BRITISH STANDARD

BS EN 969:2009

Ductile iron pipes, fittings, accessories and their joints for gas pipelines — Requirements and test methods

ICS 23.040.10; 23.040.40

British Standards

National foreword

This British Standard is the UK implementation of EN 969:2009. It supersedes BS EN 969:1996 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PSE/10, Iron pipes and fittings.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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English Version

Ductile iron pipes, fittings, accessories and their joints for gas pipelines - Requirements and test methods

Tuyaux, raccords et accessoires en fonte ductile et leurs assemblages pour canalisations de gaz - Prescriptions et méthodes d'essai

Rohre, Formstücke, Zuberhörteile aus duktilem Gusseisen und ihre Verbindungen für Gasleitungen - Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 10 February 2009.

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Foreword

This document (EN 969:2009) has been prepared by Technical Committee CEN/TC 203 “Cast iron pipes, fittings and their joints”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2009, and conflicting national standards shall be withdrawn at the latest by December 2010.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 969:1995.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of the EU Construction Products Directive (89/106/EEC).

This European Standard is in conformity with the general requirements already established by CEN/TC 165 "Waste water engineering" in the field of sewerage.

Annex ZA includes the requirements of the mandate given under the EU Construction Products Directive (89/106/EEC). Only if the requirements specified in Annex ZA are met, the CE marking will be effected.

For reasons of conformity with mandate M/131 “Pipes, tanks and ancillaries not in contact with water intended for human consumption”, EN 969 has been revised by extension with Annex ZA (see Resolution CEN/BT 113/1994 and CEN/BT 63/1996) and Clause 9 for the evaluation of conformity.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies the requirements and associated test methods applicable to ductile iron pipes, fittings, accessories and their joints used for the construction of pipelines outside buildings:

- to convey air or combustible gases (e.g. natural gas or town gas) at pressures up to 16 bar;
- to be installed below or above ground.

NOTE 1 A combustible gas is a gas or any fuel that is in gaseous state at a temperature of 15 °C at a pressure of 1 bar.

This European Standard applies to pipes, fittings and accessories which are:

- manufactured with socketed, flanged or spigot ends;
- normally delivered externally and internally coated;
- suitable for gas temperatures between – 15 °C and 50 °C.

This European Standard covers pipes, fittings and accessories cast by any type of foundry process or manufactured by fabrication of cast components, as well as corresponding joints, in a size range extending from DN 40 to DN 600 inclusive.

This European Standard specifies requirements for materials, dimensions and tolerances, mechanical properties and standard coatings of ductile iron pipes and fittings. It also gives performance requirements for all components including joints. Joint design and gasket shape are outside the scope of this European Standard.

NOTE 2 In this European Standard, all pressures are relative pressures expressed in bars (100 kPa = 1 bar).

2 Normative references

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

EN 545:2006, *Ductile iron pipes, fittings, accessories and their joints for water pipelines — Requirements and test methods*

EN 681-1, *Elastomeric seals — Material requirements for pipe joint seals used in water and drainage applications — Part 1: Vulcanized rubber*

EN 682, *Elastomeric seals — Material requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids*

EN 1092-2, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 2: Cast iron flanges*

EN 10002-1, *Metallic materials – Tensile testing — Part 1: Method of test at ambient temperature*

EN ISO 4016, *Hexagon head bolts — Product grade C (ISO 4016:1999)*

EN ISO 4034, *Hexagon nuts — Product grade C (ISO 4034:1999)*

EN ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method (ISO 6506-1:2005)*

EN ISO 7091, *Plain washers — Normal series — Product grade C (ISO 7091:2000)*

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

3.1
ductile iron
cast iron used for pipes, fittings and accessories in which graphite is present substantially in spheroidal form

3.2
pipe
casting of uniform bore, straight in axis, having either socket, spigot or flanged ends, except for flanged socket pieces, flanged spigot pieces and collars which are classified as fittings

3.3
fitting
casting other than a pipe which allows pipeline deviation, change of direction or bore; in addition flanged socket pieces, flanged spigot pieces and collars are also classified as fittings

3.4
accessory
any casting other than a pipe or fitting which is used in a pipeline, for example:

— glands and bolts for mechanical flexible joints (see 3.13)

— glands, bolts and locking rings for restrained flexible joints (see 3.14)

— pipe saddles for service cock connection

— adjustable flanges and flanges to be welded or screwed-on

NOTE Valves of all types are not covered by the term accessory.

