



Grey iron pipes, special castings and grey iron parts for pressure main lines

Tuyaux, raccords et pièces en fonte grise pour canalisations sous pression

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 13 was developed by Technical Committee ISO/TC 5, *Metal pipes and fittings*.

It was submitted directly to the ISO Council, in accordance with clause 6.13.1 of the Directives for the technical work of ISO. It cancels and replaces ISO Recommendation R 13-1955, which had been approved by the member bodies of the following countries :

Austria	Hungary	Portugal
Chile	Italy	Spain
Denmark	Japan	Sweden
France	Mexico	Switzerland
Germany	Netherlands	United Kingdom
Ireland	New Zealand	Yugoslavia
Israel	Pakistan	

No member body had expressed disapproval of the document.

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Grey iron pipes, special castings and grey iron parts for pressure main lines

SECTION ONE : GENERAL SPECIFICATION

0 INTRODUCTION

This International Standard applies generally to grey iron pipes, special castings and grey iron parts of all kinds for pressure mains, and chiefly to pipes and specials with sockets for lead joints.¹⁾

It also applies to pipes and specials with other types of joints, particularly rubber joints. However, the characteristics of these joints, many of which are patented, are not detailed: they remain the subject of private agreement between manufacturers and users.

Castings with such joints may keep the overall measurements of castings with lead joints, which will facilitate the use by the manufacturer of interchangeable patterns allowing accurate and speedy manufacture.

With regard to socket joints (see clause 3), two different types have been included, in which the centring bead is part of the interior of the socket or formed on the outside of the pipe spigot.

Centrifugal casting in a metallic mould does not allow a bead to be cast on the spigot of the pipe. The two types of joint, however, have been included because the alternative method is still used; the respective dimensions of the two types of joint are such that interchangeability is always possible.

The flanges normally have a machined facing strip and drilled holes; this does not exclude the possibility, in certain cases, of having rough-cast flanges where particularly accurate moulding processes are used.

In general, the specials (see clause 4) have a sufficiently great resistance to internal pressure for all the current uses. Different methods of reinforcement have been allowed, however, particularly in cases where high working pressures must be applied to specials with large branches in which the stresses in the metal are important.

The socket tolerances (see clause 8) have been fixed in relation to the normal caulking space.

It is logical to provide for equality between the plus and minus tolerances. Similarly, the socket tolerances are smaller than the barrel tolerances: in fact, the socket of the castings has a greater thickness than the barrel and, therefore, greater rigidity.

The value adopted for the mass density of the cast iron (see clause 12) is 7 150 kg/m³: it lies between the values fixed formerly in different countries, which vary between 7 000 and 7 250. The value of 7 150 ensures good practical agreement between the calculated and real masses.

The cast iron pipes, specials and castings for mains of different diameters are generally made in thicknesses suited to the highest working pressures generally used.²⁾

In some cases, it may happen that these castings are intended to be submitted to working pressures giving an insufficient margin of safety as compared with the works test pressures (see clause 16). In such cases it will be for the users to state this and for the manufacturers to provide for a suitable increase in thickness and in test pressure.

1) Although spun pipes at present comprise the greater part of world production, sand cast pipes have been included, as they are still made by some manufacturers or in certain diameters.

2) Water distribution pipelines follow the contours of the ground and the working pressure varies from one point to another along their route. In practice it would be very difficult to vary the thickness and consequently the resistance of the castings according to their position in the pipeline and the pressure they have to withstand. The resulting increase in the number of patterns would complicate both stocking and distribution, besides increasing the risk of errors on the construction site.

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the properties of the following products :

- a) Grey iron pipes manufactured by any one of the three following processes :
 - 1) centrifugal casting in metal moulds;
 - 2) centrifugal casting in sand moulds;
 - 3) vertical casting in sand moulds.
- b) Grey iron special castings and parts.

It is applicable to pipes and all special castings with sockets, spigots or flanges defined by this International Standard and to pipes and special castings with other types of joints, the general dimensions of which, except those relating to the joints, conform to the requirements of this International Standard. It is not applicable to the down pipes and their specials used in the building industry.

2 REFERENCE

ISO/R 79, *Brinell hardness test for steel*, Amendment 1.

