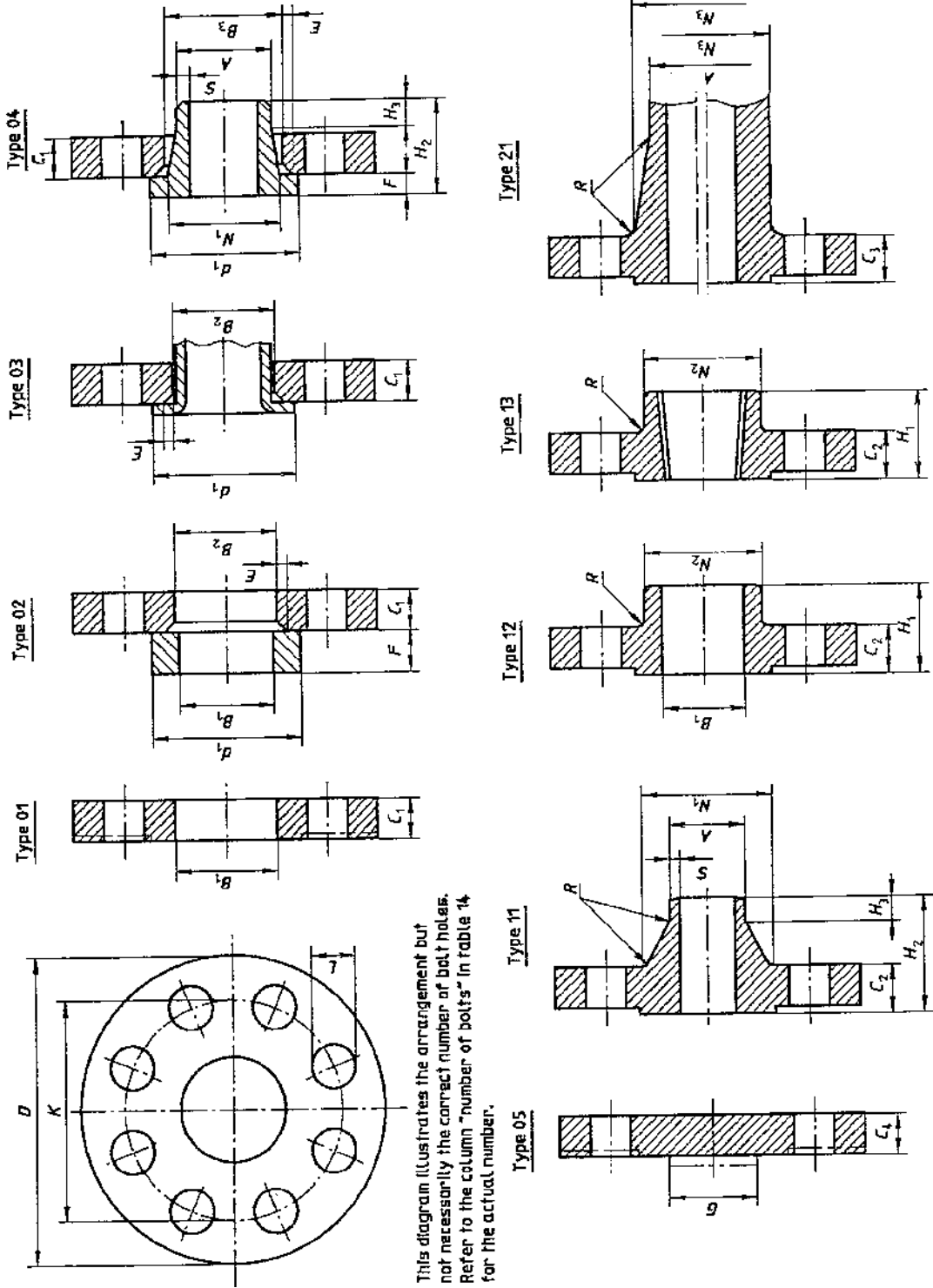
Table 13 — Dimensions of PN 25 flanges
(See the notes on page 46.)

Dimensions in millimetres

Nominal size DN	Mating dimensions					Outside diameter of neck A	Bore diameter				Flange thickness				Chamfer E	Collar thickness F	Shoulder diameter G	Length of hub			Neck diameter N ₁ N ₂ N ₃	Corner radius R	Neck thickness (see note 6) S	Nominal size DN					
	Outside diameter of flange D	Diameter of bolt circle K	Diameter of bolt holes L	Bolts Number	Nominal size		B ₁	B ₂	B ₂	B ₂	C ₁	C ₂	C ₃	C ₄				H ₁	H ₂	H ₃					N ₁	N ₂	N ₃	11, 12, 13, 21	04, 11
10	360	310	26	12	M24	221,5	226	250	32	30	30	30	30	52	80	16	244	256	252	8	6,3	200							
15	425	370	29,5	12	M27	276,5	281	302	35	32	32	32	32	60	88	18	296	310	304	10	6,3	250							
20	485	430	29,5	16	M27	327,5	333	356	38	34	34	34	34	67	92	18	350	364	364	10	7,1	300							
25	555	490	32,5	16	M30	359,5	365	408	42	38	38	38	38	72	100	20	398	418	418	10	8	350							
32	620	550	35,5	16	M33	411	416	462	46	40	40	40	40	78	110	20	452	472	472	10	8,8	400							
40	670	600	35,5	20	M33	462	467	510	50	46	46	46	46	84	110	20	500	520	520	12	10	450							
50	730	660	35,5	20	M36	513,5	519	568	56	48	48	48	48	90	125	20	558	580	580	12	11	500							
65	845	770	39	20	M36	616,5	622	670	68	58	58	58	58	100	125	20	660	684	684	12	12,5	600							
80	960	875	42	24	M39	—	—	—	—	46	50	—	—	125	20	20	760	780	780	12	—	700							
100	1 085	990	48	24	M45	—	—	—	—	50	54	—	—	135	22	22	864	—	882	12	—	800							
125	1 185	1 090	48	28	M45	—	—	—	—	54	58	—	—	145	24	24	968	—	982	12	—	900							
150	1 320	1 210	55	28	M52	—	—	—	—	58	62	—	—	155	24	24	1 070	—	1 086	12	—	1 000							
200	1 530	1 420	55	32	M52	—	—	—	—	70	—	—	—	—	—	—	—	—	1 296	12	—	1 200							
250	1 755	1 640	60	36	M56	—	—	—	—	76	—	—	—	—	—	—	—	—	1 508	12	—	1 400							
300	1 975	1 860	60	40	M56	—	—	—	—	84	—	—	—	—	—	—	—	—	1 726	12	—	1 600							
400	2 195	2 070	68	44	M64	—	—	—	—	90	—	—	—	—	—	—	—	—	1 920	15	—	1 800							
450	2 425	2 300	68	48	M64	—	—	—	—	96	—	—	—	—	—	—	—	—	2 150	15	—	2 000							

Use PN 40

NOTE — For d₁ and facing dimensions, see table 4.



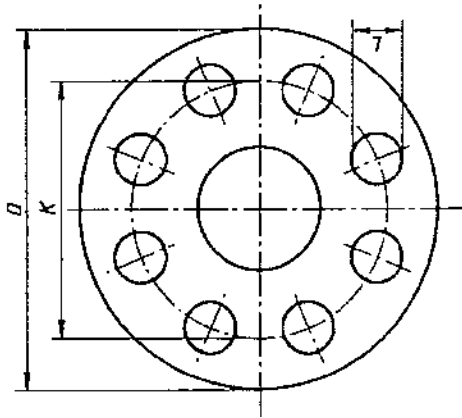
This diagram illustrates the arrangement but not necessarily the correct number of bolt holes. Refer to the column "number of bolts" in table 14 for the actual number.

Table 14 — Dimensions of PN 40 flanges
(See the notes on page 46.)

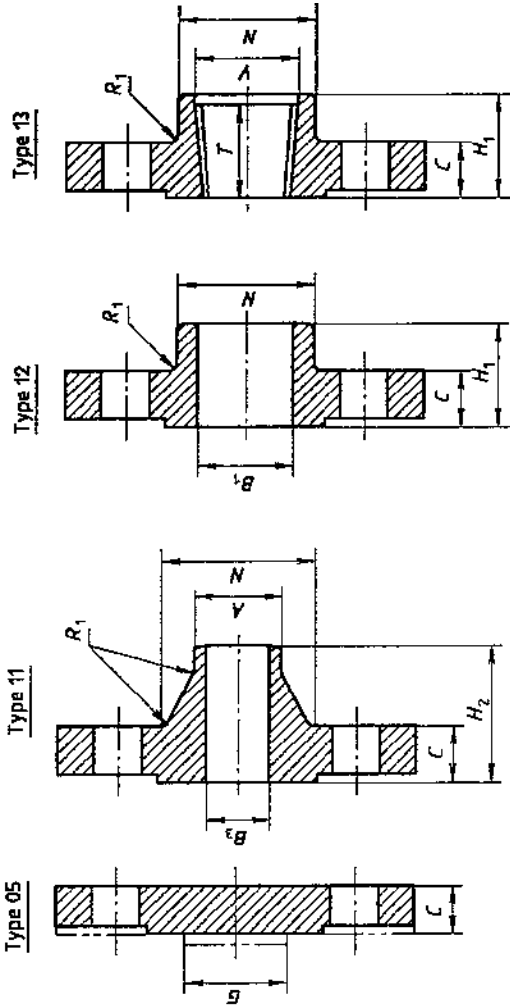
Dimensions in millimetres

Nominal size DN	Mating dimensions				Outside diameter of neck A	Bore diameter		Flange thickness				Chamfer E	Collar thickness F	Shoulder diameter G	Length of hub			Neck diameter			Corner radius R	Neck thickness (see note 6) S	Nominal size DN
	Outside diameter of flange D	Diameter of bolt circle K	Diameter of bolt holes L	Number Bolts Nominal size		B ₁	B ₂	B ₃	C ₁	C ₂	C ₃				C ₄	H ₁	H ₂	H ₃	N ₁	N ₂			
	01, 02, 03, 04, 05, 11, 12, 13, 21				04, 11, 21	01, 02, 03, 12	04	01, 02, 03, 04	02, 04	05	12, 13	04, 11	04, 11	12, 13	04, 11	11, 12, 13, 21	04, 11						
10	90	60	14	4	M12	18	21	31	14	14	14	12	12	—	22	35	6	28	30	28	3	2,3	10
15	95	65	14	4	M12	22	25	35	14	14	14	12	12	—	22	38	6	32	35	32	3	3,2	15
20	105	75	14	4	M12	27,5	31	42	16	16	16	14	14	—	26	40	6	40	45	40	4	3,2	20
25	115	85	14	4	M12	33,7	38	49	16	16	16	14	14	—	28	40	6	46	52	50	4	3,2	25
32	140	100	18	4	M16	42,4	43,5	47	18	18	18	14	14	—	30	42	6	56	60	60	5	3,6	32
40	150	110	18	4	M16	48,3	49,5	53	18	18	18	14	14	—	32	45	7	64	70	70	5	3,6	40
50	165	125	18	4	M16	60,3	61,5	65	20	20	20	16	16	—	34	48	8	74	84	84	5	4	50
65	185	145	18	8	M16	76,1	77,5	81	22	22	22	16	16	55	38	52	10	92	104	104	6	5	65
80	200	160	18	8	M16	88,9	90,5	94	24	24	24	18	18	70	40	58	12	110	120	120	6	5,6	80
100	235	190	22	8	M20	114,3	120	138	24	24	24	20	20	90	44	65	12	134	145	142	6	6,3	100
125	270	220	26	8	M24	139,7	141,5	145	26	26	26	22	22	115	48	68	12	162	170	162	6	6,3	125
150	300	250	26	8	M24	168,3	170,5	174	28	28	28	24	24	140	52	75	12	190	200	192	8	7,1	150
200	375	320	29,5	12	M27	219,1	221,5	226	36	34	34	28	28	190	—	88	16	244	—	254	8	8	200
250	450	385	32,5	12	M30	273	276,5	281	42	42	42	30	30	235	—	105	18	306	312	312	10	10	250
300	515	450	32,5	16	M30	323,9	327,5	333	48	48	48	34	34	285	—	115	18	362	—	378	10	10	300
350	580	510	35,5	16	M33	355,6	359,5	365	55	55	55	36	36	325	—	125	20	408	—	432	10	11	350
400	660	585	39	16	M36	406,4	411	416	60	60	60	42	42	375	—	135	20	462	—	498	10	12,5	400
450	685	610	39	20	M36	457	462	467	66	66	66	46	46	425	—	135	20	500	—	522	12	14,2	450
500	755	670	42	20	M39	508	513,5	519	72	72	72	50	50	475	—	140	20	562	—	576	12	16	500
600	890	795	48	20	M45	610	616,5	622	84	84	84	54	54	575	—	150	20	666	—	686	12	17,5	600

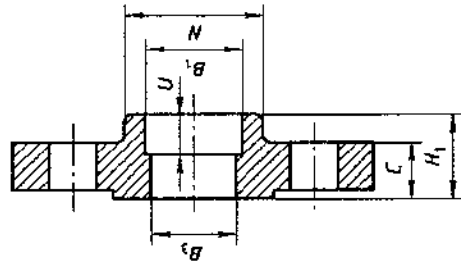
NOTE — For d₁ and facing dimensions, see table 4.



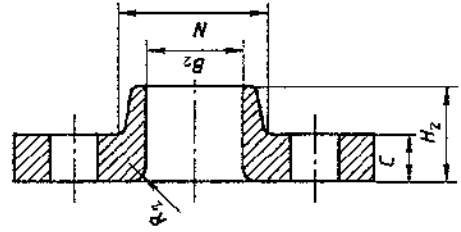
This diagram illustrates the arrangement but not necessarily the correct number of bolt holes. Refer to the column "number of bolts" in table 15 for the actual number.



Type 14



Type 15



Type 21

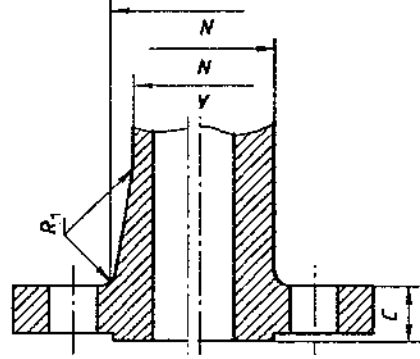
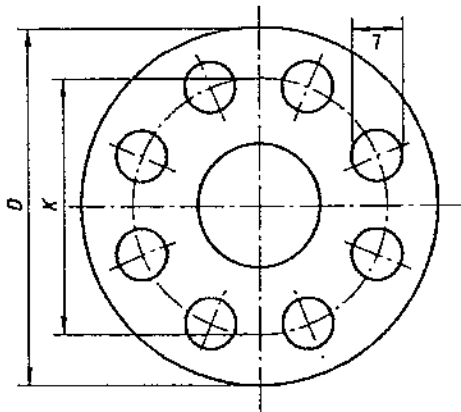


Table 15 — Dimensions of PN 50 flanges
(See the notes on page 46.)