3.5
flange
flat circular end of a pipe or fitting extending perpendicular to its axis, with bolt holes equally spaced on a circle

NOTE A flange may be fixed (e.g. integrally cast or welded) or adjustable; an adjustable flange comprises a ring, in one or several parts assembled together, which bears on an end hub and can freely rotate around the barrel axis before jointing.

3.6
spigot
male end of a pipe or fitting

3.7
spigot end
maximum insertion depth of the spigot plus 50 mm

3.8
socket
female end of a pipe or fitting to make the connection with the spigot of the next component

3.9
gasket
sealing component of a joint

3.10
joint
connection between the ends of two pipes and/or fittings in which a gasket is used to effect a seal

3.11
flexible joint
joint which permits significant angular deflection both during and after installation and which can accept a slight offset of the centreline

3.12
push-in flexible joint
flexible joint assembled by pushing the spigot through the gasket in the socket of the mating component

3.13
mechanical flexible joint
flexible joint in which sealing is obtained by applying pressure to the gasket by mechanical means, e.g. a gland

3.14
restrained flexible joint
flexible joint in which a means is provided to prevent separation of the assembled joint

3.15
flanged joint
joint between two flanged ends

3.16
nominal size
DN
alphanumerical designation of size for components of a pipework system, which is used for reference purposes. It comprises the letters DN followed by a dimensionless whole number which is indirectly related to the physical size, in millimetres, of the bore or outside diameter of the end connections

[EN ISO 6708:1995]

3.17
nominal pressure
PN
alphanumerical designation used for reference purposes related to a combination of mechanical and dimensional characteristics of a component of a pipework system. It comprises the letters PN followed by a dimensionless number

[EN 1333:2006]

3.18
leak tightness test pressure
pressure applied to a component during manufacture in order to ensure its leak tightness

3.19
allowable operating pressure
PFA
maximum pressure that a component can withstand continuously in service

3.20
allowable maximum operating pressure
PMA
maximum pressure occurring from time to time, including surge, that a component is capable of withstanding in service

3.21
allowable test pressure
PEA
maximum hydrostatic pressure that a newly installed component is capable of withstanding for a relatively short duration, in order to insure the integrity and tightness of the pipeline

3.22
diametral stiffness of a pipe
characteristic of a pipe which allows it to resist ovalization under loading when installed

3.23
performance test
proof of design test which is done once and is repeated only after change of design

3.24
length
effective length of a pipe or fitting, as shown on the figures of Clause 8

NOTE For flanged pipes and fittings, the effective length L (l for branches) is equal to the overall length. For socketed pipes and fittings, the effective length L_U (l_U for branches), is equal to the overall length minus the spigot insertion depth as given in the manufacturer's catalogues.

3.25
deviation
design length allowance with respect to the standardized length of a pipe or a fitting

3.26
ovality
out of roundness of a pipe section; it is equal to:

$$100\left(\frac{A_1 - A_2}{A_1 + A_2}\right)$$

where

A_1 is the maximum axis, in millimetres;

A_2 is the minimum axis, in millimetres.

4 Technical requirements

4.1 General

4.1.1 Ductile iron pipes and fittings

The supplier shall make available the allowable service pressure of his pipes and fittings.

Nominal sizes, thickness classes, lengths and coatings are specified in 4.1.1, 4.2.1, 4.2.3, 4.4 and 4.5 respectively. When, by agreement between manufacturer and purchaser (insofar as this agreement does not conflict with any regulatory requirement), pipes and fittings with different wall thickness classes, lengths and/or coatings and other types of fittings than those given in 8.3 and 8.4, are supplied with reference to this standard, they shall comply with all the other requirements of this standard.

NOTE 1 Other types of fittings include angle branches, tees and tapers with other combinations DN × dn, etc.

The standardized nominal sizes DN of pipes and fittings are as follows: 40, 50, 60, 65, 80, 100, 125, 150, 200, 250, 300, 350, 400, 450, 500 and 600.