3 TYPES OF JOINTS

Socket pipes and special castings for lead joints may be provided with a centring ring in the socket, and in this case, are supplied with a plain spigot end. Alternatively, the sockets may be without centring ring, in which case the spigot ends could be plain or have a bead integrally cast or formed by means of a permanent hoop shrunk on hot.

Unless otherwise specified, flanges are machined on boss and their dimensions are in accordance with the relevant tables in this International Standard. Bolt holes may be drilled or cored.

When pipes and special castings are ordered with a joint of a type other than those mentioned in this International Standard, the dimensions and other characteristics of the joint are those applicable to that joint.

4 SPECIAL CASTINGS

The special castings are of the thickness shown in the relevant tables, except when the working conditions necessitate some strengthening. Such strengthening may be in the form of additional thickness, ribs, bolts, or other means proposed by the manufacturer and finally approved by the purchaser.

If necessary, the reinforcement of the thickness may be obtained by reducing the internal diameter.

5 MARKING

Each pipe and special casting has cast or painted on it the mark of the manufacturer, the nominal diameter and, if necessary, its principal characteristics.

The marks are placed :

- a) on the socket faces of pipes centrifugally cast in metal moulds;
- b) on the outsides of the sockets or on the barrels of pipes centrifugally cast in sand moulds;
- c) on the outsides of the sockets or towards the ends of the barrels of pipes vertically cast in sand moulds;
- d) on the barrels of special castings.

The class or any other marks required by the purchaser may be painted on.

6 MANUFACTURE OF GREY IRON USED

The grey iron used for the manufacture of pipes and special castings should be of good quality. It is prepared at the discretion of the manufacturer in a cupola, an active mixer, or other suitable furnace, and is made from pig iron, or molten iron, or good iron and steel scrap with additions of good quality materials suited to the production method, excluding any raw material of inferior quality. Upon fracture, the iron should show a grey, close and uniform grain.

7 QUALITY OF PIPES AND SPECIAL CASTINGS

Pipes and special castings are stripped with all precautions necessary to avoid warping or shrinking defects detrimental to their good quality.

The pipes and special castings should be sound and free from surface or other defects.

Repairing of defects by soldering or by the application of mastic may not be done without previously securing the consent of the purchaser or his representative. This stipulation also applies to the plugging of leaks by caulking.

Pipes and special castings showing small imperfections inseparable from the method of manufacture and not affecting their use, are not rejected.

The pipes and special castings should be such that they can be cut, drilled or machined; in case of dispute, the castings are considered as acceptable, provided that the Brinell hardness, measured at the centre of the thickness, does not exceed 215 HB. The superficial Brinell hardness of pipes centrifugally cast in metal moulds does not exceed 230 HB (for the hardness test, see clause 15).

8 TOLERANCES ON THE EXTERNAL DIAMETER OF THE BARREL, THE INTERNAL DIAMETER OF THE SOCKET, AND THE DEPTH OF THE SOCKET

The socket tolerances are given in table 1, where

DN is the nominal diameter of the pipes and special castings in millimetres;

f is the caulking space of the joint in millimetres ($f = 9 + 0,003 \text{ DN}$).

TABLE 1

Dimension	Nominal diameter	Tolerance mm
External diameter of barrel DE	All diameters	$\pm 1/2 f = \pm (4,5 + 0,0015 \text{ DN})$
Internal diameter of socket DI	All diameters	$\pm 1/3 f = \pm (3 + 0,001 \text{ DN})$
Depth of socket P	Up to and including DN 600	± 5
	Over DN 600 and up to and including DN 1 000	± 10

The maximum or minimum jointing space resulting from these tolerances is such that the jointing of the pipes and special castings is not adversely affected.

9 TOLERANCES ON THICKNESS

The tolerances on the wall thickness and flange thickness are given in table 2, where

e is the standard thickness of the wall in millimetres;

b is the standard thickness of the flange in millimetres.