Dimensions in millimetres

Nominal size	Mating dimensions				Outside diameter of neck (see note 7)	Bore diameter			Flange thickness (see note 9)	Shoulder diameter	Length of hub		Neck diameter	Corner radius		Mini- mum thread length of flange (see note 5)	Depth of socket threaded flange	Mini- mum diameter of counter- bore threaded flange	Nominal size										
	Outside diameter of flange	Diameter of bolt circle	Diameter of bolt holes	Number		Nominal size	A	B ₁			B ₂	B ₃		C	G					H ₁	H ₂	N	R ₁	R ₂	T	U	V	DN	
																													D
DN	Flange type																												
	05, 11, 12, 13, 14, 15, 21																												
15	95	66,5	16	4	M14	11, 21	12, 14	15	11, 14	05, 11, 12, 13, 14, 15, 21	05	12, 13, 14	15	11	11, 12, 13, 14, 15, 21	15	13	14	13	15	11, 12, 13, 21	38	—	3	16	10	24	15	
20	120	82,5	18	4	M16	21,5	22	23	16	14,5	—	—	22	25	57	22	25	25	25	25	25	25	48	—	3	16	11	29	20
25	125	89	18	4	M16	33,5	34,5	35	26,5	17,5	—	—	27	27	62	27	27	27	27	27	27	54	—	3	18	13	36	25	
32	135	98,5	18	4	M16	42	43,5	43,5	35	19,5	—	—	27	27	65	27	27	27	27	27	27	64	—	5	21	14	45	32	
40	155	114,5	22	4	M20	48,5	49,5	50	41	21	—	—	30	30	68	30	30	30	30	30	30	70	—	6	22	16	51	40	
50	165	127	18	8	M16	60,5	62	62,5	52,5	22,5	—	—	33	33	70	33	33	33	33	33	33	84	—	8	29	17	64	50	
65	190	149	22	8	M20	73	74,5	75,5	62,5	25,5	—	—	38	38	76	38	38	38	38	38	38	100	—	8	32	19	76	65	
80	210	168,5	22	8	M20	89	90,5	91,5	78	29	—	—	43	43	79	43	43	43	43	43	43	118	—	10	32	21	92	80	
100	255	200	22	8	M20	114,5	116	117	102,5	32	—	—	48	48	86	48	48	48	48	48	48	146	—	11	37	—	118	100	
125	280	235	22	8	M20	141,5	143,5	144,5	128	35	—	—	51	51	98	51	51	51	51	51	51	178	—	11	43	—	146,5	125	
150	320	270	22	12	M20	168,5	170,5	171,5	154	37	—	—	52	52	98	52	52	52	52	52	52	206	—	13	46	—	171,5	150	
200	380	330	26	12	M24	219	221,5	222	202,5	41,5	—	—	62	62	111	62	62	62	62	62	62	260	—	—	51	—	222,5	200	
250	445	387,5	29,5	16	M27	273	276	277,5	254,5	48	—	—	67	67	130	67	67	67	67	67	67	321	—	—	56	—	276,5	250	
300	520	451	32,5	16	M30	324	327	328	305	51	—	—	73	73	130	73	73	73	73	73	73	375	—	10	61	—	329	300	
350	585	514,5	32,5	20	M30	355,5	359	360	—	54	—	—	76	76	143	76	76	76	76	76	76	426	—	10	64	—	360,5	350	
400	650	571,5	35,5	20	M33	406,5	410,5	411	—	57,5	—	—	83	83	146	83	83	83	83	83	83	483	—	10	68	—	411	400	
450	710	628,5	35,5	24	M33	457	462	462,5	—	60,5	—	—	89	89	159	89	89	89	89	89	89	533	—	10	70	—	462	450	
500	775	686	35,5	24	M33	508	513	514,5	—	63,5	—	—	95	95	162	95	95	95	95	95	95	587	—	10	73	—	513	500	
550	840	743	42	24	M39	559	—	—	—	66,5	—	—	—	—	165	—	—	—	—	—	—	640	—	10	—	—	550		
600	915	813	42	24	M39	609,5	616	616	—	70	—	—	104	104	168	104	104	104	104	104	104	702	—	10	83	—	614,5	600	
Flange types affected for DN 650 and above are types 05 and 11 only.																													
650	970	876	45	28	M42	—	—	—	—	84	—	—	—	184	720	—	—	—	—	—	—	—	—	10	—	—	—	650	
700	1 035	940	45	28	M42	—	—	—	—	84	—	—	—	184	775	—	—	—	—	—	—	—	—	11	—	—	—	700	
750	1 090	997	48	28	M45	—	—	—	—	85,5	—	—	—	197	825	—	—	—	—	—	—	—	—	11	—	—	—	750	
800	1 150	1 054	51	28	M48	—	—	—	—	90,5	—	—	—	210	880	—	—	—	—	—	—	—	—	11	—	—	—	800	
850	1 205	1 105	51	28	M48	—	—	—	—	92	—	—	—	222	935	—	—	—	—	—	—	—	—	13	—	—	—	850	
900	1 270	1 168	55	32	M52	—	—	—	—	98,5	—	—	—	232	990	—	—	—	—	—	—	—	—	13	—	—	—	900	
950	1 170	1 092	42	32	M39	—	—	—	—	102	—	—	—	241	995	—	—	—	—	—	—	—	—	13	—	—	—	950	
1 000	1 240	1 156	45	32	M42	—	—	—	—	105	—	—	—	181	1 050	—	—	—	—	—	—	—	—	13	—	—	—	1 000	
1 050	1 290	1 206	45	32	M42	—	—	—	—	108	—	—	—	194	1 100	—	—	—	—	—	—	—	—	13	—	—	—	1 050	
1 100	1 355	1 264	48	32	M45	—	—	—	—	111	—	—	—	206	1 150	—	—	—	—	—	—	—	—	13	—	—	—	1 100	
1 150	1 415	1 321	51	28	M48	—	—	—	—	114	—	—	—	216	1 205	—	—	—	—	—	—	—	—	13	—	—	—	1 150	
1 200	1 465	1 372	51	32	M48	—	—	—	—	119	—	—	—	224	1 255	—	—	—	—	—	—	—	—	13	—	—	—	1 200	
1 250	1 530	1 429	55	32	M52	—	—	—	—	124	—	—	—	232	1 305	—	—	—	—	—	—	—	—	13	—	—	—	1 250	
1 300	1 580	1 480	55	32	M52	—	—	—	—	129	—	—	—	238	1 355	—	—	—	—	—	—	—	—	13	—	—	—	1 300	
1 350	1 660	1 549	60	28	M56	—	—	—	—	133	—	—	—	252	1 410	—	—	—	—	—	—	—	—	13	—	—	—	1 350	
1 400	1 710	1 600	60	28	M56	—	—	—	—	140	—	—	—	260	1 465	—	—	—	—	—	—	—	—	13	—	—	—	1 400	
1 450	1 760	1 651	60	32	M56	—	—	—	—	144	—	—	—	267	1 515	—	—	—	—	—	—	—	—	13	—	—	—	1 450	
1 500	1 810	1 702	60	32	M56	—	—	—	—	152	—	—	—	273	1 565	—	—	—	—	—	—	—	—	13	—	—	—	1 500	

NOTE — For facing dimensions, see tables 5, 6 and 7.



This diagram illustrates the arrangement but not necessarily the correct number of bolt holes. Refer to the column "number of bolts" in table 16 for the actual number.

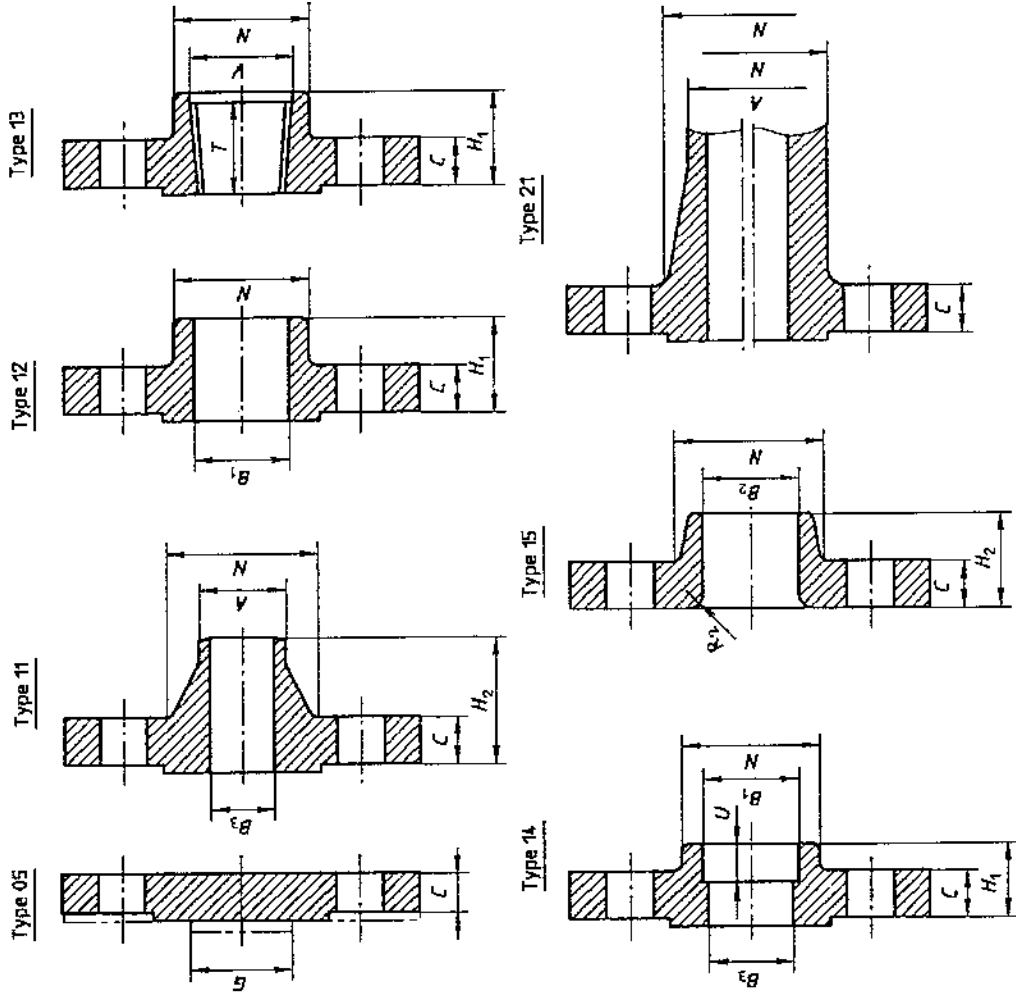
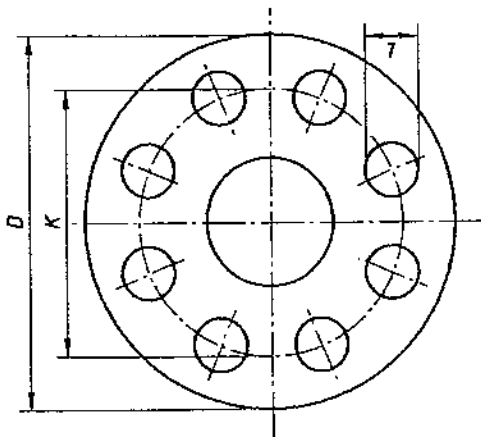


Table 16 — Dimensions of PN 110 flanges
(See the notes on page 46.)

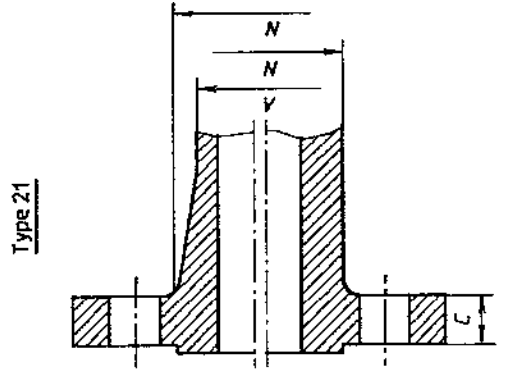
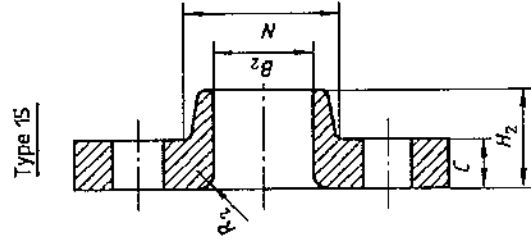
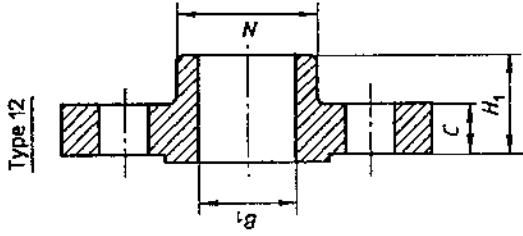
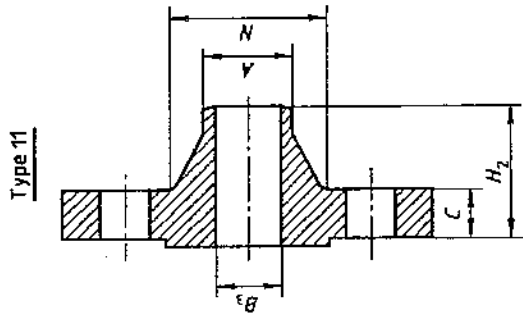
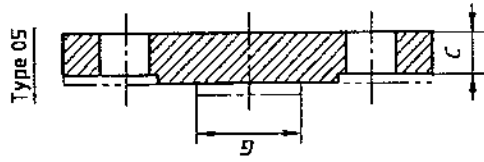
Dimensions in millimetres

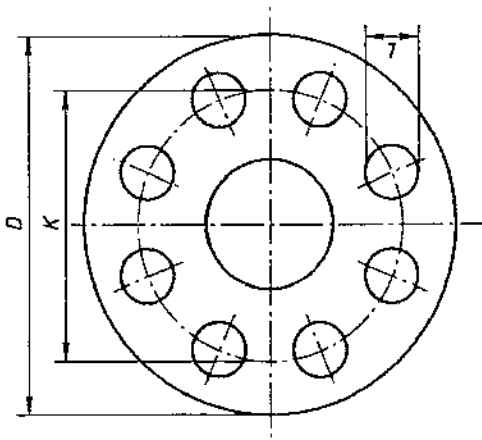
Nominal size DN	Mating dimensions			Outside diameter of neck (see note 7) A	Bore diameter (see note 8) B ₁ , B ₂ , B ₃		Flange thickness C	Shoulder diameter G	Length of hub H ₁ , H ₂		Neck diameter (see note 9) N	Lap radius (at pipe end) R ₂	Mini- mum thread length of flange (see note 5) T	Depth of socket threaded flange U	Mini- mum diameter of counter- bore threaded flange V	Nominal size DN
	Outside diameter of flange D	Diameter of bolt circle K	Diameter of bolt holes L		Number	Boles Nominal size			11, 14	12, 14						
15	95	66,5	16	4	M14	22	23	14,5	—	22	52	3	16	10	24	15
20	120	82,5	18	4	M16	28	28	16	—	25	57	3	16	11	29	20
25	125	89	18	4	M16	36,5	35	17,5	—	27	62	3	18	13	36	25
32	135	98,5	18	4	M16	42	43,5	21	—	29	67	5	21	14	45	32
40	155	114,5	22	4	M20	48,5	50	22,5	—	32	70	6	22	16	51	40
50	165	127	18	8	M16	60,5	62,5	25,5	—	37	73	8	29	17	64	50
65	190	149	22	8	M20	73	74,5	29	38	41	79	8	32	19	76,5	65
80	210	168,5	22	8	M20	89	90,5	32	51	46	83	10	35	21	92,5	80
100	275	216	26	8	M24	114,5	117	38,5	76	54	102	11	41	—	118	100
125	330	267	29,5	8	M27	141,5	145	44,5	102	60	114	11	48	—	145	125
150	355	292	29,5	12	M27	168,5	171	48	127	67	117	13	51	—	171,5	150
200	420	349	32,5	12	M30	219	221,5	55,5	175	76	133	13	57	—	222	200
250	510	432	35,5	16	M33	273	276	63,5	222	86	152	13	65	—	276,5	250
300	560	489	35,5	20	M33	324	327	67	273	92	156	13	70	—	329	300
350	605	527	39	20	M36	355,5	359	70	302	94	165	13	73	—	360,5	350
400	685	603	42	20	M39	406,5	411	76,5	349	106	178	13	78	—	411,5	400
450	745	654	45	20	M42	457	462	83	394	117	184	13	79	—	462,5	450
500	815	724	45	24	M42	508	513	89	438	127	190	13	82	—	513	500
550	870	778	48	24	M45	559	—	95	—	—	197	—	—	—	—	550
600	940	838	51	24	M48	609,5	616	102	533	140	203	13	92	—	614,5	600
Flange types affected for DN 650 and above are types 05 and 11 only.																
650	1 015	914	51	28	M48	—	—	125	108	—	222	—	—	—	—	650
700	1 075	965	55	28	M52	—	—	132	111	—	235	—	—	—	—	700
750	1 130	1 022	55	28	M52	—	—	140	114	—	248	—	—	—	—	750
800	1 195	1 080	60	28	M56	—	—	148	117	—	260	—	—	—	—	800
850	1 245	1 130	60	28	M56	—	—	154	121	—	270	—	—	—	—	850
900	1 315	1 194	68	28	M64	—	—	162	124	—	283	—	—	—	—	900
950	1 270	1 162	60	28	M56	—	—	156	152	—	254	—	—	—	—	950
1 000	1 320	1 213	60	32	M56	—	—	162	159	—	264	—	—	—	—	1 000
1 050	1 405	1 283	68	28	M64	—	—	171	168	—	279	—	—	—	—	1 050
1 100	1 455	1 334	68	32	M64	—	—	178	173	—	289	—	—	—	—	1 100
1 150	1 510	1 391	68	32	M64	—	—	186	179	—	300	—	—	—	—	1 150
1 200	1 595	1 460	74	32	M70	—	—	195	189	—	316	—	—	—	—	1 200
1 250	1 670	1 524	80	28	M76	—	—	203	197	—	329	—	—	—	—	1 250
1 300	1 720	1 575	80	32	M76	—	—	210	203	—	337	—	—	—	—	1 300
1 350	1 780	1 632	80	32	M76	—	—	217	210	—	349	—	—	—	—	1 350
1 400	1 855	1 695	86	32	M82	—	—	225	217	—	362	—	—	—	—	1 400
1 450	1 905	1 746	86	32	M82	—	—	232	222	—	370	—	—	—	—	1 450
1 500	1 995	1 822	94	28	M90	—	—	243	233	—	389	—	—	—	—	1 500

NOTE — For facing dimensions, see tables 5, 6 and 7.