Annexes A and B, respectively, give the longitudinal bending resistance and the diametral stiffness of ductile iron pipes.

NOTE 2 The maximum allowable pressure for gas application is 16 bar which gives a mechanical safety factor of at least 2,25 * 3 = 6,75 for the DN 600 or more for smaller diameters (see Annex A of EN 545:2006 for the calculation method).

NOTE 3 When installed and operated under the conditions for which they are designed (see Annex C and Annex D), ductile iron pipes, fittings, accessories and their joints maintain all their functional characteristics over their operating life, due to the constant material properties, to the stability of their cross section and to their design with high safety factors.

4.1.2 Surface condition and repair

Pipes, fittings and accessories shall be free from defects and surface imperfections which could lead to non-compliance with Clauses 4 and 5.

When necessary, pipes and fittings may be repaired, for example by welding, in order to remove surface imperfections and localized defects which do not extend through the entire wall thickness, provided that:

— the repairs are carried out according to the manufacturer’s written procedure;

— the repaired pipes and fittings comply with all the requirements of Clause 4 and Clause 5.

4.1.3 Types of joints and interconnection

4.1.3.1 General

Rubber gasket materials shall comply with the requirements of EN 681-1 or EN 682 depending on air or gas. When materials other than rubber are necessary (e.g. for flanged joints), they shall comply with the appropriate European Standard or, where no European Standard exists, the appropriate International Standard.

4.1.3.2 Flanged joints

Flanges shall be constructed in such a way that they can be attached to flanges whose dimensions and tolerances comply with EN 1092-2. This ensures interconnection between all flanged components (pipes, fittings, valves, etc.) of the same PN and DN and adequate joint performance.

Bolts and nuts shall comply as a minimum with the requirements of EN ISO 4016 and EN ISO 4034 (grade 4.6). Where washers are required, they shall comply with EN ISO 7091.

Although it does not affect interconnection, the manufacturer shall state in his catalogues whether his products are normally delivered with fixed flanges or adjustable flanges.

NOTE Flange gaskets may be one of any type given in EN 1514.

4.1.3.3 Flexible joints

Pipes and fittings with flexible joints shall comply with 4.2.2.1 for their spigot external diameter DE and their tolerances. This offers the possibility of interconnection between components equipped with different types of flexible joints. In addition, each type of flexible joint shall be designed to fulfil the performance requirements of Clause 5.

NOTE 1 For interconnection with certain types of joints operating within a different tolerance range on DE, the manufacturer's guidance should be followed as to the means of ensuring adequate joint performance at high pressures (e.g. measurement and selection of external diameter).

NOTE 2 For interconnection with existing pipelines which can have external diameters not in compliance with 4.2.2.1, the manufacturer's guidance should be followed as to the appropriate means of interconnection (e.g. adaptors).

NOTE 3 If components of different suppliers are used, care should be taken to ensure that the requirements of the performance tests are met.

4.2 Dimensional requirements

4.2.1 Wall thickness

The nominal iron wall thickness of pipes and fittings shall be calculated as a function of the nominal size, DN, by the following formula (K class formula), with a minimum of 6 mm for pipes and 7 mm for fittings:

$$e = K(0{,}5 + 0{,}001\,\mathrm{DN}) \quad (1)$$

where

e is the nominal wall thickness, in millimetres;

DN is the nominal size;

K is a coefficient used for thickness class designation. It is selected from a series of whole numbers: e.g. 8, 9, 10, 11, 12, etc.

For pipes, the standardized thickness classes are given in 8.1. Other thicknesses are possible for pipes.

For the fittings, the thickness *e* given in tables and on figures of 8.3 and 8.4, is the nominal thickness corresponding to the main part of the body. The actual thickness at any particular point requires to be increased to meet localized high stresses depending on the shape of the casting (e.g. at internal radius of bends, at the branch-body junction of tees, etc.).

The limit deviations on the nominal wall thickness of pipes and fittings shall be as given in Table 1. The measurement of wall thickness shall be in accordance with 6.1.1.