TABLE 2

Type of casting	Dimension	Tolerance mm
Pipes	Wall thickness	$-(1 + 0,05 e)^{1)}$
	Flange thickness	$\pm (2 + 0,05 b)$
Special castings	Wall thickness	$-(2 + 0,05 e)^{1)}$
	Flange thickness	$\pm (3 + 0,05 b)$

1) No limit for the plus tolerances has been set (see clause 12, note).

The thickness of special castings may exceptionally be reduced to not less than the minimum thickness of class B pipes of the same diameter, provided that the area of the affected part is not more than 1/10 of the cross-sectional area of the bore.

10 TOLERANCES ON LENGTH

The tolerances on normally manufactured lengths of pipes and special castings are given in table 3.

TABLE 3

Type of casting	Nominal diameter	Tolerance mm
Socket and spigot and plain ended pipes	All diameters	± 20
Socket special castings, flange and socket and flange and spigot pieces	Up to and including DN 450	± 20
	Over DN 450	$+ 20$ $- 30$
Flanged pipes and flanged special castings	All diameters	± 10

Should smaller tolerances be demanded, for example in the case of flanged closing pieces, they are specially fixed, but the minimum tolerance may not be less than ± 1 mm.

Of the total number of socket and spigot pipes to be supplied in each diameter, the manufacturer may supply up to 10 % in lengths shorter than specified as shown in table 4.

TABLE 4

Specified length	Decrease in length m			
	0,5	1	1,5	2
4 m	0,5	1	—	—
Over 4 m	0,5	1	1,5	2

11 PERMISSIBLE DEVIATION FROM A STRAIGHT LINE

The pipes should be straight. When rolled along two gantries separated by approximately two-thirds the length of the pipe to be checked, the maximum deviation f_m , in millimetres, should not be greater than 1,25 times the length l in metres of this pipe, thus

$$f_m \leq 1,25 l$$

12 TOLERANCES ON MASSES

The standard masses are those shown in the attached tables or, for reinforced or non-standard special castings, those calculated by taking the mass density of cast iron as 7 150 kg/m³.

The tolerances on standard masses are given in table 5.

TABLE 5

Type of casting	Tolerance %
Pipes	± 5
Special castings except as stated below	± 8
Bends, special castings with more than one branch and non-standard special castings	± 12

NOTE — Castings of a greater mass than the maximum are accepted, provided they comply in every other respect with the requirements of this International Standard.

13 MECHANICAL TESTS

13.1 For pipes centrifugally cast in metal moulds

Test are made :

- a) on rings for pipes up to and including the nominal diameter DN 300;
- b) on tensile bars for pipes over the nominal diameter DN 300.

The rings and bars are cut from the spigot end of the pipes.

13.2 For pipes centrifugally cast in sand moulds

Tensile tests are made on bars for pipes of all nominal diameters. The bars are cut from the spigot end of the pipes.

13.3 For pipes vertically cast in sand moulds and special castings

Tensile tests are made, for pipes and special castings of all nominal diameters, on bars cast from the same metal as is used in the castings.

13.4 Ring tests for pipes centrifugally cast in metal moulds (figure 1)

Rings of approximately 25 mm width are tested on a suitable machine. The rings are supported on two knife edges diametrically opposed and the load is applied from the inside at these points.

The bending strength modulus of the ring is calculated from the breaking load by the following formula :

$$R = \frac{3 P (D - e)}{\pi b e^2}$$

where

R is the bending strength modulus of the ring, in newtons per square millimetre;

P is the breaking load, in newtons;

D is the external diameter of the ring, in millimetres;

e is the thickness of the wall of the ring, in millimetres;

b is the width of the ring, in millimetres.

13.5 Tests on bars for pipes centrifugally cast in metal or sand moulds (figure 2)

The tensile test bars cut from the pipes are about 90 mm long, and have a diameter of about 6 mm, which dimension may vary with the thickness of the pipe. The ends are prepared so as to fit the testing machine. Figure 2 shows one suitable design.

13.6 Tests on bars for pipes vertically cast in sand moulds and special castings (figure 3)

The tensile test bars are correctly moulded and free from defects and are either unmachined, or machined to give a diameter of about 20 mm to 25 mm. The ends are selected by the manufacturer to fit the testing machine; figure 3 shows one suitable design.