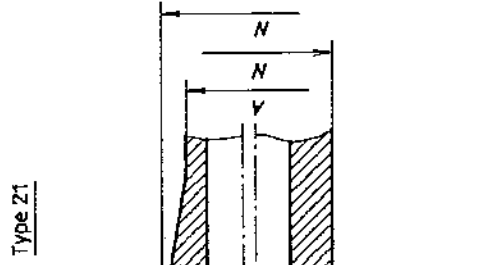
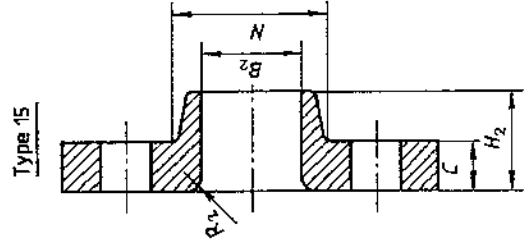
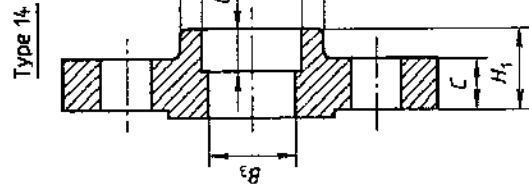
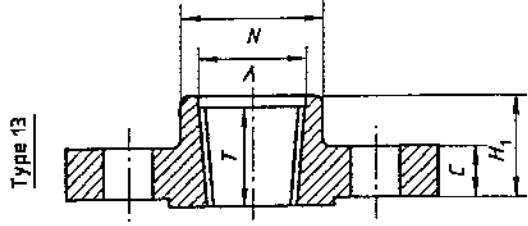
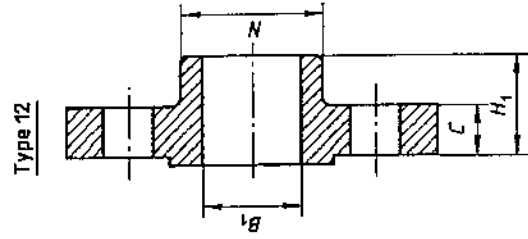
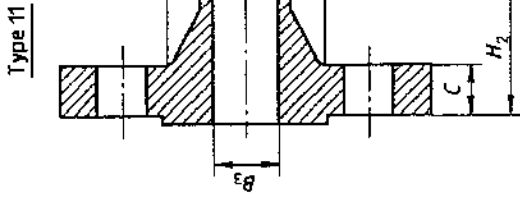
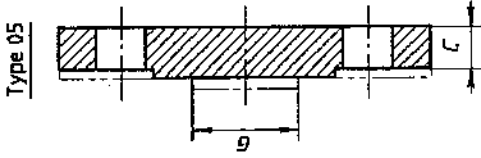


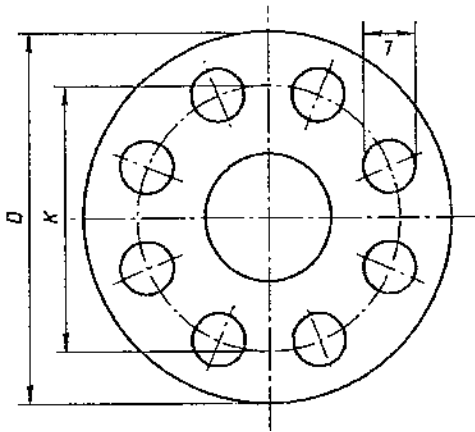
This diagram illustrates the arrangement but not necessarily the correct number of bolt holes. Refer to the column "number of bolts" in table 17 for the actual number.



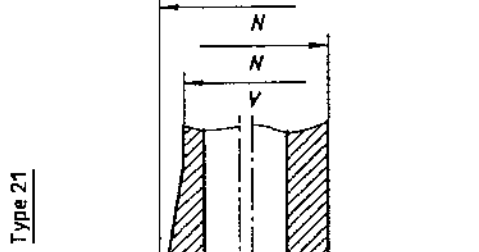
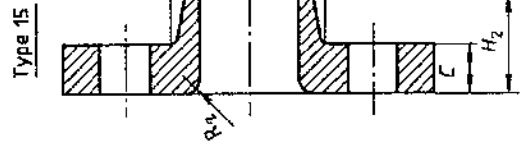
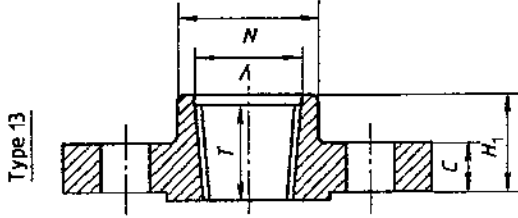
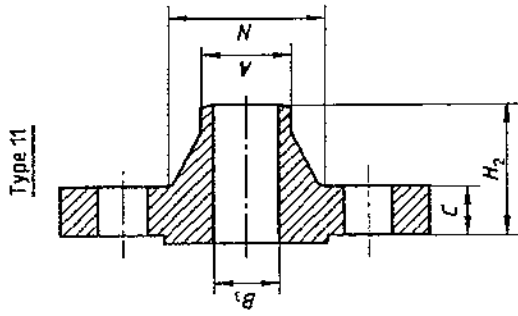
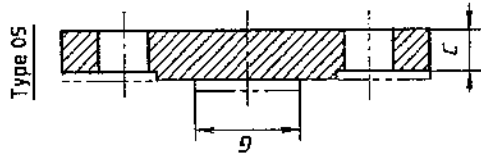


This diagram illustrates the arrangement but not necessarily the correct number of bolt holes. Refer to the column "number of bolts" in table 18 for the actual number.





This diagram illustrates the arrangement but not necessarily the correct number of bolt holes. Refer to the column "number of bolts" in table 19 for the actual number.



Notes to tables 8, 9 10, 11, 13 and 14

- 1 For tolerances, see 2.7 and section 4.
- 2 For facings, see 2.5, figure 6 and table 4.
- 3 For spot-facing, see 2.6.
- 4 For reducing threaded, slip-on and weld neck flanges, see 2.4.4.2.
- 5 For threads in threaded flanges, see 2.4.3.
- 6 The neck thickness dimension S is applicable to the majority of flanges, but for sizes above DN 600 or for flanges to be used with other pipe wall thicknesses, the neck thickness is subject to agreement between the manufacturer and purchaser.
- 7 The neck diameter N_3 is the theoretical maximum which will permit the use of ISO ring spanners or the fitting, if required, of the normal series of ISO washers (ISO 887) without some form of additional machining such as spot-facing (see 2.6). The washer, if used, may theoretically overlap slightly the corner radius but in practice it is deemed that there is sufficient space to fit the washer satisfactorily.
- 8 The bore diameter B in sizes generally above DN 600 should be specified by the purchaser.

The bore for a welding neck (type 11) or a socket weld (type 14) flange should be specified by the purchaser if required to differ from the dimensions given in tables 8 to 11, 13 and 14.

- 9 In respect of threaded flanges, the outside diameters of DN 65, DN 125 and DN 150 pipes should be as shown in the following table.

Dimensions in millimetres

Nominal size DN	Outside diameter	
	threaded to ISO 7-1	threaded to ANSI/ASME B1.20.1
65	76,1	73
125	139,7	141,3
150	165,1	168,3

- 10 Up to and including nominal size DN 600, the flanges have been recalculated recently according to the relevant German (DIN) calculation method. For this reason it was necessary to increase certain flange thicknesses. Above nominal size DN 600, flange thicknesses remain as they were, but the previous pressure/temperature ratings are no longer applicable (see E.1).

Notes to tables 12, 15, 16, 17, 18 and 19

- 1 For tolerances, see 2.7 and section 4.
- 2 For facings, see 2.5, figure 7 and tables 5, 6 and 7.
- 3 For spot-facing, see 2.6.
- 4 For reducing threaded, slip-on and weld neck flanges, see 2.4.4.2.
- 5 For threads in threaded flanges, see 2.4.3.
- 6 Blank flanges may be with or without hubs at the manufacturer's option.
- 7 For welding of unequal wall thicknesses, see the acceptable bevel designs in annex B.
- 8 Dimensions for B_3 correspond to the inside diameter of the pipe as given in ANSI/ASME B36.10 for Standard Wall pipe. The thickness of Standard Wall is the same as Schedule 40 in sizes DN 250 and smaller. Tolerances in table 20 apply.
- 9 When PN 20 and PN 50 flanges are required with flat face, either the full thickness or the thickness with the raised face removed may be furnished. Users are reminded that removing the raised face will make the length through the hub non-standard. See 2.5.2.
- 10 The bore for a welding neck (type 11) or a socket weld (type 14) flange should be specified by the purchaser if required to differ from the dimensions given in tables 12 and 15 to 19.
- 11 In respect of threaded flanges, the outside diameters of DN 65, DN 125 and DN 150 pipes should be as shown in the following table.

Dimensions in millimetres

Nominal size DN	Outside diameter	
	threaded to ISO 7-1	threaded to ANSI/ASME B1.20.1
65	76,1	73
125	139,7	141,3
150	165,1	168,3

- 12 Attention is drawn to D.4 and annex F for DN 300 and above for pipeline applications.
- 13 The R_1 dimension only applies to DN 300 and above for flanges used in pipeline applications.
- 14 Welding end diameters A given are for general application and not for pipeline applications.

Section 4: Tolerances

Table 20 — Tolerances

Dimensions in millimetres

Dimension	PN	Flange type	Tolerance	Size range	
Bore diameter B_1, B_2, B_3	All	11, 14 ¹⁾ , 33	+0,5 -1,0	≤ DN 125	
			+1,0 -1,5	DN 150 up to and including DN 300	
			±2	≥ DN 350	
		Other than 11, 14 ¹⁾ and 33	+1 0	≤ DN 125	
			+1,5 0	DN 150 up to and including DN 600	
Flange thickness C_1, C_2, C_3	All	All (machined on both faces)	+2 0	thickness ≤ 18	
			+3 0	18 < thickness ≤ 50	
			+4 0	thickness > 50	
		All (machined on front face only)	+3,5 0	thickness ≤ 18	
			+5,5 0	18 < thickness ≤ 50	
			+9 0	thickness > 50	
Length through hub H	All	11	±1,5	≤ DN 250	
			±3	DN 300 up to and including DN 600	
			±4,5	≥ DN 650	
Outside diameter of neck A	All	04,11	+2,5 -1,0	≤ DN 150	
			+4 -1	DN 200 up to and including DN 600	
			+5,5 -1,5	≥ DN 650	
Facing diameter d_1	2, 5, 6, 10, 16, 25, 40	All	+2 -1	≤ DN 250	
			+3 -1	≥ DN 300	
	20, 50, 110, 150, 260, 420		$f_1 = 2$	$f_1 = 7$	≤ DN 600
			±1	±0,5	
		±2	±1	≥ DN 650	
Facing height f_1	All	All	1 min.	All	
Facing diameters x_1, x_2, y_1, y_2, y_3	All	All	±0,5	≤ DN 600	
w, y	All	All	+0,5 0	≤ DN 600	
x, y	All	All	0 -0,5	≤ DN 600	
Diameter of bolt circle K	All	All	±1	bolt sizes M10 to M24	
			±1,25	bolt sizes M27 to M33	
			±1,5	bolt sizes M36 to M52	
			±2	bolt sizes M56 to M95	
			±2,5	bolt sizes M100	

Table 20 (concluded)

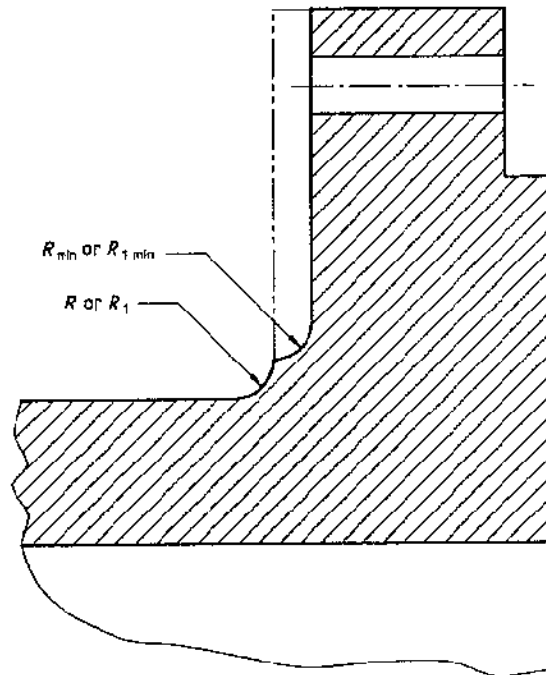
Dimensions in millimetres

Dimension	PN	Flange type	Tolerance	Size range
Centre-to-centre of adjacent bolt holes	All	All	±0,5	bolt sizes M14 to M24
			±0,625	bolt sizes M27 to M33
			±0,75	bolt sizes M36 to M52
			±1	bolt sizes M56 to M95
			±1,25	bolt sizes M100
Eccentricity of machined facing diameters	All	All	0,5	≤ DN 65
			1	DN 80 up to and including DN 150
			2	DN 200 up to and including DN 500
			3	≥ DN 600
Bolting bearing faces shall be parallel with the flange gasket surface within 1°.				
1) Small bore only.				

Table 21 — Minimum hub radius after back-facing

Dimensions in millimetres

Flange nominal size	R_{min} and $R_{1 min}$
Up to and including DN 50	2
Over DN 50 and up to and including DN 200	3
Over DN 200	5



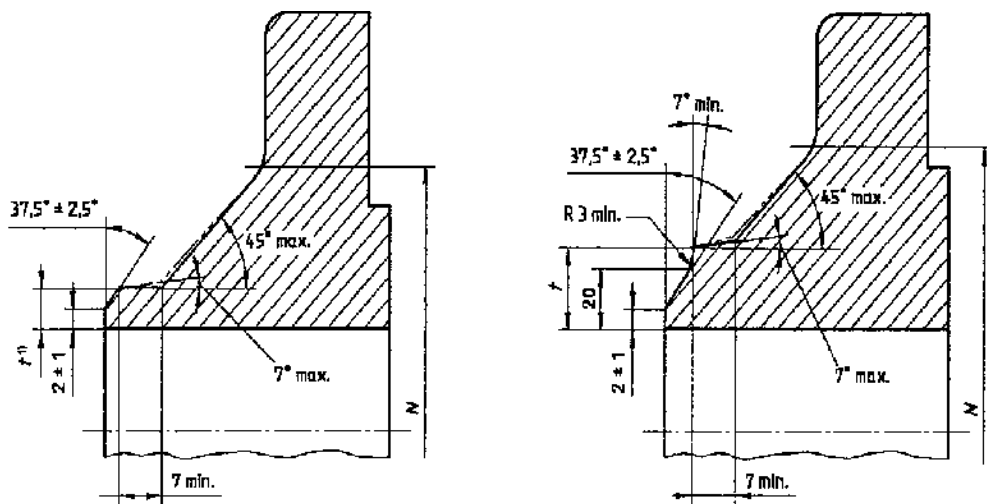
NOTE — For dimensions of R and R_1 , see tables 8 to 19.