Table 1 – Limit deviations on thickness of pipes and fittings

Dimensions in millimetres

Type of casting	Nominal iron wall thickness	Limit deviation on the nominal wall thickness [a]
Pipes centrifugally cast	$\leq 6{,}0$	$-1{,}3$
	$> 6{,}0$	$-(1{,}3 + 0{,}001\ \mathrm{DN})$
Pipes not centrifugally cast and fittings	$\leq 7{,}0$	$-2{,}3$
	$> 7{,}0$	$-(2{,}3 + 0{,}001\ \mathrm{DN})$

[a] The lower limit only is given, so as to ensure sufficient resistance to internal pressure.

4.2.2 Diameter

4.2.2.1 External diameter

Subclause 8.1 specifies the values of the external diameter DE of the coated spigot ends of pipes and fittings and their maximum allowable limit deviations, when measured using a circumferential tape in accordance with 6.1.2. These limit deviations apply to the spigot ends of all thickness classes of pipes and fittings.

NOTE 1 Certain types of flexible joints operate within a different range of tolerance (see 4.1.3.3).

For DN ≤ 300, the external diameter of the pipe barrel measured with a circumferential tape shall be such as to allow the assembly of the joint over at least two thirds of the pipe length from the spigot when the pipe needs to be cut on site.

For DN > 300, the above requirement applies to a minimum of 5 % of the pipes manufactured, defined by agreement between manufacturer and purchaser insofar as any such agreement would not be in conflict with any regulatory requirements. Such pipes shall be marked.

In addition, the ovality (see 3.26) of the spigot end of pipes and fittings shall:

— remain within the tolerance on DE (see Table 11) for DN 40 to DN 200;

— not exceed 1 % for DN 250 to DN 600.

NOTE 2 For specific projects, the purchaser should consider any requirement for pipes DN > 300 meeting the above specification.

NOTE 3 The manufacturer's guidance should be followed as to the necessity and means of ovality correction; certain types of flexible joints can accept the maximum ovality without a need for spigot re-rounding prior to jointing.

4.2.2.2 Internal diameter

The nominal values of the internal diameter of centrifugally cast pipes, expressed in millimetres, are equal to the numbers indicating their nominal size, DN.

Their lower limit deviation shall be – 10mm, which will only appear locally along the pipe length.

Compliance shall be demonstrated according to 6.1.3 or by calculation from the measurements taken for pipe external diameter, iron wall thickness and lining thickness.

4.2.3 Length

4.2.3.1 Standardized lengths of socket and spigot pipes

Pipes shall be supplied in standardized lengths of 3 m, 5 m, 5,5 m and 6 m.

The deviations (see 3.25) on the standardized length L_u of pipes may be ± 100 mm.

Pipes shall be designed to a length taken in the range: standardized length plus or minus the permissible deviation; they shall be manufactured to this design length plus or minus the limit deviation given in Table 4.

The manufacturer shall show his design lengths (see 3.24) in his catalogues.

The length shall be measured according to 6.1.4 and shall be within the limit deviations given in Table 4.

Of the total number of socket and spigot pipes to be supplied in each diameter, the percentage of shorter pipes shall not exceed 10 %, in which case the length reduction shall be:

— up to 0,15 m for the pipes in which samples have been cut for testing (see 4.3);

— up to 2 m by increments of 0,5 m.

4.2.3.2 Standardized lengths of flanged pipes

Pipes shall be supplied to the standardized lengths given in Table 2.

Table 2 – Standardized lengths of flanged pipes

Dimensions in metres

Type of pipe	Standardized lengths L [a]
With cast flanges	0,5 or 1 or 2 or 3
With screwed or welded flanges	2 or 3 or 4 or 5

[a] See 3.24. Other lengths are available by agreement between manufacturer and purchaser.

4.2.3.3 Standardized lengths of fittings

Fittings shall be supplied to the standardized lengths as given in 8.3 and 8.4.

NOTE Two series of dimensions are shown, the series A corresponding to ISO 2531 and the series B, generally limited up to DN 450.

The permissible deviations (see 3.25) on the standardized length of series A fittings shall be as given in Table 3. No deviation is permitted for the fittings of series B. Fittings shall be designed to a length taken in the range: standardized length plus or minus the permissible deviation; they shall be manufactured to this design length plus or minus the limit deviations given in Table 4.