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14 TESTING RESULTS

The mechanical tests are carried out during manufacture and at the most twice per day of casting. The results obtained are representative of all pipes and special castings of all diameters made during the day.

The manufacturer is allowed to take three test pieces from the same pipe or during the same run of metal, of which test pieces at least two should satisfy the requirements of table 6.

NOTE — The manufacturer and the purchaser may agree to replace the tensile test on machined test bar by a quicker test on ring. They determine the test conditions.

All pipes from which the rings or bars have been cut are accepted by the purchaser as complete lengths.

15 BRINELL HARDNESS TEST

For the checking of the hardness limits, specified in clause 7, Brinell tests are carried out, in accordance with the requirements of ISO/R 79, on the test rings or bars cut from the pipes and used for the previous tests.

The test consists of applying either a load of 3 000 kg to a ball of 10 mm diameter for 15 s, or a load of 750 kg to a ball of 5 mm diameter for 10 s.

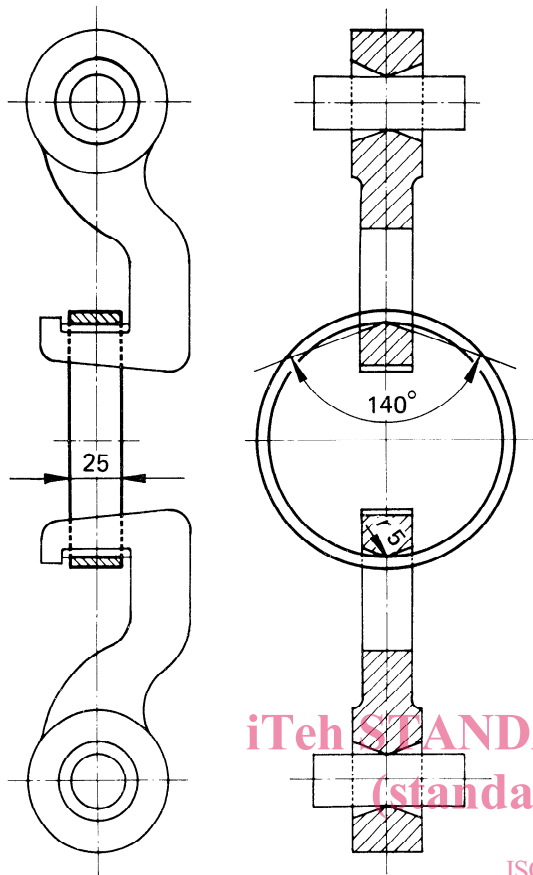


FIGURE 1 <https://standards.iteh.ai/catalog/standards/sist/21cab028-2351-4081-b058-a4be091105ac/iso-13-1978>