Figure 8 — Minimum hub radius after back-facing

Annex A (normative)

Bevel for specified wall thicknesses from 5 mm to 22 mm inclusive and greater than 22 mm

Dimensions in millimetres



1) t is the specified wall thickness of pipe, in millimetres

a) t from 5 mm to 22 mm inclusive

b) t greater than 22 mm

NOTES

1 See 2.4.4.1, 2.4.5.3 and 2.4.6.

2 For flanges required to connect with ferritic steel pipe of nominal wall thickness less than 4,8 mm the welding ends shall be finished to a slight chamfer or shall be square, at the option of the manufacturer.

For flanges required to connect with austenitic stainless steel pipe of nominal wall thickness 3,2 mm or less, the welding ends shall be finished to a slight chamfer.

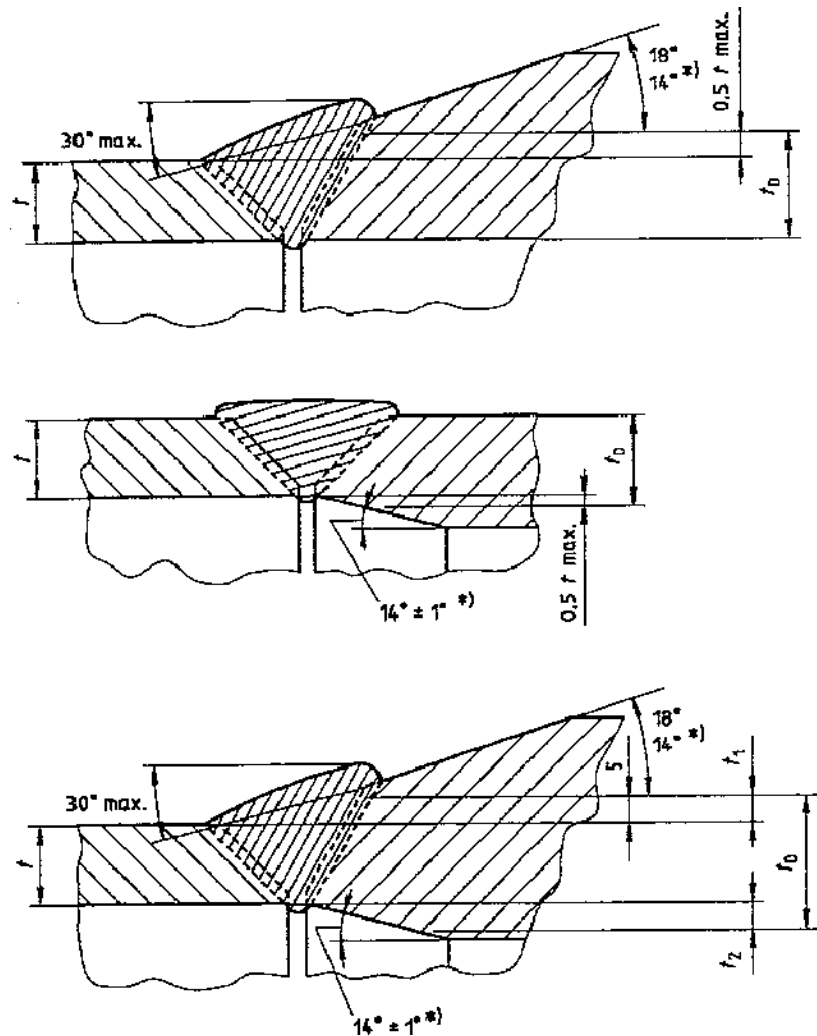
3 When flanges covered by this part of ISO 7005 are intended for service with light-wall high-strength pipe, the thickness of the hub at the bevel may be greater than that of the pipe to which the flange is joined. Under these conditions a single taper hub may be provided and the outside diameter of the hub at the base (dimension N) may be modified.

4 For dimensions of welding-neck thickness (type 11), see the tables in section 3.

Figure A.1 — Bevel for specified wall thicknesses t

Annex B (normative)

Acceptable bevel designs for unequal wall thicknesses (pipeline applications)



*) No minimum when materials joined have equal yield strength.

NOTE — None of the dimensions t_1 , t_2 or $t_1 + t_2$ shall exceed $0,5t$.

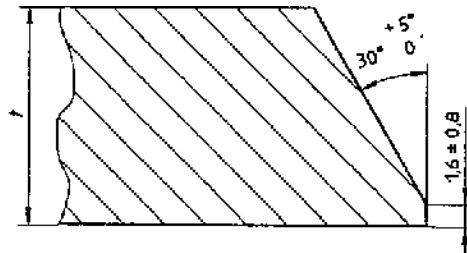
Figure B.1 — Acceptable bevel designs for unequal wall thicknesses

When the minimum specified yield strengths of the sections to be joined are unequal, the deposited weld metal shall have mechanical properties at least equal to those of the section having the high strength, and the minimum thickness t_D shall equal at least t times the ratio of the minimum specified yield strength of the pipe and of the flange, but shall not exceed $1,5 t$.

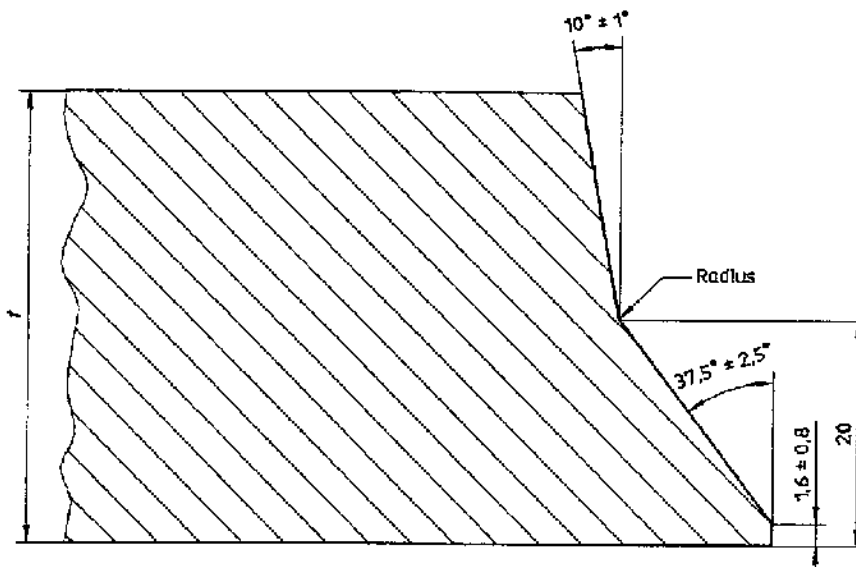
Annex C (informative)

Recommended bevel for equal wall thicknesses t at the end of the flange hub from 5 mm to 22 mm inclusive and greater than 22 mm (pipeline applications)

Dimensions in millimetres



a) t from 5 mm to 22 mm inclusive (pipeline applications)



b) t greater than 22 mm (pipeline applications)

Figure C.1 — Recommended bevel for equal wall thicknesses t at the end of the flange hub

Annex D (informative)

Guidance on flange materials

D.1 General

When work started on this part of ISO 7005 it was decided to refer to the German and American steels which were used for the manufacture of the European and American steel flanges on which this part of ISO 7005 is based. Since then a number of ISO standards have been published, or are in preparation, which specify steels suitable for the manufacture of flanges. However, the complete suite of ISO standards has yet to be published, and therefore the materials specified in this annex are given for guidance only and users are entitled to select other steels from national standards in preference, as deemed necessary. Moreover, if specifying steels not given in this part of ISO 7005, users of this part of ISO 7005 have the responsibility to ensure that the steels are suitable for the PN designations given. In a future edition of this part of ISO 7005, steels from ISO standards only will be specified.

Guidance on pressure/temperature ratings for certain flanges made from the materials given in this annex is given in annex E.

D.2 Range of materials

Except for pipeline flanges, flanges specified in this part of ISO 7005 may be manufactured from materials selected from tables D.1 and D.2.

NOTE — See also 1.1.

When PN 20, PN 50, PN 110 and PN 150 flanges are specified for pipeline applications, materials may be selected from table D.3.

D.3 Material groupings

Materials in this part of ISO 7005 are identified by a basic material reference.

NOTES

1 Several materials have been placed in any one group with the provision that they give a compatible rating for the flanged joint i.e. materials likely to be used together are capable of maintaining the same rating). In this respect the characteristics of any material in a given group are compatible with the rating for that group. Consequently, ratings for some materials are conservative (see also annex E).

2 The specifications may not be equivalent in all details and therefore may not be equally suitable for all applications.

D.4 Materials for PN 20, PN 50, PN 110 and PN 150 flanges types 05 and 11 for nominal sizes DN 300 and larger for pipeline applications

The steel used in the manufacture of PN 20, PN 50, PN 110 and PN 150 flanges types 05 and 11 for nominal sizes DN 300 and larger for pipeline applications given in table D.3 should be selected by the manufacturer to meet the following recommendations.

D.4.1 The 4.A.330 and higher grades of steel for PN 110 and PN 150 flanges should be killed steel.

D.4.2 The steel used should be suitable for field welding to other flanges, fittings or pipe manufactured to the appropriate International Standards.

D.4.3 The steel used should have a maximum carbon content of 0,35 % (*m/m*) and a carbon equivalent (C.E.) computed using the following equation:

$$\text{C.E.} = \text{C} + \frac{\text{Mn}}{6} + \frac{\text{Cr} + \text{Mo} + \text{V}}{5} + \frac{\text{Ni} + \text{Cu}}{15}$$

which should not exceed 0,50, based on check analysis. If the carbon equivalent exceeds 0,50, the acceptance of the flanges should be based on agreement between the purchaser and the manufacturer.

The choice and use of alloying elements, combined with the elements within the limits given above to give the required tensile properties prescribed in D.4.4, should be made by the flange manufacturer and included and reported in the ladle or check analyses to identify the type of steel.

D.4.4 The steel used should have tensile properties conforming to the requirements given in table D.3 and be capable of meeting the flange manufacturer's design conditions as given in annex F.

The test specimens should be taken from the forgings or, at the manufacturer's option, from the billets or forging bars used to manufacture the finished product, provided that such a test specimen has undergone substantially the same forming and the equivalent heat treatment as the finished flange. The dimensions of the test specimen should be such as to reflect adequately

the heat treatment properties of the hub of the flange. Specimens should be obtained from the midwall of the thinnest section of the hub of the flange or 19 mm from the surface of the test specimen. The orientation of specimens taken from a flange should be longitudinal. If a separate test bar is used, it should be heat treated in a heat treat batch with the flanges it represents.

D.4.5 The 4.A.290 and higher grades of steel for PN 20, PN 50, PN 110 and PN 150 flanges and the 4.A.250 grade of steel for PN 110 and PN 150 flanges should be normalized or quenched and tempered.

NOTE — It is recognized that the cooling rate in a quenching operation may be slower in the thicker ring section of the flange than in the thinner hub section. Hence, the increase in yield strength due to the quenching operations may be less in the ring section than in the hub section. This factor is accounted for in D.4.6.

D.4.6 The flange ring should have sufficient pressure capacity for the service based on its strength in the normalized condition. This capacity should be substantiated by design calculations using the allowable design stresses as given in annex F of this part of ISO 7005.

Table D.1 — Basic properties and reference standards for materials used for PN 2,5, PN 6, PN 10, PN 16, PN 25 and PN 40 flanges

Description	Group	DIN steel		ISO steel		
		Limiting thickness mm	Original DIN standard and grade	Limiting thickness mm	ISO standard and grade	Service temperature ¹⁾ °C
Casting	1E0	—	DIN 1681 GS-38,3	—	ISO 3755 200-400W	—
Forging		≤ 16 > 16 ≤ 40 > 40 ≤ 63	DIN 17100 RSt 37-2	≤ 63	ISO 2604-1 F8	−10 to 300
Plate		≤ 16 > 16 ≤ 40 > 40 ≤ 63	DIN 17100 RSt 37-2	≤ 63	ISO 630 Fe 360B	−10 to 300
Forging	2E0	60 — —	DIN 2528 C 16.8 C 21 C22.3	—	ISO 2604-1 F9	−10 to 360
Plate		≤ 16 > 16 ≤ 40 > 40 ≤ 60	DIN 17155	≤ 60	ISO 9328-2 PH 235	−10 to 480
Casting	3E0	—	DIN 17245 GS-C25	—	ISO 4991 C23-45AH	—
Forging		≤ 100	DIN 17243 C 22.8	≤ 100	ISO 2604-1 F13	−10 to 420
Plate		> 16 ≤ 40	DIN 17155 H11	≤ 60	ISO 9328-2 PH 265	−10 to 480
Casting	4E0	—	DIN 17245 GS-22 Mo4	—	ISO 4991 C28H	—
Forging		≤ 16 > 16 ≤ 40 > 40 ≤ 60	DIN 17175 15 Mo 3	≤ 60	ISO 2604-1 F26	−10 to 530
Plate		≤ 16 > 16 ≤ 40 > 40 ≤ 60	DIN 17155 15 Mo 3	≤ 60	ISO 9328-2 16 Mo 3	−10 to 530
		—	DIN 2528 16 Mo 5	—	—	—

Table D.1 (continued)

Description	Group	DIN steel		ISO steel		
		Limiting thickness mm	Original DIN standard and grade	Limiting thickness mm	ISO standard and grade	Service temperature ¹⁾ °C
Casting	5E0	—	DIN 17245 GS-17 CrMo 5 5	—	ISO 4991 C32H	—
Forging		≤ 60	DIN 17243 13 CrMo 4 4	≤ 60	ISO 2604-1 F32	-10 to 570
Plate		≤ 16 > 16 ≤ 40 > 40 ≤ 63	DIN 17155 13 CrMo 4 4	≤ 60	ISO 9328-2 14 CrMo 4 5	-10 to 570
Casting	6E0	—	DIN 17245 GS-18 CrMo 9 10	—	ISO 4991 C34BH	—
Forging		—	DIN 17243 10 CrMo 9 10	—	ISO 2604-1 F34	-10 to 600
Plate		≤ 16 > 16 ≤ 40 > 40 ≤ 60	DIN 17155 10 CrMo 9 10	—	ISO 9328-2 13 CrMo 9 10 T1	—
Casting	7E1	30	DIN 17245 GS-10 Ni 19	< 35	ISO 4991 C43L	—
	7E1	35	DIN 17245 GS-10 Ni 14			
Forging	7E1	—	DIN 17280 10 Ni 14	—	—	—
	7E0	—	DIN 17102 TStE 315	—	—	—
	7E0	—	DIN 17102 TStE 355	—	—	—
	7E1	—	DIN 17102 TStE 380	—	ISO 2604-1 F44	—
	7E1	—	DIN 17102 TStE 420	—	—	—
	7E2	—	DIN 17280 X8 Ni 9	—	ISO 2604-1 F45	—
	7E1	—	DIN 17280 12 Ni 19	—	—	—
Plate	7E1	—	DIN 17280 10 Ni 14	—	—	—
	7E0	—	DIN 17102 TStE 315	—	ISO 9328-4 P 315 TN	—
	7E0	—	DIN 17102 TStE 355	—	ISO 9328-4 P 355 TN	—
	7E1	—	DIN 17102 TStE 380	—	ISO 9328-4 PL 390 TN	—
	7E1	—	DIN 17102 TStE 420	—	ISO 9328-4 PL 420 TN	—
	7E2	—	DIN 17280 X 8 Ni 9	—	ISO 9328-3 X 8 Ni 9	—
	7E1	—	DIN 17280 12 Ni 19	—	ISO 9328-3 12 Ni 14 G2	—

Table D.1 (continued)