Table 3 – Permissible deviations on standardized lengths of fittings

Dimensions in millimetres

Type of fitting	Deviation
Flanged sockets Flanged spigots Collars, tapers	± 25
Tees	+ 50 / – 25
Bends 90° (1/4)	± (15 + 0,03) DN
Bends 45° (1/8)	± (10 + 0,025) DN
Bends 22°30' and 11°15' (1/16 and 1/32)	± (10 + 0,02) DN

4.2.3.4 Limit deviations

The limit deviations on lengths shall be as given in Table 4.

Table 4 – Limit deviations on standardized lengths of pipes and fittings

Dimensions in millimetres

Type of castings	Limit deviations
Socket and spigot pipes (full length or shortened)	− 30 / + 70
Fittings for socketed joints	± 20
Pipes and fittings for flanged joints	± 10 [a]
[a] Smaller limit deviations are possible, but not less than ± 3 mm.	

4.2.1 Straightness of pipes

Pipes shall be straight, with a maximum deviation of 0,125 % of their length.

The verification of this requirement is usually carried out by visual inspection, but in case of doubt or dispute, the deviation may also be measured in accordance with 6.2.

4.3 Material characteristics

4.3.1 Tensile properties

Pipes, fittings and accessories of ductile iron shall have the tensile properties given in Table 5.

The tensile strength shall be tested in accordance with 6.3.

Table 5 – Tensile properties

Type of casting	Minimum tensile strength, R_m MPa	Minimum elongation after fracture, A %
Pipes centrifugally cast	420	10
Pipes not centrifugally cast, fittings and accessories	420	5
The 0,2 % proof stress (Rp 0,2) may be measured. It shall be not less than: – 270 MPa when A ≥ 12 %; – 300 MPa in other cases. For centrifugally cast pipes, the minimum elongation after fracture shall be 7 % for thickness classes over K12.		

4.3.2 Hardness

The hardness of the various components shall be such that they can be cut, drilled, tapped and/or machined with normal tools. The reference test for hardness shall be the Brinell hardness test in accordance with 6.4.

The Brinell hardness shall not exceed 230 HBW for pipes and 250 HBW for fittings and accessories. For components manufactured by welding, a higher Brinell hardness is allowed in the heat-affected zone of the weld.

4.4 Coatings and linings for pipes

4.4.1 General

Unless otherwise requested, all pipes shall be delivered with an external coating of zinc with finishing layer in accordance with 4.4.2 and an internal coating of paint in accordance with 4.5.2, or when pipes have to be capable of carrying either gas or water, an internal cement mortar lining in conformity with EN 545.

The joint areas are generally coated as follows:

— external surface of spigots: zinc coating with finishing layer;

— flanges and sockets (face and internal surface): bituminous paint or synthetic resin paint, alone or as a supplement to a primer or zinc coating.

The following coatings may also be supplied, depending on the external and internal conditions of use.

a) External coatings:

- zinc rich paint coating having a minimum mass of 150 g/m^2, with finishing layer;
- thicker metallic zinc coating having a minimum mass of 200 g/m^2, with finishing layer;
- polyethylene sleeve (as a supplement to the zinc coating with finishing layer);
- extruded polyethylene coating;
- polyurethane coating;
- fibre reinforced cement mortar coating having a nominal thickness of at least 5 mm;
- adhesive tape.

b) Internal coatings (linings):

- polyurethane lining.

c) Coating of the joint area:

- epoxy coating;
- polyurethane coating.

These external and internal coatings shall comply with the corresponding European Standards or with an appropriate International Standard which the manufacturer shall declare as part of the product marking.

For the coatings given in c), the upper limit deviation on the external diameter DE of the coated spigot may be greater than that specified in 8.1, provided that the interconnection of the products is ensured.

NOTE 1 The field of use of these coatings is given in Annex C.

Pipes with cast-on flanges may be coated as fittings (see 4.5).

The maximum gas temperature may be limited to 35 °C for some polymeric coatings. If such coatings are to be used at higher temperatures, additional performance testing should be carried out.

4.4.2 External coating of zinc with finishing layer

4.4.2.1 General

The external coating of centrifugally cast ductile iron pipes shall comprise a layer of metallic zinc, covered by a finishing layer of bituminous product of synthetic resin compatible with zinc. Both layers shall be works applied.

