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ISO 7005-1

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Metallic flanges —

Part 1: Steel flanges

iTeh STANDARD PREVIEW

*Brides métalliques —
Partie 1. Brides en acier*
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ISO 7005-1:1992

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 7005-1 was prepared by Technical Committee ISO/TC 5, *Ferrous metal pipes and metallic fittings*, Sub-Committee SC 10, *Metallic flanges and their joints*.

This first edition of ISO 7005-1, together with ISO 7005-2 and ISO 7005-3, cancels and replaces ISO 2084 : 1974, ISO 2229 : 1973 and ISO 2441 : 1975, of which they constitute a technical revision.

ISO 7005 consists of the following parts, under the general title *Metallic flanges*:

- *Part 1: Steel flanges*
- *Part 2: Cast iron flanges*
- *Part 3: Copper alloy and composite flanges*

Annexes A and B form an integral part of this part of ISO 7005. Annexes C to G are for information only.

Introduction

Various flange systems based on differing design criteria have been in use throughout the world for many years. Recognizing the increasing difficulties arising from such a situation, representatives of ISO/TC 5, *Ferrous metal pipes and metallic fittings*, ISO/TC 67, *Materials and equipment for petroleum and natural gas industries*, and ISO/TC 153, *Valves*, established principles for the preparation of an International Standard for a single series of flanges.

This part of ISO 7005 is based on the American and European steel flange systems combined with some changes to the dimensions specified in the two systems. PN 20, PN 50, PN 110, PN 150, PN 260 and PN 420 steel flanges are designed to be interchangeable with flanges to American standards ANSI/ASME B16.5 and MSS SP44; they are not identical but are deemed to comply with dimensions specified in ANSI/ASME B16.5 and MSS SP44 as appropriate.

This part of ISO 7005 takes into account unpublished work of the European Committee for Standardization CEN/TC 74, *Flanges*, up to 1972 and the amendments that would have been necessary to ISO 2229 arising from the revision of ANSI/ASME B16.5 up to 1988 and MSS SP44 : 1985, plus amendments due to the changes in pressure designation. In the American system, flanges are designated by a Class rating, but these ratings have now been converted to nominal pressure (PN) designations. The equivalent PN designations are as follows:

Class 150:	PN 20
Class 300:	PN 50
Class 600:	PN 110
Class 900:	PN 150
Class 1500:	PN 260
Class 2500:	PN 420

This part of ISO 7005 does not specify materials or pressure/temperature ratings of flanges, but guidance is given in annexes D and E on selected materials and pressure/temperature ratings of flanges (see note 10 to tables 8, 9, 10, 11, 13 and 14, page 46) using the materials listed. Annex D lists German (DIN) steels on which the European flange system is based and American (ASTM) steels on which the American flange system is based, together with international (ISO) steels given in published and draft International Standards. Users of this part of ISO 7005 may wish to use steels specified in national standards in preference to those given in annex D. Annex E gives the pressure/temperature ratings for certain flanges made using the materials given in annex D. (See E.1 and tables E.1 to E.4 for restrictions on the applicability of pressure/temperature ratings to flanges.)

Ultimately it is the intention that only ISO materials and pressure/temperature ratings of flanges made using ISO materials will be specified in this part of ISO 7005; this will be achieved in a revision and when work on standardizing the ISO materials and their elevated temperature properties has been completed.

Flange details in all three parts of ISO 7005 are such as that flanges having the same PN designations and nominal size (DN) designations and compatible flange facings will mate together.

The method of specifying tolerances has been to combine the existing DIN and ANSI specified tolerances into one table (table 20).

To avoid possible confusion in giving descriptive names to flanges, all flanges are designated by a type number and flange facings by a letter.

Users of this part of ISO 7005 should satisfy themselves that the flanges comply with any statutory requirements.

It should be noted that, in general, flanges previously manufactured to ISO 2084, ISO 2229 and ISO 2441 will mate with flanges manufactured to ISO 7005.

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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^{*)}

PN 10
PN 16
PN 20
PN 50
PN 110
PN 150
PN 260
PN 420

Series 2¹⁾

PN 2,5
PN 6
PN 25
PN 40

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 7005-1:1992
<https://standards.iteh.ai/catalog/standards/sist/b99109-2108-11-831-5d291c6b36ca/iso-7005-1-1992>
 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.

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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.

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

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:

- a) the number of this part of ISO 7005 (i.e. ISO 7005-1);
- b) the nominal size (DN) and the PN designation;
- c) the material designation (see 2.8.2);
- d) the manufacturer's name or trade-mark;
- e) the thread identification where appropriate (see 2.8.3);
- f) 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 SP44, 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 SP44 as appropriate.

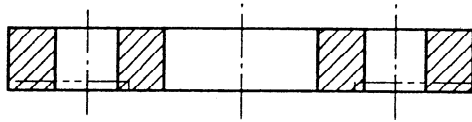
2 This part of ISO 7005 does not make provision for routine inspection or pressure testing of separate flanges. However, flanges may be required to be pressure tested after attachment of a pipe or other equipment or when forming an integral part of such equipment. The test pressure is then dependent 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:

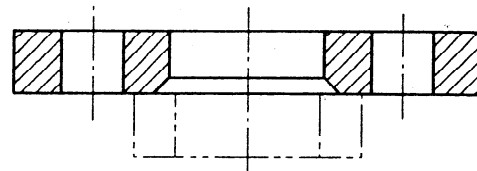
- a) the number of this part of ISO 7005 (i.e. ISO 7005-1);
- b) the nominal size — DN followed by the appropriate number (see 1.3);
- c) the PN designation — PN followed by the appropriate number (see 1.3);
- d) the flange type number (see 1.4), together with reference to the ancillary component type 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;
- l) 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



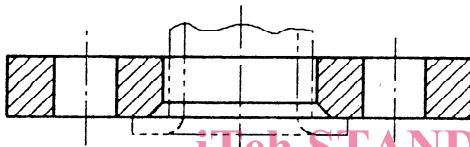
Type 01

Plate flange for welding



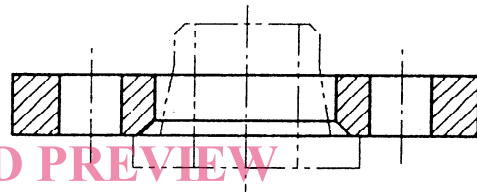
Type 02

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



Type 03

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

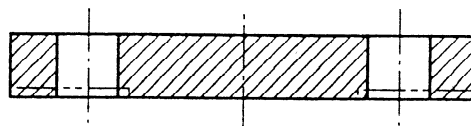


Type 04

Loose flange with welding neck collar
(see type 34)

STANDARD PREVIEW
(standards.iteh.ai)

ISO 7005-1:1992
<https://standards.iteh.ai/catalog/standards/sist/fb793d9-528-41f1-8151-5d291c6b36ca/iso-7005-1-1992>



Type 05

Blank flange

NOTE — These sketches are diagrammatic only.

Figure 1 — Flanges — Types 01 to 05