Description	Group	DIN steel		ISO steel		
		Limiting thickness mm	Original DIN standard and grade	Limiting thickness mm	ISO standard and grade	Service temperature ¹⁾ °C
Forging	8E0	—	DIN 17102 WStE 255	—	—	—
	8E1	—	WStE 285	—	—	—
	8E2	—	WStE 315	—	—	—
	8E3	—	WStE 355	—	—	—
Plate	8E0	—	DIN 17102 WStE 255	—	ISO 9328-4 P 255 TN	—
	8E1	—	WStE 285	—	P 285 TN	—
	8E2	—	WStE 315	—	P 315 TN	—
	8E3	—	WStE 355	—	P 355 TN	—
Casting	9E0	—	DIN 17245 G-X 22 CrMoV 12 1	—	ISO 4991 C40H	—
Forging		≤ 16 > 16 ≤ 40 > 40 ≤ 60	DIN 17175 X 20 CrMoV 12 1	60	ISO 2604-1 F40	—
Casting	10E0	—	—	—	ISO 4991 C46	—
Forging		—	DIN 17440 X 2 CrNi 19 11 X 2 CrNiN 18 10	—	ISO 2604-1 F46	—
Plate		—	DIN 17440 X 2 CrNi 19 11 X 2 CrNiN 18 10	—	— ISO 9328-5 X 2 CrNi 18 10	— -196 to 550
Casting	11E0	—	DIN 17445 G-X 6 CrNi 18 9	—	ISO 4991 C47	—
Forging		—	DIN 17440 X 5 CrNi 18 10	—	ISO 2604-1 F47	-196 to 550
Plate		—	DIN 17440 X 5 CrNi 18 9	—	ISO 9328-5 X 5 CrNi 18 9	-196 to 550
Casting	12E0	—	DIN 17445 G-X 5 CrNiNb 18 9	—	ISO 4991 C50	—
Forging		—	DIN 17440 X 6 CrNiTi 18 10	—	ISO 2604-1 F53	-196 to 550
Plate		—	DIN 17440 X 6 CrNiNb 18 10 X 6 CrNiTi 18 10 X 6 CrNiNb 18 10	—	ISO 2604-1 F50 ISO 9328-5 X 6 CrNiTi 18 10 X 6 CrNiNb 18 10	— -196 to 550 —
Casting	13E0 13E1	—	DIN 17445 G-X 3 CrMoN 17 13 5	—	ISO 4991 C57 C612C	— —
Forging		—	DIN 17440 X 2 CrNiMo 17 13 2	—	ISO 2604-1 F59	-60 to 550
Plate		—	DIN 17440 X 2 CrNiMo 17 13 2 X 2 CrNiMoN 17 12 2	—	ISO 9328-5 X 2 CrNiMo 17 12 X 2 CrNiMoN 17 12	-60 to 550 —

Table D.1 (concluded)

Description	Group	DIN steel		ISO steel		
		Limiting thickness mm	Original DIN standard and grade	Limiting thickness mm	ISO standard and grade	Service temperature ¹⁾ °C
Casting	14E0	—	DIN 17445 G-X 6 CrNiMo 18 10	— —	ISO 4991 C60 C61	— —
Forging		—	DIN 17440 X 5 CrNiMo 17 12 2	—	ISO 2604-1 F62	-60 to 550
Plate		—	DIN 17440 X 5 CrNiMo 17 12 2	—	ISO 9328-5 X 5 CrNiMo 17 12	-60 to 550
Casting	15E0	—	DIN 17445 G-X 5 CrNiMoNb 18 10	—	ISO 4991 C60Nb	—
Forging		— —	DIN 17440 X 6 CrNiMoTi 17 12 2 X 10 CrNi 18 10	— —	ISO 2604-1 F66 —	-60 to 550 —
Plate		— —	DIN 17440 X 6 CrNiMoTi 17 12 2 X 10 CrNiMoNb 18 10	— —	ISO 9328-5 X 6 CrNiMoTi 17 12 X 6 CrNiMoNb 17 12	— —
Forging	16E0	—	SEW 470 X 7 CrNi 23 14	—	ISO 4955 H14	—
Forging	17E0	—	SEW 470 X 15 CrNiSi 25 20	—	ISO 4955 H15	—
		—	—	X 12 CrNi 25 21	—	H16

1) The upper limiting value indicates that prolonged use above the given temperature is not recommended.

NOTE — The mechanical properties given in the standards referred to should be regarded as the minimum values for which the pressure/temperature ratings given in annex E are valid.

Table D.2 — Reference standards for materials used for PN 20, PN 50, PN 110, PN 150, PN 260 and PN 420 flanges

Material group	Description	ASTM specification and grade	Remarks	ISO standard and grade	Limiting thickness	Remarks
					mm	
1A1	Casting	ASTM A216 WCB	1), 2)	ISO 4991 C26 — 52H	—	1), 2)
	Forging	ASTM A105 ASTM A350 LF2	1), 2) 3)	ISO 2604-1 F22 F13 F18	≤ 63 ≤ 63 > 63 ≤ 250	1), 2) 3) 3)
	Plate	ASTM A515 70 ASTM A516 70 ASTM A537 CL1	1), 2) 1), 4) 3)	ISO 9328-2 PH290 PH315 PH355	≤ 60 > 60 ≤ 100 ≤ 100	1), 4) 1), 4) 3)
1A2	Casting	ASTM A216 WCC ASTM A352 LC2 LC3 LCC	1), 2) 3) 3) 3)	ISO 4991 C26 — 52H, N(+T) C26 — 52L C43L	— — —	1), 2) 3) 3)
	Forging	ASTM A350 LF3	3)	ISO 2604-1 F44	≤ 250	3)
	Plate	ASTM A203 B E	1), 2) 1), 2)	ISO 9328-3 12 Ni 14 G1	≤ 50	1), 2)
1A3	Casting	ASTM A352 LCB	1)	ISO 4991 C23 — 46BL	—	1)
	Plate	ASTM A203 A D ASTM A515 65 ASTM A516 65	1), 2) 1), 2) 1), 2) 1), 4)	ISO 9328-2 PH290 PH315 ISO 9328-3 12 Ni 14 G1	≤ 100 > 100 ≤ 50	1), 4) 1), 4) 1), 2)
1A4	Forging	ASTM A350 LF1	3)	ISO 2604-1 F9	≤ 250	3)
	Plate	ASTM A515 60 ASTM A516 60	1), 2) 1), 4)	ISO 9328-2 PH235 PH265 PH290	≤ 40 > 40 ≤ 60 > 60 ≤ 150	1), 4) 1), 4) 1), 4)
1A5	Casting	ASTM A217 WC1 ASTM A325 LC1	2), 5) 3)	ISO 4991 C28H	—	2), 5)
	Forging	ASTM A182 F1	2), 5)	ISO 2604-1 F28	—	2), 5)
	Plate	ASTM A204 A B	2), 5) 2), 5)	ISO 9328-2 16 Mo 3	≤ 60	2), 5)

Table D.2 (continued)

Material group	Description	ASTM specification and grade	Remarks	ISO standard and grade	Limiting thickness mm	Remarks
1A7	Casting	ASTM A217 WC4 WC5	2) 6)	—	—	—
	Forging	ASTM A182 F2	2)	—	—	—
	Plate	ASTM A204 C	4)	—	—	—
1A9	Casting	ASTM A217 WC6	7)	ISO 4991 C32H	—	7)
	Forging	ASTM A182 F11 F12	8) 8)	—	—	—
	Plate	ASTM A387 11 CL2	8)	—	—	—
1A10	Casting	ASTM A217 WC9	7)	ISO 4991 C34AH	—	7)
	Forging	ASTM A182 F22	7)	ISO 2604-1 F34Q	—	8)
	Plate	ASTM A387 22 CL2	8)	ISO 9328-2 13 CrMo 9 10 T2	≤ 100	8)
1A13	Casting	ASTM A217 C5	—	ISO 4991 C37H	—	—
	Forging	ASTM A182 F5 F5a	— —	ISO 2604-1 F37	—	—
1A14	Casting	ASTM A217 C12	—	ISO 4991 C38H	—	—
	Forging	ASTM A182 F9	—	—	—	—
2A1	Casting	ASTM A351 CF8 CF3	— 9)	ISO 4991 C46 C47	— —	9) —
	Forging	ASTM A182 F304 F304H	— —	ISO 2604-1 F49	—	—
	Plate	ASTM A240 304 304H	— 9)	ISO 9328-5 X 5 CrNi 18 9	—	—
2A2	Casting	ASTM A351 CF8M CF3M	— 4)	ISO 4991 C57 C61LC C60 C61	— — — —	4) 4) 4) 4)
	Forging	ASTM A182 F316 F316H	— —	ISO 2604-1 F62 F64	— —	— —
	Plate	ASTM A240 316 317 316H	— — 4)	ISO 9328-5 X 5 CrNiMo 17 12 — X 7 CrNiMo 17 12	— — —	— — 4)

Table D.2 (concluded)

Material group	Description	ASTM specification and grade	Remarks	ISO standard and grade	Limiting thickness mm	Remarks
2A3	Forging	ASTM A182 F304L F316L	9) 4)	ISO 2604-1 F46 F59	— —	— —
	Plate	ASTM A240 304L 316L	9) 4)	ISO 9328-5 X 2 CrNi 18 10 X 2 CrNiMo 17 12 X 2 CrNiMo 17 13	— — —	9) 4) 4)
2A4	Forging	ASTM A182 F321 F321H	2) —	ISO 2604-1 F53 F54B)	— —	2) —
	Plate	ASTM A240 321 321H	2) —	ISO 9328-5 X 6 CrNiTi 18 10 X 7 CrNiTi 18 10	— —	2) —
2A5	Forging	ASTM A182 F347 F347H F348 F348H	2) — 2) —	ISO 2604-1 F50 F51 — —	— — — —	2) — — —
	Plate	ASTM A240 347 347H 348 348H	2) — 2) —	ISO 9328-5 X 6 CrNiNb 18 10 X 7 CrNiNb 18 10 — —	— — — —	2) — — —
2A6	Casting	ASTM A351 CH8 CH20	— —	— —	— —	— —
	Plate	ASTM A240 309S	—	ISO 4955 H14	—	—
2A7	Casting	ASTM A351 CK20	—	—	—	—
	Forging	ASTM A182 F310	10)	ISO 2604-1 F68	—	10)
	Plate	ASTM A240 310S	10)	ISO 4955 H15	—	10)

1) Permissible but not recommended for prolonged use above about 425°C.

2) Not to be used over 540°C.

3) Not to be used over 345°C.

4) Not to be used over 455°C.

5) Permissible but not recommended for prolonged use above about 455°C.

6) Not to be used over 565°C.

7) Not to be used over 590°C.

8) Permissible but not recommended for prolonged use above about 590°C.

9) Not to be used over 425°C.

10) For service temperature 565°C and above, should be used only when assurance is provided that grain size is not finer than ASTM No. 6.

Table D.3 — Materials applicable to tables 12, 15, 16 and 17 covering PN 20, PN 50, PN 110 and PN 150 flanges types 05 and 11 in the size range DN 300 and larger for pipeline applications ¹⁾

Material group and grade identification number	Yield point min.	Tensile strength min.	Minimum elongation on a length L_0 of 50,8 mm
	N/mm ²	N/mm ²	%
4.A.250	250	410	20
4.A.290	290	410	20
4.A.315	315	410	20
4.A.330	330	430	20
4.A.345	345	440	20
4.A.360	360	460	20
4.A.385	385	470	20
4.A.415	415	520	20
4.A.450	450	530	18
4.A.485	485	550	18

1) See also D.4.

D.5 Reference documents

ISO 630 : 1980, *Structural steels.*

ISO 2604-1 : 1975, *Steel products for pressure purposes — Quality requirements — Part 1: Forgings.*

ISO 3755 : 1991, *Cast carbon steels for general engineering purposes.*

ISO 4955: 1983, *Heat-resisting steels and alloys.*

ISO 4991 : —¹⁾, *Steel castings for pressure purposes.*

ISO 9328-1 : 1991, *Steel plates and strips for pressure purposes — Technical delivery conditions — Part 1: General requirements.*

ISO 9328-2 : 1991, *Steel plates and strips for pressure purposes — Technical delivery conditions — Part 2: Unalloyed and low-alloyed steels with specified room temperature and elevated temperature properties.*

ISO 9328-3 : 1991, *Steel plates and strips for pressure purposes — Technical delivery conditions — Part 3: Nickel-alloyed steels with specified low temperature properties.*

ISO 9328-4 : 1991, *Steel plates and strips for pressure purposes — Technical delivery conditions — Part 4: Weldable fine grain steels with high proof stress supplied in the normalized or quenched and tempered condition.*

ISO 9328-5 : 1991, *Steel plates and strips for pressure purposes — Technical delivery conditions — Part 5: Austenitic steels.*

ASTM A 105/A105M-87a, *Specification for Forgings, Carbon Steel, for Piping Components.*

ASTM A 182/A182M-88, *Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.*

ASTM A 203/A203M-82(1988), *Specification for Pressure Vessel Plates, Alloy Steel, Nickel.*

ASTM A 204/A204M-88, *Specification for Pressure Vessel Plates, Alloy Steel, Molybdenum.*

ASTM A 216/A216M-84b, *Specification for Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service.*

ASTM A 217/A217M-87, *Specification for Steel Castings, Martensitic Stainless and Alloy, for Pressure-Containing Parts Suitable for High-Temperature Service.*

ASTM A 240-88a, *Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.*

ASTM A 325-88a, *Specification for High-Strength Bolts for Structural Steel Joints.*

ASTM A 350/A350M-87a, *Specification for Forgings, Carbon and Low-Alloy Steel, Requiring Notch Toughness Testing for Piping Components.*

ASTM A 351/A351M-88, *Specification for Steel Castings, Austenitic, for High-Temperature Service.*

ASTM A 352/A352M-88, *Specification for Steel Castings, Ferritic and Martensitic, for Pressure-Containing Parts Suitable for Low-Temperature Service.*

1) To be published.

ASTM A 387/A387M-88, *Specification for Pressure Vessel Plates, Alloy Steel, Chromium-Molybdenum.*

ASTM A 515/A515M-82(1987), *Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service.*

ASTM A 516/A516M-86, *Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service.*

ASTM A 537/A537M-86, *Specification for Pressure Vessel Plates, Heat-treated, Carbon-Manganese-Silicon Steel.*

DIN 1681 : 1985, *Cast steels for general engineering purposes.*

DIN 2528 : 1987, *Flanges; steel flanges ready for use; materials.*

DIN 17100 : 1980, *Steels for general structural purposes-quality standard.*

DIN 17102 : 1983, *Weldable normalized fine grain structural steels; technical delivery conditions for plate strip, wide flats, sections and bars.*

DIN 17155 : 1983, *Creep resistant steel plate and strip; technical delivery conditions.*

DIN 17175 : 1979, *Seamless tubes of heat-resistant steels; technical conditions of delivery.*

DIN 17243 : 1987, *Weldable heat resisting steel forgings and rolled or forged steel bars; technical delivery conditions.*

DIN 17245 : 1987, *Ferritic steel castings with elevated temperature properties; technical delivery conditions.*

DIN 17280 : 1985, *Steels with low temperature toughness; technical delivery conditions for plate, sheet, strip, wide flats, sections, bars and forgings.*

DIN 17440 : 1985, *Stainless steels; technical delivery conditions for plate and sheet, hot rolled strip, wire rod, drawn wire, steel bars, forgings and semi-finished products.*

DIN 17445 : 1984, *Stainless steel castings; technical delivery conditions.*

SEW 470 : 1976, *Heat resisting wrought steels.*

Annex E (informative)

Guidance on pressure/temperature ratings

E.1 General

The pressure/temperature ratings given in this annex apply only to certain flanges made using the materials listed in annex D.

Where given, the pressure/temperature ratings of the materials specified are maximum allowable non-shock working pressures (expressed as gauge pressure in bar) at the temperatures given in the respective tables for the applicable material. Linear interpolation is permitted for intermediate temperatures.

The ratings of the flange materials are given in the following tables.

Tables E.1 to E.4 — Pressure/temperature ratings for PN 2,5, PN 6, PN 10, PN 16, PN 25 and PN 40 for the material groups given in table D.1 and valid only for flanges of types 05, 11, 12, 13 and 21 in nominal sizes up to and including DN 600.

For all flanges of types 01, 02, 03 and 04 and for types 05, 11, 12, 13 and 21 having nominal sizes greater than DN 600, pressure/temperature ratings applied are the responsibility of the user.

For austenitic stainless steels, pressure/temperature ratings are based on a reference stress of 205 N/mm^2 for the 0,2 % proof stress and a reference stress of 225 N/mm^2 for the 1% proof stress, the rating being given in tables E.3 and E.4 respectively. Two tables of pressure/temperature ratings for austenitic stainless steels are given because some codes of practice for the design of flanged equipment use the 0,2% proof stress value and others use the 1% proof stress value.

Tables E.5 to E.21 — Pressure/temperature ratings for PN 20, PN 50, PN 110, PN 150, PN 260 and PN 420 for the material groups given in table D.2. The ratings are in accordance with the standard ratings for flanged and butt weld end fittings specified in ANSI/ASME B16.5.