The zinc is normally applied on oxide-surfaced pipes after heat treatment; at the manufacturer's option, it may also be applied on blast-cleaned pipes. Prior to application of the zinc, the pipe surface shall be dry and free from rust or non-adhering particles or foreign matter such as oil or grease.

4.4.2.2 Coating characteristics

The metallic zinc coating shall cover the external surface of the pipe and provide a dense, continuous, uniform layer. It shall be free from such defects as bare patches or lack of adhesion. The uniformity of the coating shall be checked by visual inspection. When measured in accordance with 6.6, the mean mass of zinc per unit area shall be not less than 130 g/m^2. The purity of the zinc used shall be at least 99,99 %.

The finishing layer shall uniformly cover the whole surface of the metallic zinc layer and be free from such defects as bare patches or lack of adhesion. The uniformity of the finishing layer shall be checked by visual inspection. When measured in accordance with 6.7, the mean thickness of the finishing layer shall be not less than 70 µm and the local minimum thickness not less than 50 µm.

4.4.2.3 Repairs

Damage to coatings where the area of total removal of metallic zinc and finishing layer has a width exceeding 5 mm and areas left uncoated (e.g. under test token, see 6.6) shall be repaired.

Repairs shall be carried out by:

— metallic zinc spray complying with 4.4.2.2, or application of zinc-rich paint containing at least 90 % zinc by mass of dry film and with a mean mass of applied paint not less than 150 g/m^2; and

— application of a finishing layer complying with 4.4.2.2.

4.5 Coatings for fittings and accessories

4.5.1 General

Unless otherwise requested, all fittings, accessories and pipes not centrifugally cast shall be delivered externally and internally coated by a paint coating in conformity with 4.5.2. When fittings have to be capable of carrying water and gas they may also receive an internal lining of cement mortar conforming with EN 545, machine or hand applied, as a supplement to or as a replacement of the above paint coating.

The following coatings may also be supplied, depending on the external and infernal conditions of use.

a) External coatings:

   — zinc coating with finishing layer;

   — polyethylene sleeving (as a supplement to the bituminous paint or to the zinc coating with finishing layer);

   — electro-deposited coating with a minimum thickness of 50 µm, applied on a blast-cleaned and phosphated surface;

- epoxy coating;
- adhesive tape.

b) Internal coatings (linings):

- electro-deposited coating with a minimum thickness of 50 µm, applied on a blast-cleaned and phosphated surface;
- polyurethane coating;
- enamel coating;
- epoxy coating.

These external and internal coatings shall comply with the corresponding European Standards or with an appropriate International Standard which the manufacturer shall declare as part of the product marking.

NOTE The field of use of these coatings and linings is given in Annex C.

4.5.2 Paint coatings

4.5.2.1 General

The coating material shall be of a bitumen or synthetic resin base. Appropriate additives (such as solvents, inorganic fillers, etc.) to allow easy application and drying are permitted. Prior to application of the coating, the casting surface shall be dry, free from rust or non adhering particles or foreign matter such as oil or grease. The coating shall be works-applied.

4.5.2.2 Coating characteristics

The coating shall uniformly cover the whole surface of the casting and have a smooth regular appearance. Drying shall be sufficient to ensure that it will not stick to adjacent coated pieces.

When measured in accordance with 6.7, the mean thickness of the coating shall be not less than 70 µm and the local minimum thickness shall be not less than 50 µm. For electro-deposited synthetic resin based coatings, the coating thickness shall be not less than 35 µm.

4.6 Marking of pipes and fittings

All pipes and fittings shall be legibly and durably marked and shall bear at least the following information:

- manufacturer’s name or mark;
- identification of the year of manufacture;
- identification as ductile iron;
- DN;
- PN rating of flanges when applicable;
- reference to this standard;
- class designation of centrifugally cast pipes when other than K9.

The first five markings given above shall be cast-on or cold stamped; the three other markings can be applied by any method, e.g. painted on the casting.

NOTE For CE marking and labelling, Clause ZA.3 of Annex ZA applies. When Clause ZA.3 requires the CE marking to be accompanied by the same information as required by this clause, the requirements of the clause are met.