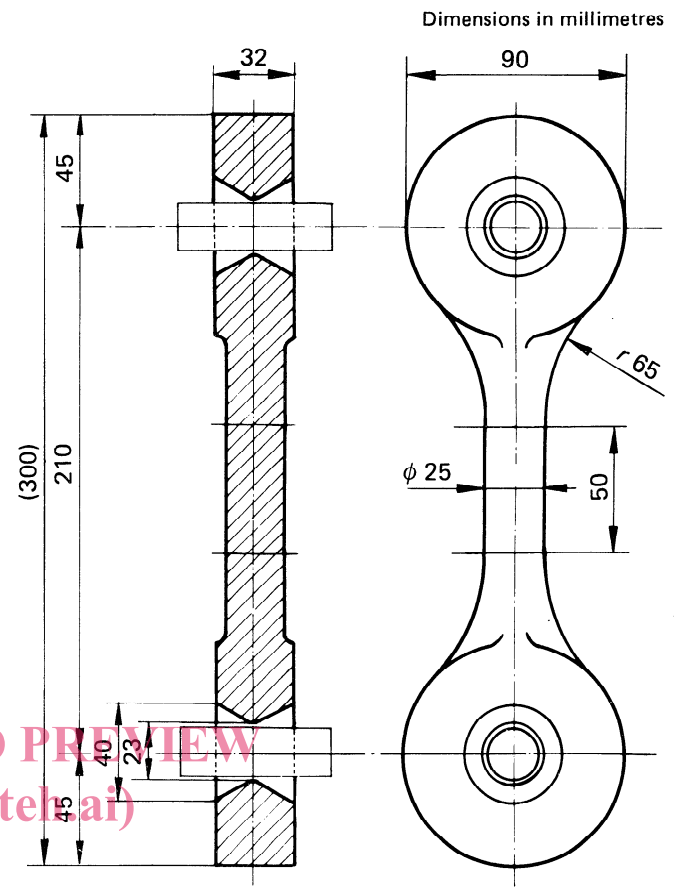


FIGURE 3

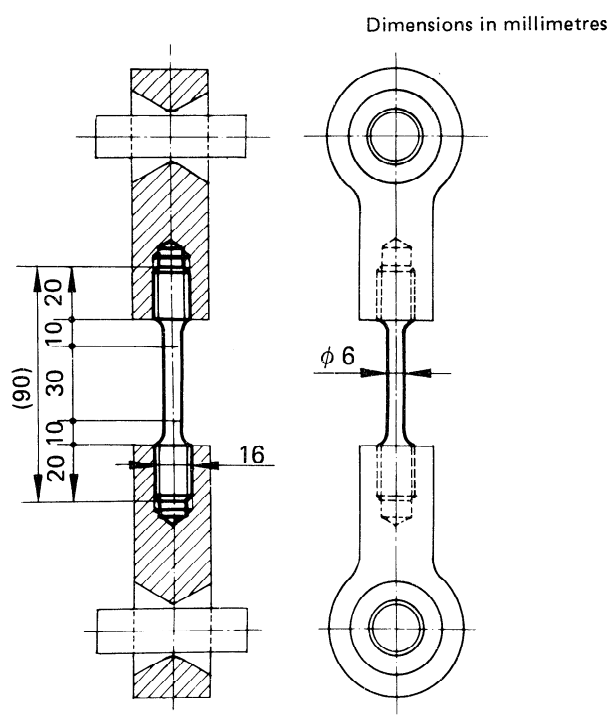


FIGURE 2

TABLE 6

Type of casting	Nominal diameter	Type of test	Minimum resistance N/mm ²
Pipes centrifugally cast in metal moulds	Up to and including DN 300	Deflection on ring	(modulus) 400
	Over DN 300 and up to and including DN 600	Tensile on machined test bar	200
	Over DN 600	Tensile on machined test bar	180
Pipes centrifugally cast in sand moulds	Up to and including DN 600	Tensile on machined test bar	180
	Over DN 600	Tensile on machined test bar	180
Pipes vertically cast in sand moulds and special castings	All diameters	Tensile on cast test bar	140

16 HYDRAULIC TESTS

Hydraulic tests are carried out in accordance with tables 7, 8 and 9.

16.1 For centrifugally cast socket and spigot pipes

TABLE 7

Nominal diameter	Test pressure bar*		
	Class LA	Class A	Class B
Up to and including DN 600	35	35	35
Over DN 600	15	20	25

16.2 For vertically cast pipes

TABLE 8

Nominal diameter	Test pressure bar*	
	Class A	Class B
Up to and including DN 600	20	25
Over DN 600	15	20

16.3 For other pipes and special castings

TABLE 9

Type of casting	Nominal diameter	Test pressure bar*
Flanged pipes Special castings	Up to and including DN 300	25
	Over DN 300 and up to and including DN 600	20
Flanged pipes, special castings, without branches or with branches not greater than half the principal diameter	Over DN 600 and up to and including DN 1 000	15
Special castings with branches greater than half the principal diameter	Over DN 600 and up to and including DN 1 000	10

NOTE — Where pipes or special castings are required for higher test pressures, they are specially considered (see clause 4).

To perform the hydraulic test, the pipes are kept under pressure for 15 s; they may be struck moderately with a 700 g hammer, and they must withstand the pressure test without showing any leakage, sweating or other defect of any kind.

Wherever manufacturing practice permits, the hydraulic test is applied before coating.

17 COATING

Except when otherwise specified, all pipes and special castings are coated inside and outside.

The coating must set rapidly with good adherence and not scale off.