Table E.22 — Pressure/temperature ratings for PN 20, PN 50, PN 110 and PN 150 for the material groups given in table D.3 for use in pipeline applications in the size range DN 300 and larger for types 05 and 11 only.

NOTE — There is not yet in existence a common internationally accepted procedure to evaluate pressure/temperature ratings for flanges. Before introducing tables E.1 to E.22 into national standards, it should be checked whether they comply with the relevant national codes and regulations.

E.2 Rating of flanged joints

If two flanges in a flanged joint do not have the same pressure/temperature rating, the rating of the joint at any temperature should not exceed the lower of the two flange ratings at that temperature.

NOTES

- 1 The temperature shown for a corresponding pressure rating is considered to be that of the contained fluid. The use of a pressure rating corresponding to a temperature other than that of the contained fluid is the responsibility of the user and is subject to the requirements of any applicable code or regulation.
- 2 Application of the ratings in this part of ISO 7005 to flanged joints should take into consideration the risk of leakage due to forces and moments developed in the connecting pipework.
- 3 At temperatures in the creep range, gradual relaxation of flanged joints may progressively reduce bolt loads and the tightness of the joint.
- 4 At low temperatures some of the materials listed in the rating tables undergo a sufficient decrease in impact resistance that they cannot safely sustain sudden changes in stress or temperature.
- 5 Owing to the nature of any thread sealant used, additional limitations may be placed on a threaded flange.
- 6 These notes on service conditions are not intended to be exhaustive.

Table E.1 — Pressure/temperature (P/T) ratings¹⁾ for flanges made using material groups 1E0 to 6E0

PN	Material group	Temperature (°C)													
		0 to 120	150	200	250	300	350	400	425	450	475	500	510	520	530
		Maximum non-shock working pressure (bar)													
2,5	1E0	2,5	2,25	2	1,75	1,5									
	2E0	2,5	2,25	2	1,75	1,5	1,25	0,88							
	3E0	2,5	2,45	2,25	2	1,75	1,38	1,13							
6	1E0	6	5,4	4,8	4,2	3,6									
	2E0	6	5,4	4,8	4,2	3,6	3	2,1							
	3E0	6	5,9	5,7	5,4	4,8	4,2	3,3	2,7						
10	1E0	10	9	8	7	6									
	2E0	10	9	8	7	6	5	3,5							
	3E0	10	9,8	9,5	9	8	7	5,5	4,5						
	4E0	10	10	10	10	8,7	7,8	7,4	7,2	7					
16	1E0	16	14,4	12,8	11,2	9,6									
	2E0	16	14,4	12,8	11,2	9,6	8	5,6							
	3E0	16	15,7	15,2	14,4	12,8	11,2	8,8	7,2						
	4E0	16	16	16	16	13,9	12,5	11,8	11,5	11,2					
	5E0	16	16	16	16	16	15,2	14,6	14,2	13,9	13,1	11,8	9,9	7,8	6,1
25	1E0	25	22,5	20	17,5	15									
	2E0	25	22,5	20	17,5	15	12,5	8,8							
	3E0	25	24,5	23,8	22,5	20	17,5	13,8	11,3						
	4E0	25	25	25	25	21,8	19,5	18,5	18	17,5					
	5E0	25	25	25	25	25	23,8	22,8	22,3	21,8	20,5	18,5	15,5	12,3	9,5
	6E0	25	25	25	25	25	25	22,8	22,3	21,8	20	13,8	12,5	11	9,5
40	1E0	40	36	32	28	24									
	2E0	40	36	32	28	24	20	14							
	3E0	40	39,2	38	36	32	28	22	18						
	4E0	40	40	40	40	34,8	31,2	29,6	28,8	28					
	5E0	40	40	40	40	40	38	36,4	35,6	34,8	32,8	29,6	24,8	19,6	15,2
	6E0	40	40	40	40	40	40	36,4	35,6	34,8	32	22	20	17,6	15,2

1) Pressure/temperature ratings of flanges PN 2,5, PN 6, PN 10, PN 16, PN 25 and PN 40 are valid only for flanges of types 05, 11, 12, 13 and 21 having nominal sizes up to and including DN 600.

Table E.2 — Pressure/temperature (P/T) ratings¹⁾ for flanges made using material groups 7E0 to 9E0

PN	Material group	Temperature (°C)										
		≤ 20	100	150	200	250	300	350	400	450	500	550
Maximum non-shock working pressure (bar)												
2,5	7E0	3,5	2,44	2,27	2	1,82	1,56					
	7E1	3,94	2,72	2,5	2,28	2,11	1,89					
	7E2	5,44	4,11	3,91	3,72	3,5	3,33					
	8E0	2,39	2,18	1,97	1,86	1,63	1,31	1,09	0,98			
	8E1	2,72	2,51	2,29	2,07	1,86	1,52	1,31	1,09			
	8E2	3,06	2,72	2,51	2,29	2,07	1,74	1,52	1,31			
	8E3	3,5	3,06	2,83	2,61	2,4	2,18	1,97	1,63			
	9E0	5,44	5,12	4,94	4,78	4,61	4,33	4,22	4	3,67	2,87	1,48
6	7E0	8,4	5,9	5,4	4,8	4,4	3,8					
	7E1	9,5	6,5	6	5,5	5,1	4,5					
	7E2	13,1	9,9	9,4	8,9	8,4	8					
	8E0	5,7	5,2	4,7	4,5	3,9	3,1	2,6	2,3			
	8E1	6,5	6	5,5	5	4,5	3,7	3,1	2,6			
	8E2	7,3	6,5	6	5,5	5	4,2	3,7	3,1			
	8E3	8,4	7,3	6,8	6,3	5,8	5,2	4,7	3,9			
	9E0	13,1	12,3	11,9	11,5	11,1	10,4	10,1	9,6	8,8	6,9	3,5
10	7E0	14	9,8	9,1	8	7,3	6,3					
	7E1	15,8	10,9	10	9,1	8,4	7,6					
	7E2	21,8	16,4	15,6	14,9	14	13,3					
	8E0	9,6	8,7	7,9	7,4	6,5	5,2	4,4	3,9			
	8E1	10,9	10	9,2	8,3	7,4	6,1	5,2	4,4			
	8E2	12,2	10,9	10	9,2	8,3	7	6,1	5,2			
	8E3	14	12,2	11,3	10,4	9,6	8,7	7,9	6,5			
	9E0	21,8	20,5	19,8	19,1	18,4	17,3	16,9	16	14,7	11,5	5,9
16	7E0	22,4	15,6	14,5	12,8	11,7	10					
	7E1	25,2	17,4	16	14,6	13,5	12,1					
	7E2	34,8	26,3	25	23,8	22,4	21,3					
	8E0	15,3	13,9	12,6	11,9	10,5	8,4	7	6,3			
	8E1	17,4	16,1	14,6	13,2	11,9	9,7	8,4	7			
	8E2	19,6	17,4	16,1	14,6	13,2	11,2	9,7	8,4			
	8E3	22,4	19,6	18,1	16,7	15,4	13,9	12,6	10,5			
	9E0	34,8	32,8	31,6	30,6	29,5	27,7	27	25,6	23,5	18,3	9,5
25	7E0	35	24,4	22,7	20	18,2	15,7					
	7E1	39,4	27,2	25	22,8	21,1	18,9					
	7E2	54,4	41,1	39,1	37,2	35	33,3					
	8E0	23,9	21,8	19,7	18,6	16,3	13,1	10,9	9,8			
	8E1	27,2	25,1	22,9	20,7	18,6	15,2	13,1	10,9			
	8E2	30,6	27,2	25,1	22,9	20,7	17,4	15,2	13,1			
	8E3	35	30,6	28,3	26,1	24	21,8	19,7	16,3			
	9E0	54,4	51,2	49,4	47,8	46,1	43,3	42,2	40	36,7	28,7	14,8
40	7E0	56	39,1	36,3	32	29,2	25,1					
	7E1	63,1	43,6	40	36,4	33,8	30,2					
	7E2	87,1	65,8	62,6	59,6	56,3	53,3					
	8E0	38,2	34,8	31,5	29,7	26,1	21	17,4	15,6			
	8E1	43,6	40,2	36,6	33,1	29,7	24,4	21	17,4			
	8E2	48,9	43,6	40,2	36,6	33,1	27,9	24,4	21			
	8E3	54,4	51,2	49,4	47,8	46,1	43,3	42,2	40			
	9E0	87,1	81,9	79,1	76,4	73,8	69,3	67,6	64	58,7	45,9	23,6

1) Pressure/temperature ratings of flanges PN 2,5, PN 6, PN 10, PN 16, PN 25 and PN 40 are valid for flanges of types 05, 11, 12, 13 and 21 having nominal sizes up to and including DN 600.

Table E.3 — Pressure/temperature (P/T) ratings¹⁾ for flanges made using austenitic stainless steels (based on 0,2% proof stress²⁾, material groups 10E0 to 15E0

PN	Material group	Temperature (°C)										
		≤ 20	50	100	150	200	250	300	350	400	450	500
		Maximum non-shock working pressure (bar)										
2,5	10E0	2	1,8	1,63	1,47	1,31	1,2	1,11	1,04	0,99	0,94	0,9
	10E1	3	2,72	2,28	1,94	1,74	1,61	1,51	1,44	1,39	1,34	1,32
	11E0	2,17	1,97	1,74	1,58	1,41	1,31	1,22	1,16	1,09	1,06	1,02
	12E0	2,22	2,11	1,96	1,86	1,74	1,63	1,51	1,44	1,39	1,34	1,32
	13E0	2,11	2,02	1,84	1,69	1,52	1,41	1,31	1,26	1,2	1,14	1,11
	13E1	3,11	2,78	2,34	2,06	1,86	1,72	1,61	1,56	1,5	1,46	1,43
	14E0	2,28	2,18	1,97	1,8	1,63	1,52	1,41	1,33	1,28	1,24	1,22
	15E0	2,33	2,24	2,06	1,97	1,86	1,74	1,61	1,56	1,5	1,46	1,43
6	10E0	4,8	4,3	3,9	3,5	3,1	2,9	2,7	2,5	2,4	2,3	2,2
	10E1	7,2	6,5	5,5	4,7	4,2	3,9	3,6	3,5	3,3	3,2	3,2
	11E0	5,2	4,7	4,2	3,8	3,4	3,1	2,9	2,8	2,6	2,5	2,5
	12E0	5,3	5,1	4,7	4,5	4,2	3,9	3,6	3,5	3,3	3,2	3,2
	13E0	5,1	4,9	4,4	4,1	3,7	3,4	3,1	3	2,9	2,7	2,7
	13E1	7,5	6,7	5,6	4,9	4,5	4,1	3,9	3,7	3,6	3,5	3,4
	14E0	5,5	5,2	4,7	4,3	3,9	3,7	3,4	3,2	3,1	3	2,9
	15E0	5,6	5,4	4,9	4,7	4,5	4,2	3,9	3,7	3,6	3,5	3,4
10	10E0	8	7,2	6,5	5,9	5,2	4,8	4,4	4,2	4	3,8	3,6
	10E1	12	10,9	9,1	7,8	7	6,4	6	5,8	5,6	5,4	5,3
	11E0	8,7	7,9	7	6,3	5,6	5,2	4,9	4,6	4,4	4,2	4,1
	12E0	8,9	8,4	7,8	7,4	7	6,5	6	5,8	5,6	5,4	5,3
	13E0	8,4	8,1	7,4	6,8	6,1	5,6	5,2	5	4,8	4,6	4,4
	13E1	12,4	11,1	9,4	8,2	7,4	6,9	6,4	6,2	6	5,8	5,7
	14E0	9,1	8,7	7,9	7,2	6,5	6,1	5,6	5,3	5,1	5	4,9
	15E0	9,3	9	8,2	7,9	7,4	7	6,4	6,2	6	5,8	5,7
16	10E0	12,8	11,5	10,5	9,4	8,4	7,7	7,1	6,7	6,3	6	5,8
	10E1	19,2	17,4	14,6	12,4	11,2	10,3	9,7	9,2	8,9	8,6	8,5
	11E0	13,9	12,6	11,2	10,1	9	8,4	7,8	7,4	7	6,8	6,5
	12E0	14,2	13,5	12,5	11,9	11,2	10,5	9,7	9,2	8,9	8,6	8,5
	13E0	13,5	12,9	11,8	10,8	9,7	9	8,4	8	7,7	7,3	7,1
	13E1	19,9	17,8	15	13,2	11,9	11	10,3	10	9,6	9,3	9,2
	14E0	14,6	13,9	12,6	11,5	10,5	9,7	9	8,5	8,2	8	7,8
	15E0	14,9	14,4	13,2	12,6	11,9	11,2	10,3	10	9,6	9,3	9,2
25	10E0	20	18	16,3	14,7	13,1	12	11,1	10,4	9,9	9,4	9
	10E1	30	27,2	22,8	19,4	17,4	16,1	15,1	14,4	13,9	13,4	13,2
	11E0	21,7	19,7	17,4	15,8	14,1	13,1	12,2	11,6	10,9	10,6	10,2
	12E0	22,2	21,1	19,6	18,6	17,4	16,3	15,1	14,4	13,9	13,4	13,2
	13E0	21,1	20,2	18,4	16,9	15,2	14,1	13,1	12,6	12	11,4	11,1
	13E1	31,1	27,8	23,4	20,6	18,6	17,2	16,1	15,6	15	14,6	14,3
	14E0	22,8	21,8	19,7	18	16,3	15,2	14,1	13,3	12,8	12,4	12,2
	15E0	23,3	22,4	20,6	19,7	18,6	17,4	16,1	15,6	15	14,6	14,3
40	10E0	32	28,8	26,1	23,5	21	19,2	17,8	16,7	15,8	15	14,4
	10E1	48	43,6	36,4	31,1	27,9	25,8	24,2	23,1	22,2	21,5	21,2
	11E0	34,7	31,5	27,9	25,2	22,6	21	19,6	18,5	17,4	16,9	16,4
	12E0	35,6	33,8	31,3	29,7	27,9	26,1	24,2	23,1	22,2	21,5	21,2
	13E0	33,8	32,4	29,5	27	24,4	22,6	21	20,1	19,2	18,3	17,8
	13E1	49,8	44,4	37,5	32,9	29,7	27,6	25,8	24,9	24	23,3	22,9
	14E0	36,4	34,8	31,5	28,8	26,1	24,4	22,6	21,3	20,4	19,9	19,6
	15E0	37,3	35,9	32,9	31,5	29,7	27,9	25,8	24,9	24	23,3	22,9

1) Pressure/temperature ratings of flanges PN 2,5, PN 6, PN 10, PN 16, PN 25 and PN 40 are valid only for flanges of types 05, 11, 12, 13 and 21 having nominal sizes up to and including DN 600.

2) Based on a reference stress of 205 N/mm².