4.7 Leak tightness

Pipes, fittings and joints shall be designed to be leak tight at their allowable test pressure (PEA):

— pipes and fittings shall be tested in accordance with 6.5 and shall exhibit no visible leakage, sweating or any other sign of failure;

— joints shall comply with the performance requirements of Clause 5.

5 Performance requirements for joints

5.1 General

In order to ensure their fitness for purpose in the field of gas supply, all the joints shall fulfil the performance requirements of Clause 5.

There shall be a performance test for at least one DN for each of the groupings given in Table 6. One DN is representative of a grouping when the performances are based on the same design parameters throughout the size range. If a grouping covers products of different designs and/or manufactured by different processes, the grouping shall be sub-divided.

Table 6 – DN grouping performance tests

DN groupings	40 to 250	300 to 600
Preferred DN in each grouping	200	400

When flanges are involved, there shall be a performance test for at least one PN for each of the groupings given in Table 6. The PN to be tested is the highest PN existing for each flange design. One PN is representative of a grouping when the performances are based on the same design parameters throughout the size range. If a grouping covers products of different designs and/or manufactured by different processes, the grouping shall be sub-divided.

If for a manufacturer a grouping contains only one DN or PN, this DN or this PN may be considered as part of the adjacent grouping provided that it is of identical design and manufactured by the same process.

5.2 Flexible joints

5.2.1 General

All joints shall be designed to be fully flexible; consequently, the allowable angular deflection declared by the manufacturer shall be not less than:

— 3°30’ for DN 40 to DN 300;

— 2°30’ for DN 350 to DN 600.

All joints shall be designed to provide sufficient axial movement; the allowable withdrawal shall be declared by the manufacturer.

NOTE This permits the installed pipeline to accommodate ground movements and/or thermal effects without incurring additional stresses.

5.2.2 Test conditions

All joint designs shall be performance tested under the most unfavourable applicable conditions of tolerance and joint movement as given below:

a) joint of maximum annulus (see 5.2.3.1) aligned, withdrawn to the allowable value declared by the manufacturer, and subject to shear (see 5.2.3.3);

b) joint of maximum annulus (see 5.2.3.1) deflected to the allowable value declared by the manufacturer (see 5.2.1).

The joints shall exhibit no visible leakage, and the pipes or the fittings being tested with the joints shall not exhibit any detrimental damage, when subjected to the tests given in Table 7.

Table 7 – Performance tests for joints

Test	Test requirements	Test conditions	Test method
1. Internal pneumatic pressure	Test pressure: 1,5 PFA bar Test duration: 2 h No visible leakage PFA as defined by the supplier	Joint of maximum annulus, aligned and withdrawn, with shear load Joint of maximum annulus, deflected	In accordance with 7.1
2. Positive external hydrostatic pressure	Test pressure: 2 bar Test duration: 2 h No visible leakage	Joint of maximum annulus, aligned, with shear load	In accordance with 7.2

Test 2 (positive external pressure) is required only when the joints are intended for use deeper than 5 m below the water level (e.g. river, lake, aquifer).

5.2.3 Test parameters

5.2.3.1 Annulus

All joints shall be performance tested at the extremes of manufacturing tolerance such that the annular gap between the sealing surfaces of the socket and of the spigot is equal to the maximum design value plus 0 %, minus 5 %. It is permissible to machine socket internal surfaces to achieve the required annulus for the performance test even though the resultant diameter can be slightly outside the normal manufacturing tolerance.

5.2.3.2 Pipe thickness

All joints shall be performance tested with a spigot having an average iron wall thickness (over a distance of 2 x DN in millimetres from the spigot face) equal to the specified minimum value for the pipe for which the joint is designed plus 10 %, minus 0 %. It is permissible to machine the spigot of the test pipe in the bore to achieve the required thickness.

5.2.3.3 Shear

All joints shall be performance tested with a resultant shear force across the joints of not less than 30 x DN, in newtons, taking into account the weight of the pipe and of its contents and the geometry of the test assembly (see 7.2).

5.3 Restrained flexible joints

All restrained joints shall be designed to be at least semi-flexible; consequently, the allowable angular deflection declared by the manufacturer shall be not less than half of the value shown in 5.2.1.