The inside coating must not contain any constituent soluble in water or any ingredient liable to impart any taste or smell whatsoever to the water, after suitable washing out of the main.

18 INSPECTION

If the purchaser wishes to inspect the pipes and special castings, such inspection is undertaken at the works of the manufacturer. The equipment and labour necessary for the carrying out of the inspection are provided by the manufacturer.

The inspector appointed by the purchaser and accredited to the manufacturer is previously advised of the time at which the operations of manufacture and inspection will normally take place.

The inspector may witness the casting, the sampling, the preparation and testing of the test pieces, the checking of dimensions and masses and the hydraulic tests.

The inspection and weighing of pipes and special castings may be carried out after coating.

Should the purchaser or his representative not be present for the carrying out of these operations at the time agreed upon, the manufacturer is entitled to proceed with the manufacture and inspection without the purchaser or his representative being present.

* 1 bar = 10⁵ Pa = 10⁵ N/m²

SECTION TWO : JOINTS

19 GENERAL

Grey iron pipes, specials and castings for mains may be manufactured in the range of nominal diameters from DN 20 to DN 2 000¹⁾.

For the time being, it has been decided to retain the recommended range of the previous edition of this International Standard (ISO/R 13-1955), i.e. nominal diameters ranging from DN 80 to DN 1 000, which does not preclude in any way the possible extension of this International Standard to other nominal diameters at a later date.

For the flanges, it is to be noted that the diameter of the

holes is greater by 1 mm than that provided for surface mains. This increase facilitates the installation of the castings, which is always difficult in the case of underground mains, and permits the use of bolts of increased diameter whenever this is thought necessary in order to resist corrosion.

It has been decided to delete the values of the bolt diameters expressed in inches, as has been done in ISO 2531. Moreover it has been decided to modify the number of bolt holes for flanges of the nominal diameter DN 80, in accordance with ISO 2531, although the former drilling can be obtained at the purchaser's request.

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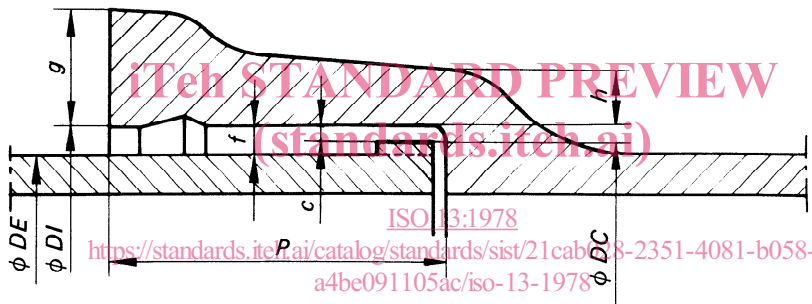
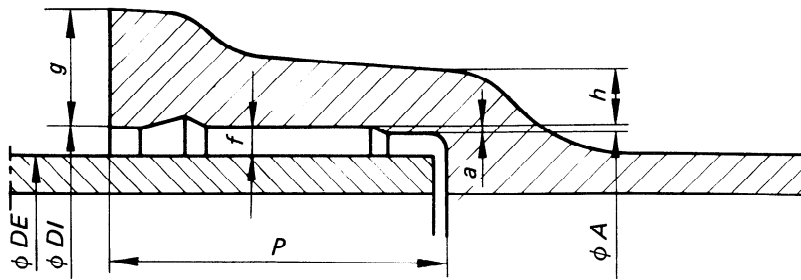
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1) In the tables, nominal diameter (DN) is only a number designating and classifying the dimensions of pipes, specials and line parts.

20 DIMENSIONS OF SOCKETS AND SPIGOTS

$a = 3 + 0,001 \text{ DN}$
 $g = 20 + 0,03 \text{ DN}$
 $h = 8 + 0,025 \text{ DN}$
 $c = 3 + 0,001 \text{ DN}$
 $f = 9 + 0,003 \text{ DN}$