Table E.4 — Pressure/temperature (P/T) ratings¹⁾ for flanges made using austenitic stainless steels (based on 1% proof stress²⁾, material groups 10E0 to 15E0

PN	Material group	Temperature (°C)										
		≤ 20	50	100	150	200	250	300	350	400	450	500
Maximum non-shock working pressure (bar)												
2,5	10E0	2,39	2,23	2,01	1,8	1,63	1,52	1,41	1,34	1,29	1,24	1,21
	10E1	3,39	3,11	2,67	2,33	2,08	1,94	1,85	1,79	1,73	1,69	1,66
	11E0	2,56	2,34	2,12	1,91	1,74	1,61	1,5	1,43	1,39	1,36	1,33
	12E0	2,61	2,47	2,31	2,17	2,06	1,94	1,86	1,79	1,73	1,69	1,66
	13E0	2,5	2,41	2,21	2,01	1,86	1,74	1,61	1,54	1,5	1,44	1,42
	13E1	3,5	3,16	2,73	2,42	2,2	2,03	1,94	1,88	1,82	1,78	1,76
	14E0	2,67	2,56	2,34	2,12	1,97	1,86	1,73	1,67	1,6	1,57	1,54
	15E0	2,72	2,6	2,42	2,29	2,18	2,07	1,94	1,88	1,82	1,78	1,76
6	10E0	5,7	5,4	4,8	4,3	3,9	3,7	3,4	3,2	3,1	3	2,9
	10E1	8,1	7,5	6,4	5,6	5	4,7	4,5	4,3	4,2	4,1	4
	11E0	6,1	5,6	5,1	4,6	4,2	3,9	3,6	3,4	3,3	3,3	3,2
	12E0	6,3	5,9	5,5	5,2	4,9	4,7	4,5	4,3	4,2	4,1	4
	13E0	6	5,8	5,3	4,8	4,5	4,2	3,9	3,7	3,6	3,5	3,4
	13E1	8,4	7,6	6,6	5,8	5,3	4,9	4,7	4,5	4,4	4,3	4,2
	14E0	6,4	6,1	5,6	5,1	4,7	4,5	4,2	4	3,8	3,8	3,7
	15E0	6,5	6,2	5,8	5,5	5,2	5	4,7	4,5	4,4	4,3	4,2
10	10E0	9,6	8,9	8	7,2	6,5	6,1	5,6	5,4	5,2	5	4,8
	10E1	13,6	12,4	10,7	9,3	8,3	7,8	7,4	7,2	6,9	6,8	6,6
	11E0	10,2	9,4	8,5	7,6	7	6,4	6	5,7	5,6	5,4	5,3
	12E0	10,4	9,9	9,2	8,7	8,2	7,8	7,4	7,2	6,9	6,8	6,6
	13E0	10	9,6	8,8	8	7,4	7	6,4	6,2	6	5,8	5,7
	13E1	14	12,6	10,9	9,7	8,8	8,1	7,8	7,5	7,3	7,1	7
	14E0	10,7	10,2	9,4	8,5	7,9	7,4	6,9	6,7	6,4	6,3	6,2
	15E0	10,9	10,4	9,7	9,2	8,7	8,3	7,8	7,5	7,3	7,1	7
16	10E0	15,3	14,3	12,9	11,5	10,5	9,7	9	8,6	8,2	8	7,8
	10E1	21,7	19,9	17,1	14,9	13,3	12,4	11,9	11,4	11,1	10,8	10,6
	11E0	16,4	15	13,6	12,2	11,2	10,3	9,6	9,2	8,9	8,7	8,5
	12E0	16,7	15,8	14,8	13,9	13,2	12,4	11,9	11,4	11,1	10,8	10,6
	13E0	16	15,4	14,2	12,9	11,9	11,2	10,3	9,9	9,6	9,2	9,1
	13E1	22,4	20,2	17,5	15,5	14,1	13	12,4	12	11,7	11,4	11,2
	14E0	17,1	16,4	15	13,6	12,6	11,9	11,1	10,7	10,2	10	9,9
	15E0	17,4	16,6	15,5	14,6	13,9	13,2	12,4	12	11,7	11,4	11,2
25	10E0	23,9	22,3	20,1	18	16,3	15,2	14,1	13,4	12,9	12,4	12,1
	10E1	33,9	31,1	26,7	23,3	20,8	19,4	18,5	17,9	17,3	16,9	16,6
	11E0	25,6	23,4	21,2	19,1	17,4	16,1	15	14,3	13,9	13,6	13,3
	12E0	26,1	24,7	23,1	21,7	20,6	19,4	18,6	17,9	17,3	16,9	16,6
	13E0	25	24,1	22,1	20,1	18,6	17,4	16,1	15,4	15	14,4	14,2
	13E1	35	31,6	27,3	24,2	22	20,3	19,4	18,8	18,2	17,8	17,6
	14E0	26,7	25,6	23,4	21,2	19,7	18,6	17,3	16,7	16	15,7	15,4
	15E0	27,2	26	24,2	22,9	21,8	20,7	19,4	18,8	18,2	17,8	17,6
40	10E0	38,2	35,7	32,2	28,8	26,1	24,4	22,6	21,5	20,6	19,9	19,4
	10E1	54,2	49,8	42,7	37,3	33,2	31,1	29,7	28,6	27,7	27	26,5
	11E0	40,9	37,5	34	30,6	27,9	25,8	24	22,9	22,2	21,7	21,3
	12E0	41,8	39,5	37	34,7	32,9	31,1	29,7	28,6	27,7	27	26,5
	13E0	40	38,6	35,4	32,2	29,7	27,9	25,8	24,7	24	23,1	22,8
	13E1	56	50,5	43,7	38,8	35,2	32,5	31,1	30	29,2	28,4	28,1
	14E0	42,7	40,9	37,5	34	31,5	29,7	27,7	26,7	25,6	25,1	24,7
	15E0	43,6	41,6	38,8	36,6	34,8	33,1	31,1	30	29,2	28,4	28,1

1) Pressure/temperature ratings of flanges PN 2,5, PN 6, PN 10, PN 16, PN 25 and PN 40 are valid only for flanges of types 05, 11, 12, 13 and 21 having nominal sizes up to and including DN 600.

2) Based on a reference stress of 225 N/mm².

Table E.5 — Pressure/temperature (P/T) ratings for flanges made using group 1A1 materials

Temperature (°C)	Maximum non-shock working pressure (bar)					
	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420
-29 to 38	19,6	51,1	102,1	153,2	255,3	425,5
50	19,2	50,1	100,2	150,2	250,4	417,3
100	17,7	46,4	92,8	139,1	231,9	386,5
150	15,8	45,2	90,5	135,7	226,1	376,9
200	14	43,8	87,6	131,5	219,1	365,2
250	12,1	41,7	83,4	125,2	208,6	347,7
300	10,2	38,7	77,5	116,2	193,7	322,8
350	8,4	37	73,9	110,9	184,8	308
375	7,4	36,5	72,9	109,4	182,3	303,9
400	6,5	34,5	69	103,5	172,5	287,5
425	5,6	28,8	57,5	86,3	143,8	239,6
450	4,7	20	40,1	60,1	100,2	166,9
475	3,7	13,5	27,1	40,6	67,7	112,9
500	2,8	8,8	17,6	26,4	44	73,3
525	1,9	5,2	10,4	15,5	25,9	43,2
540	1,3	3,3	6,5	9,8	16,3	27,2

NOTE — Consult table D.2 and the notes to table D.2 for limitations on use.

Table E.6 — Pressure/temperature (P/T) ratings for flanges made using group 1A2 materials

Temperature (°C)	Maximum non-shock working pressure (bar)					
	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420
-29 to 38	20	51,7	103,4	155,2	258,6	431
50	19,2	51,7	103,4	155,2	258,6	431
100	17,7	51,5	103,1	154,6	257,7	429,5
150	15,8	50,2	100,4	150,6	251	418,3
200	14	48,8	97,6	146,4	243,9	406,6
250	12,1	46,3	92,7	139	231,7	386,1
300	10,2	42,4	84,9	127,3	212,1	353,5
350	8,4	40,2	80,5	120,7	201,2	335,3
375	7,4	38,8	77,6	116,4	194	323,4
400	6,5	34,5	69	103,5	172,5	287,5
425	5,6	28,8	57,5	86,3	143,8	239,6
450	4,7	20	40,1	60,1	100,2	166,9
475	3,7	13,5	27,1	40,6	67,7	112,9
500	2,8	8,8	17,6	26,4	44	73,3
525	1,9	5,2	10,4	15,5	25,9	43,2
540	1,3	3,3	6,5	9,8	16,3	27,2

NOTE — Consult table D.2 and the notes to table D.2 for limitations on use.

Table E.7 — Pressure/temperature (P/T) ratings for flanges made using group 1A3 materials

Temperature (°C)	Maximum non-shock working pressure (bar)					
	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420
-29 to 38	18,4	47,9	95,7	143,6	239,4	398,9
50	18,1	47,3	94,6	141,9	236,5	394,2
100	17,3	45,1	90,2	135,3	225,5	375,9
150	15,8	44	87,9	131,9	219,8	366,3
200	14	42,7	85,4	128	213,4	355,6
250	12,1	40,6	81,2	121,8	202,9	338,2
300	10,2	37,7	75,4	113,1	188,5	314,2
350	8,4	36	71,9	107,9	179,8	299,7
375	7,4	35,3	70,6	105,9	176,6	294,3
400	6,5	32,4	64,8	97,2	162	270
425	5,6	27,3	54,6	81,9	136,5	227,5
450	4,7	19,8	39,6	59,4	99	165
475	3,7	13,5	27,1	40,6	67,7	112,9
500	2,8	8,8	17,6	26,4	44	73,3
525	1,9	5,2	10,4	15,5	25,9	43,2
540	1,3	3,3	6,5	9,8	16,3	27,2

NOTE — Consult table D.2 and the notes to table D.2 for limitations on use.

Table E.8 — Pressure/temperature (P/T) ratings for flanges made using group 1A4 materials

Temperature (°C)	Maximum non-shock working pressure (bar)					
	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420
-29 to 38	16,3	42,5	85,1	127,6	212,7	354,6
50	16	41,7	83,4	125,2	208,6	347,7
100	14,8	38,6	77,2	115,8	193,1	321,8
150	14,5	37,7	75,4	113,1	188,6	314,3
200	14	36,6	73,1	109,7	182,8	304,7
250	12,1	34,7	69,4	104,1	173,6	289,3
300	10,2	32,3	64,6	96,9	161,5	269,1
350	8,4	30,9	61,9	92,8	154,6	257,7
375	7,4	30,9	61,7	92,6	154,3	275,2
400	6,5	30,3	60,6	90,9	151,5	252,5
425	5,6	25,8	51,6	77,4	128,9	214,9
450	4,7	19,6	39,2	58,7	97,9	163,2
475	3,7	13,5	27,1	40,6	67,7	112,9
500	2,8	8,8	17,6	26,4	44	73,3
525	1,9	5,2	10,4	15,5	25,9	43,2
540	1,3	3,3	6,5	9,8	16,3	27,2

NOTE — Consult table D.2 and the notes to table D.2 for limitations on use.

Table E.9 — Pressure/temperature (P/T) ratings for flanges made using group 1A5 materials

Temperature (°C)	Maximum non-shock working pressure (bar)					
	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420
-29 to 38	18,4	47,9	95,8	143,6	239,4	399
50	18,3	47,6	95,3	142,9	238,2	397,1
100	17,7	46,6	93,2	139,8	233	388,3
150	15,8	45	89,9	134,9	224,8	374,6
200	14	44,2	88,4	132,6	221	368,3
250	12,1	43,1	86,2	129,2	215,4	359
300	10,2	42	84,1	126,1	210,1	350,2
350	8,4	40,2	80,5	120,7	201,2	335,3
375	7,4	38,8	77,6	116,4	194	323,4
400	6,5	36,6	73,2	109,8	182,9	304,9
425	5,6	35,1	70,2	105,3	175,5	292,5
450	4,7	33,8	67,6	101,4	169	218,7
475	3,7	31,7	63,3	95	158,3	263,8
500	2,8	24,1	48,1	72,2	120,3	200,6
525	1,9	15	30,1	45,1	75,2	125,4
540	1,3	10,7	21,4	32,1	53,5	89,2

NOTE — Consult table D.2 and the notes to table D.2 for limitations on use.

Table E.10 — Pressure/temperature (P/T) ratings for flanges made using group 1A7 materials

Temperature (°C)	Maximum non-shock working pressure (bar)					
	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420
-29 to 38	20	51,7	103,4	155,2	258,6	431
50	19,2	51,7	103,4	155,2	258,6	431
100	17,7	51,5	103,1	154,6	257,7	429,5
150	15,8	50,2	100,4	150,6	251	418,3
200	14	48,8	97,6	146,4	243,9	406,6
250	12,1	46,3	92,7	139	231,7	386,1
300	10,2	42,4	84,9	127,3	212,1	353,5
350	8,4	40,2	80,5	120,7	201,2	335,3
375	7,4	38,8	77,6	116,4	194	323,4
400	6,5	36,6	73,2	109,8	182,9	304,9
425	5,6	35,1	70,2	105,3	175,5	292,5
450	4,7	33,8	67,6	101,4	169	281,7
475	3,7	31,7	63,3	95	158,3	263,8
500	2,8	27,1	54,1	81,2	135,3	225,4
525	1,9	18,8	37,6	56,4	94	156,6
550	1,3 ¹⁾	13,9	27,9	41,8	69,7	116,1
575	—	12,4	24,9	37,3	62,2	103,7

1) The maximum non-shock working pressure is 1,3 bar at 540°C for PN 20.

NOTE — Consult table D.2 and the notes to table D.2 for limitations on use.

Table E.11 — Pressure/temperature (P/T) ratings for flanges made using group 1A9 materials

Temperature (°C)	Maximum non-shock working pressure (bar)					
	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420
-29 to 38	20	51,7	103,4	155,2	258,6	431
50	19,2	51,1	102,3	153,4	255,7	426,2
100	17,7	48,8	97,5	146,3	243,8	406,4
150	15,8	46,4	92,7	139,1	231,9	386,4
200	14	45,5	91	136,4	227,4	379
250	12,1	44,5	88,9	133,4	222,3	370,6
300	10,2	42,4	84,9	127,3	212,1	353,5
350	8,4	40,2	80,5	120,7	201,2	335,3
375	7,4	38,8	77,6	116,4	194	323,4
400	6,5	36,6	73,2	109,8	182,9	304,9
425	5,6	35,1	70,2	105,3	175,5	292,5
450	4,7	33,8	67,6	101,4	169	281,7
475	3,7	31,7	63,3	95	158,3	263,8
500	2,8	27,8	55,6	83,4	139	231,6
525	1,9	20,3	40,5	60,8	101,3	168,9
550	1,3 ¹⁾	12,8	25,5	38,3	63,8	106,4
575	—	8,5	17	25,5	42,5	70,8
600	—	5,9	11,8	17,6	29,4	49
625	—	3,4	6,8	10,1	16,9	28,2
650	—	2,3	4,6	7	11,6	19,3

1) The maximum non-shock working pressure is 1,3 bar at 540°C for PN 20.

NOTE — Consult table D.2 and the notes to table D.2 for limitations on use.

Table E.12 — Pressure/temperature (P/T) ratings for flanges made using group 1A10 materials

Temperature (°C)	Maximum non-shock working pressure (bar)					
	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420
-29 to 38	20	51,7	103,4	155,2	258,6	431
50	19,2	51,2	102,4	153,6	256	426,7
100	17,7	49	98,1	147,1	245,2	408,7
150	15,8	46,6	93,3	139,9	233,2	388,6
200	14	44,8	89,7	134,5	224,2	373,7
250	12,1	44,2	88,4	132,7	221,1	368,5
300	10,2	42,4	84,9	127,3	212,1	353,5
350	8,4	40,2	80,5	120,7	201,2	335,3
375	7,4	38,8	77,6	116,4	194	323,4
400	6,5	36,6	73,2	109,8	182,9	304,9
425	5,6	35,1	70,2	105,3	175,5	292,5
450	4,7	33,8	67,6	101,4	169	281,7
475	3,7	31,7	63,3	95	158,3	263,8
500	2,8	27,8	55,6	83,4	139	231,6
525	1,9	21,9	43,8	65,8	109,6	182,7
550	1,3 ¹⁾	16,4	32,7	49,1	81,8	136,4
575	—	11,7	23,4	35,1	58,5	97,5
600	—	7,6	15,3	22,9	38,2	63,6
625	—	6,6	13,3	19,9	33,2	55,3
650	—	3,7	7,3	11	18,3	30,4

1) The maximum non-shock working pressure is 1,3 bar at 540°C for PN 20.

Table E.13 — Pressure/temperature (P/T) ratings for flanges made using group 1A13 materials

Temperature (°C)	Maximum non-shock working pressure (bar)					
	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420
-29 to 38	20	51,7	103,4	155,2	258,6	431
50	19,2	51,7	103,4	155,2	258,6	431
100	17,7	51,5	103,1	154,6	257,7	429,5
150	15,8	50,2	100,4	150,6	251	418,3
200	14	48,8	97,6	146,4	243,9	406,6
250	12,1	46,3	92,7	139	231,7	386,1
300	10,2	42,4	84,9	127,3	212,1	353,5
350	8,4	40,2	80,5	120,7	201,2	335,3
375	7,4	38,8	77,6	116,4	194	323,4
400	6,5	36,6	73,2	109,8	182,9	304,9
425	5,6	34,5	69	103,5	172,5	287,5
450	4,7	30,9	61,8	92,7	154,5	257,6
475	3,7	25,9	51,8	77,7	129,5	215,8
500	2,8	20,3	40,5	60,8	101,3	168,9
525	1,9	15,4	30,8	46,3	77,1	128,5
550	1,3 ¹⁾	11,7	23,4	35	58,4	97,3
575	—	8,8	17,6	26,4	44,1	73,4
600	—	6,5	13,1	19,6	32,6	54,4
625	—	4,5	9	13,5	22,5	37,5
650	—	3	6	9	15	25,1

1) The maximum non-shock working pressure is 1,3 bar at 540°C for PN 20.

Table E.14 — Pressure/temperature (P/T) ratings for flanges made using group 1A14 materials

Temperature (°C)	Maximum non-shock working pressure (bar)					
	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420
-29 to 38	20	51,7	103,4	155,2	258,6	431
50	19,2	51,7	103,4	155,2	258,6	431
100	17,7	51,5	103,1	154,6	257,7	429,5
150	15,8	50,2	100,4	150,6	251	418,3
200	14	48,8	97,6	146,4	243,9	406,6
250	12,1	46,3	92,7	139	231,7	386,1
300	10,2	42,4	84,9	127,3	212,1	353,5
350	8,4	40,2	80,5	120,7	201,2	335,3
375	7,4	38,8	77,6	116,4	194	323,4
400	6,5	36,6	73,2	109,8	182,9	304,9
425	5,6	35,1	70,2	105,3	175,5	292,5
450	4,7	33,8	67,6	101,4	169	281,7
475	3,7	31,7	63,3	95	158,3	263,8
500	2,8	27,5	55	82,5	137,5	229,1
525	1,9	22,6	45,2	67,8	113	188,3
550	1,3 ¹⁾	17	34	50,9	84,9	141,5
575	—	11,2	22,5	33,7	56,2	93,6
600	—	7,2	14,4	21,5	35,9	59,8
625	—	5	9,9	14,9	24,9	41,4
650	—	3,5	7	10,4	17,4	29

1) The maximum non-shock working pressure is 1,3 bar at 540°C for PN 20.

NOTE — Consult table D.2 and the notes to table D.2 for limitations on use.

Table E.15 — Pressure/temperature (P/T) ratings for flanges made using group 2A1 materials

Temperature (°C)	Maximum non-shock working pressure (bar)					
	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420
-29 to 38	19	49,6	99,3	148,9	248,2	413,6
50	18,4	47,8	95,7	143,5	239,2	398,6
100	15,7	40,9	81,8	122,6	204,4	340,7
150	13,9	36,3	72,7	109	181,7	302,8
200	12,6	32,8	65,5	98,3	163,8	273
250	11,7	30,5	61,1	91,6	152,7	254,5
300	10,2	29,1	58,1	87,2	145,3	242,1
350	8,4	28,1	56,1	84,2	140,3	233,8
375	7,4	27,8	55,5	83,3	138,8	231,3
400	6,5	27,5	54,9	82,4	137,3	228,9
425	5,6	27,2	54,3	81,5	135,8	226,4
450	4,7	26,9	53,7	80,6	134,3	223,9
475	3,7	26,6	53,1	79,7	132,8	221,4
500	2,8	26,1	52,1	78,2	130,3	217,2
525	1,9	23,9	47,8	71,6	119,4	199
550	1,3 ¹⁾	21,8	43,6	65,4	109,1	181,8
575	—	20,1	40,1	60,2	100,4	167,3
600	—	16,7	33,4	50,1	83,6	139,3
625	—	13,1	26,2	39,2	65,4	109
650	—	10,5	21	31,6	52,6	87,6
675	—	7,8	15,5	23,3	38,8	64,6
700	—	6	12	17,9	29,9	49,8
725	—	4,6	9,3	13,9	23,1	38,5
750	—	3,7	7,3	11	18,3	30,4
775	—	2,8	5,6	8,4	14	23,3
800	—	2,1	4,1	6,2	10,3	17,1

1) The maximum non-shock working pressure is 1,3 bar at 540°C for PN 20.

NOTE — Consult table D.2 and the notes to table D.2 for limitations on use.

Table E.16 — Pressure/temperature (P/T) ratings for flanges made using group 2A2 materials

Temperature (°C)	Maximum non-shock working pressure (bar)					
	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420
-29 to 38	19	49,6	99,3	148,9	248,2	413,6
50	18,4	48,1	96,3	144,4	240,6	401
100	16,2	42,2	84,4	126,6	211	351,7
150	14,8	38,5	77	115,5	192,5	320,9
200	13,7	35,7	71,3	107	178,4	297,3
250	12,1	33,4	66,8	100,2	166,9	278,2
300	10,2	31,6	63,3	94,9	158,1	263,6
350	8,4	30,4	60,8	91,3	152,1	253,8
375	7,4	29,7	59,4	89,1	148,5	247,5
400	6,5	29,1	58,2	87,3	145,6	242,6
425	5,6	28,7	57,3	86	143,3	238,9
450	4,7	28,1	56,2	84,2	140,4	234
475	3,7	27,4	54,7	82,1	136,8	228
500	2,8	26,8	53,7	80,5	134,1	223,6
525	1,9	25,8	51,6	77,4	129	214,9
550	1,3 ¹⁾	25	49,9	74,9	124,8	208
575	—	24,1	48,2	72,3	120,5	200,8
600	—	21,4	42,9	64,3	107,2	178,6
625	—	18,3	36,5	54,8	91,3	152,1
650	—	14,1	28,2	42,4	70,6	117,7
675	—	12,6	25,3	37,9	63,2	105,3
700	—	9,9	19,9	29,8	49,7	82,9
725	—	7,7	15,4	23,1	38,5	64,2
750	—	5,9	11	17,6	29,4	49
775	—	4,6	9,1	13,7	22,8	38
800	—	3,5	7	10,5	17,5	29,2

1) The maximum non-shock working pressure is 1,3 bar at 540°C for PN 20.

NOTE — Consult table D.2 and the notes to table D.2 for limitations on use.

Table E.17 — Pressure/temperature (P/T) ratings for flanges made using group 2A3 materials

Temperature (°C)	Maximum non-shock working pressure (bar)					
	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420
-29 to 38	15,9	41,4	82,7	124,1	206,8	344,6
50	15,3	40	79,9	119,9	199,8	333
100	13,2	34,5	69	103,5	172,4	287,4
150	12	31,2	62,5	93,7	156,1	260,2
200	11	28,7	57,4	86,1	143,5	239,1
250	10,2	26,7	53,4	80,1	133,5	222,5
300	9,7	25,2	50,5	75,7	126,2	210,4
350	8,4	24	48,1	72,1	120,2	200,4
375	7,4	23,6	47,2	70,8	118	196,7
400	6,5	23,2	46,3	69,5	115,8	192,9
425	5,6	22,7	45,4	68,1	113,5	189,2
450	4,7	22,3	44,5	66,8	111,3	185,5

NOTE — Consult table D.2 and the notes to table D.2 for limitations on use.

Table E.18 — Pressure/temperature (P/T) ratings for flanges made using group 2A4 materials

Temperature (°C)	Maximum non-shock working pressure (bar)					
	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420
-29 to 38	19	49,6	99,3	148,9	248,2	413,6
50	18,4	48	96	143,9	239,9	399,8
100	15,9	41,5	83	124,5	207,5	345,9
150	14,4	37,5	75	112,5	187,5	312,5
200	13,2	34,4	68,7	103,1	171,9	286,5
250	12,1	32,1	64,1	96,2	160,3	267,2
300	10,2	30,5	61,1	91,6	152,7	254,5
350	8,4	29,3	58,7	88	146,7	244,5
375	7,4	28,9	57,8	86,8	144,6	241
400	6,5	28,6	57,3	85,9	143,1	238,6
425	5,6	28,5	57	85,4	142,4	237,3
450	4,7	28,2	56,4	84,6	141	234,9
475	3,7	28	56	84	140,1	233,5
500	2,8	27,8	55,6	83,4	139	231,6
525	1,9	25,8	51,6	77,4	129	214,9
550	1,3 ¹⁾	25	49,9	74,9	124,8	208
575	—	22,8	45,6	68,4	113,9	189,9
600	—	19,8	39,6	59,4	99	165,1
625	—	15,8	31,6	47,4	79	131,6
650	—	12,5	25	37,4	62,4	104
675	—	9,8	19,7	29,5	49,2	81,9
700	—	7,7	15,4	23	38,4	64
725	—	6,2	12,4	18,6	31	51,6
750	—	4,8	9,6	14,4	24	40
775	—	3,8	7,5	11,3	18,8	31,3
800	—	3	6,1	9,1	15,2	25,2

1) The maximum non-shock working pressure is 1,3 bar at 540°C for PN 20.

NOTE — Consult table D.2 and the notes to table D.2 for limitations on use.

Table E.19 — Pressure/temperature (P/T) ratings for flanges made using group 2A5 materials

Temperature (°C)	Maximum non-shock working pressure (bar)					
	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420
-29 to 38	19	49,6	99,3	148,9	248,2	413,6
50	18,5	48,4	96,8	145,1	241,9	403,2
100	16,7	43,5	86,9	130,4	217,3	362,2
150	15,5	40,5	81	121,5	202,5	337,5
200	14	38,4	76,8	115,3	192,1	320,2
250	12,1	36,2	72,4	108,6	181	301,7
300	10,2	34,4	68,9	103,3	172,2	287
350	8,4	32,9	65,8	98,7	164,5	274,2
375	7,4	32,2	64,4	96,6	161	268,4
400	6,5	31,8	63,5	95,3	158,8	264,7
425	5,6	31,5	62,9	94,4	157,3	262,2
450	4,7	30,8	61,5	92,3	153,8	256,3
475	3,7	30	60	90	150	250,1
500	2,8	27,8	55,6	83,4	139	231,6
525	1,9	25,8	51,6	77,4	129	214,9
550	1,3 ¹⁾	25	49,9	74,9	124,8	208
575	—	24,1	48,2	72,3	120,5	200,8
600	—	21,4	42,9	64,3	107,2	178,6
625	—	17,8	35,6	53,4	89	148,3
650	—	11,6	23,2	34,7	57,9	96,5
675	—	8,7	17,3	26	43,3	72,1
700	—	6,7	13,5	20,2	33,7	56,1
725	—	5,3	10,5	15,8	26,4	43,9
750	—	4	8	12,1	20,1	33,5
775	—	3,2	6,3	9,5	15,8	26,4
800	—	2,6	5,2	7,5	13,1	21,9

1) The maximum non-shock working pressure is 1,3 bar at 540°C for PN 20.

NOTE — Consult table D.2 and the notes to table D.2 for limitations on use.

Table E.20 — Pressure/temperature (P/T) ratings for flanges made using group 2A6 materials

Temperature (°C)	Maximum non-shock working pressure (bar)					
	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420
-29 to 38	17,8	46,3	92,7	139	231,6	386,1
50	17,4	45,3	90,7	136	226,9	377,7
100	15,9	41,4	82,8	124,2	207,1	345,1
150	15	39,2	78,4	117,5	195,9	326,5
200	14	36,9	73,9	110,8	184,7	307,9
250	12,1	35,1	70,2	105,3	175,6	292,6
300	10,2	33,4	66,9	100,3	167,2	278,7
350	8,4	32	63,9	95,9	159,8	266,3
375	7,4	31,4	62,7	94,1	156,8	261,3
400	6,5	30,8	61,5	92,3	153,8	256,3
425	5,6	30	60	90	150	250,1
450	4,7	29,4	58,8	88,2	147	245
475	3,7	28,8	57,6	86,4	144	240,1
500	2,8	27,8	55,6	83,4	139	231,6
525	1,9	25,4	50,8	76,1	126,9	211,5
550	1,3 ¹⁾	21,8	43,6	65,5	109,1	181,8
575	—	18,5	37	55,5	92,4	154,1
600	—	14,5	29	43,5	72,6	121
625	—	11,4	22,8	34,3	57,1	95,2
650	—	8	16	24	40	66,7
675	—	7	14	21	34,9	58,2
700	—	5,7	11,3	17	28,3	47,2
725	—	4,4	8,8	13,2	21,9	36,6
750	—	3,4	6,8	10,2	17,1	28,4
775	—	2,6	5,1	7,7	12,8	21,4
800	—	1,9	3,8	5,8	9,6	16

1) The maximum non-shock working pressure is 1,3 bar at 540°C for PN 20.

Table E.21 — Pressure/temperature (P/T) ratings for flanges made using group 2A7 materials

Temperature (°C)	Maximum non-shock working pressure (bar)					
	PN 20	PN 50	PN 110	PN 150	PN 260	PN 420
-29 to 38	17,8	46,3	92,7	139	231,6	386,1
50	17,4	45,3	90,7	136	226,6	377,7
100	15,9	41,4	82,8	124,2	207,1	345,1
150	15	39,2	78,4	117,5	195,9	326,5
200	14	36,9	73,9	110,8	184,7	307,9
250	12,1	35,1	70,2	105,3	175,6	292,6
300	10,2	33,4	66,9	100,3	167,2	278,7
350	8,4	32	63,9	95,9	159,8	266,3
375	7,4	31,4	62,7	94,1	156,8	261,3
400	6,5	30,8	61,5	92,3	153,8	256,3
425	5,6	30	60	90	150	250,1
450	4,7	29,4	58,8	88,2	147	245
475	3,7	28,8	57,6	86,4	144	240,1
500	2,8	27,8	55,6	83,4	139	231,6
525	1,9	25,8	51,6	77,4	129	214,9
550	1,3 ¹⁾	23,6	47,2	70,8	118	196,7
575	—	22	43,9	65,9	109,9	183,1
600	—	19,4	38,7	58,1	96,8	161,3
625	—	16,6	33,3	49,9	83,1	138,6
650	—	14,1	28,1	42,2	70,3	117,2
675	—	11,3	22,6	33,9	56,5	94,1
700	—	8,7	17,5	26,2	43,6	72,7
725	—	6,2	12,4	18,5	30,9	51,5
750	—	4,4	8,8	13,1	21,9	36,5
775	—	3,1	6,3	9,4	15,7	26,2
800	—	2,2	4,4	6,6	10,9	18,2

1) The maximum non-shock working pressure is 1,3 bar at 540°C for PN 20.

Table E.22 — Pressure/temperature (P/T) ratings for pipeline flanges

Temperature (°C)	Maximum non-shock working pressure [bar (gauge)]			
	PN 20	PN 50	PN 110	PN 150
-30 to 120	19,6	51,1	102,1	153,2
150	19	49,3	98,6	147,9
175	18,3	47,6	95,1	142,7
200	17,6	45,9	91,7	137,9
230	17	44,1	88,6	132,7

Annex F (informative)

Design criteria (pipeline applications)

F.1 For PN 50, PN 110 and PN 150 flanges, the slope and the outside diameter of the hub at the base are designed for welding ends having the same yield strength and thickness as those of the mating pipe. The wall thickness of the intended mating pipe was based on API 5LX-52 with a 0,68 design factor for the DN 650 to DN 900 sizes, and API 5LX-65 with a 0,72 design factor for the DN 950 to DN 1 500 sizes. When the manufacturer of the DN 650 to DN 900 sizes elects to utilize the alternative permitted in 2.4.5.1.2 or when the mating pipe has a minimum specified yield strength exceeding 448 N/mm^2 , it will be necessary to recalculate the design in accordance with the requirements of 2.4.5.1.2.

F.2 The design of the DN 950 and larger sizes of the PN 50 and higher class of welding neck flanges is

based on the flange material having a minimum specified yield strength of at least 290 N/mm^2 in a ring section of the flange and a minimum yield strength at the welding end at least equal to that specified for the mating pipe. When the yield strength of the welding end of the flange is less than specified, compensation in accordance with 2.4.5.1.2 may be made, but the hub slope and diameter at the larger end have to be preserved.

F.3 The design of all sizes is based on the use of heat-treated carbon steel bolt studs for PN 20 flanges and alloy steel bolt studs for PN 50, PN 110 and PN 150 flanges.

Annex G
(informative)**Bibliography**

- [1] ISO 468: 1982, *Surface roughness — Parameters, their values and general rules for specifying requirements.*
- [2] ANSI/ASME B16.5: 1988, *Pipe flanges and flanged fittings.*
- [3] ANSI/ASME B36.10M: 1985, *Welded and seamless wrought steel pipe.*
- [4] API 5LX-52, *Specification for high-test line pipe.*
- [5] API 5LX-65, *Specification for high-test line pipe.*
- [6] MSS SP44, *Steel pipe line flanges.*

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