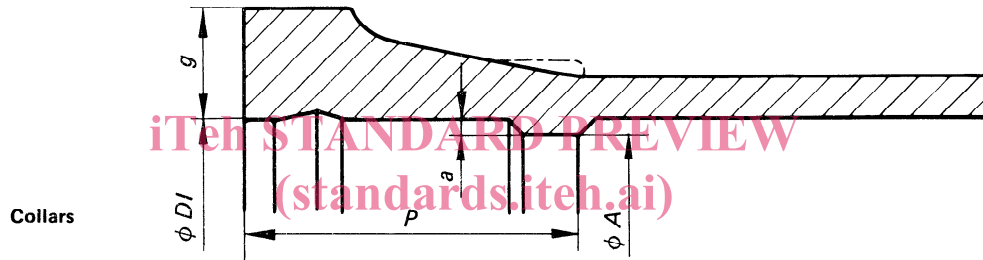
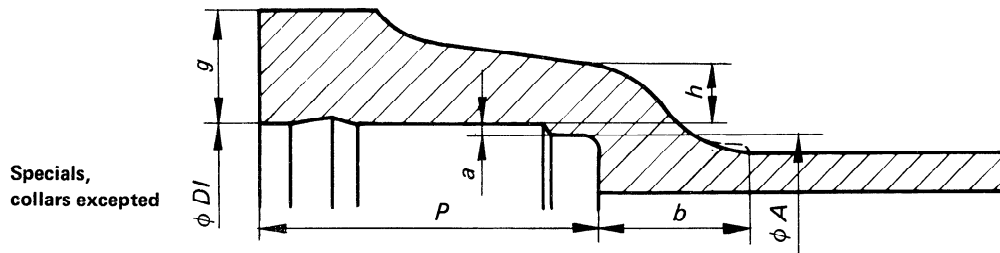
Dimensions in millimetres

Nominal diameter DN	Barrel		Socket					Bead		Joint thickness f
	DE	DI	P	A	a	$g^{1)}$	$h^{1)}$	DC	c	
80	98	116	84	110	3	22,5	10	104	3	9
100	118	137	88	131	3	23	10,5	124	3	9,5
125	144	163	91	157	3	24	11	150	3	9,5
150	170	189	94	183	3	24,5	12	176	3	9,5
200	222	241	100	235	3	26	13	228	3	9,5
250	274	294	103	287	3,5	27,5	14,5	281	3,5	10
300	326	346	105	339	3,5	29	15,5	333	3,5	10
350	378	398	107	391	3,5	30,5	17	385	3,5	10
400	429	449	110	442	3,5	32	18	436	3,5	10
500	532	553	115	546	3,5	35	20,5	539	3,5	10,5
600	635	657	120	650	3,5	38	23	642	3,5	11
700	738	760	122	753	3,5	41	25,5	745	3,5	11
800	842	865	125	857	4	44	28	850	4	11,5
900	945	968	128	960	4	47	30,5	953	4	11,5
1 000	1 048	1 072	130	1 064	4	50	33	1 056	4	12

1) Dimensions g and h do not affect interchangeability; they only indicate minimum permissible thicknesses.

21 SPECIAL CASTINGS – DIMENSIONS OF SOCKETS AND SPIGOTS

$a = 3 + 0,001 \text{ DN}$
 $b = 35 + 0,1 \text{ DN}$
 $g = 20 + 0,035 \text{ DN}$
 $h = 10 + 0,025 \text{ DN}$



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Dimensions in millimetres

Nominal diameter DN	Socket						
	DI	P	A	a	b	g ¹⁾	h ¹⁾
80	116	84	110	3	43	23	12
100	137	88	131	3	45	23,5	12,5
125	163	91	157	3	47,5	24,5	13
150	189	94	183	3	50	25,5	14
200	241	100	235	3	55	27	15
250	294	103	287	3,5	60	29	16,5
300	346	105	339	3,5	65	30,5	17,5
350	398	107	391	3,5	70	32,5	19
400	449	110	442	3,5	75	34	20
500	553	115	546	3,5	85	37,5	22,5
600	657	120	650	3,5	95	41	25
700	760	122	753	3,5	105	44,5	27,5
800	865	125	857	4	115	48	30
900	968	128	960	4	125	51,5	32,5
1 000	1 072	130	1 064	4	135	55	35

1) Dimensions *g* and *h* do not affect interchangeability; they only indicate minimum permissible thicknesses.