All restrained joint designs shall be performance tested in accordance with 7.1 and 7.2 following the requirements of 5.2.2 and 5.2.3, except that:

— the withdrawal condition of 5.2.2 a) shall not apply;

— there shall be no external axial restraint in positive internal pressure tests so that the joint is subject to the full end thrust.

During the internal pressure tests, the axial movement shall reach a stable value and cease.

When the restraining mechanism and the sealing component of a restrained joint are independent, such a joint does not need to be subjected to test 2 of 5.2.2 if the unrestrained version of the joint has passed these test.

5.4 Flanged joints as cast, screwed, welded and adjustable

In order to demonstrate their strength and leak tightness in service conditions, flanged joints shall be subjected to a performance test. When tested in accordance with 7.3, they shall show no visible leakage under the combined effects of a pneumatic internal pressure and of a bending moment given in Table 8, where:

— the pressure is 1,5 PFA bar, the PFA is defined by the supplier;

— the relevant bending moment is obtained by addition of the bending moments due to the weight of the components and to a possible external load calculated as a function of the length of the unsupported span of the testing arrangement (see 7.3).

NOTE The bending moments given in Table 8 are equal to those resulting from the weight of the pipes over an unsupported pipe length L between simple supports, with:

— L = 8 m for DN ≤ 250;

— L = 12 m for DN ≥ 300.

Table 8 – Bending moment for flange joint performance tests

Dimensions in kilo-newtons.metres

DN	Bending moment	DN	Bending moment
40	0,7	200	6,0
50	0,9	250	8,6
60	1,3	300	26,0
65	1,4	350	33,8
80	1,8	400	42
100	2,3	450	51
125	2,9	500	63
150	4,0	600	87

6 Test methods

6.1 Pipe dimensions

6.1.1 Wall thickness

Pipe wall thickness compliance shall be demonstrated by the manufacturer. He may use a combination of various means, e.g. direct wall thickness measurement, mechanical or ultrasonic measurement.

The iron wall thickness shall be measured by suitable equipment having an error limit +/– 0,1 mm.

6.1.2 External diameter

Socket and spigot pipes shall be measured at their spigot by means of a circumferential tape or controlled by pass-fail gauges. In addition, they shall be visually inspected for compliance with the spigot allowable ovality and, in case of doubt, the maximum and minimum spigot axes shall be measured by suitable equipment or controlled by pass-fail gauges.

6.1.3 Internal diameter

The internal diameter of the lined pipes shall be measured by means of suitable equipment:

either:

a) two measurements shall be taken at right angles, at a cross section 200 mm or more from the end face. The mean value of these two measurements may then be calculated; or

b) a system of pass / fail gauges shall be passed along the bore of the pipe.

6.1.4 Length

The length of socket and spigot pipes shall be measured by suitable equipment:

— on one pipe from the first batch of pipes cast from a new mould, for as-cast pipes;

— on the first pipe, for pipes which are systematically cut to a pre-set length.

6.2 Straightness of pipes

The pipe shall be rolled on two gantries or rotated around its axis on rollers, which in each case are separated by not less than two-thirds of the standardized pipe length.

The point of maximum deviation from the straight axis shall be determined and the deviation measured at that point.

6.3 Tensile testing

6.3.1 Samples

The thickness of the sample and the diameter of the test bar shall be as given in Table 9.

6.3.1.1 Centrifugally cast pipes

A sample shall be cut from the spigot of the pipe. This sample may be cut parallel with or perpendicular to the pipe axis, but in case of dispute the parallel with axis sample shall be used.

6.3.1.2 Pipes not centrifugally cast, fittings and accessories

At the manufacturer’s option, samples shall be either cast integrally with the castings or cast separately. In the latter case they shall be cast from the same metal as that used for the castings. If the castings are subjected to heat treatment, the samples shall be subjected to the same heat treatment cycle.

6.3.2 Preparation of test bar

A test bar shall be machined from each sample to be representative of the metal at the mid thickness of the sample, with a cylindrical part having the diameter given in Table 9.

The test bar shall have a gauge length equal to at least five times the nominal test bar diameter. The ends of the test bar shall be such that they will fit the testing machine.

The surface roughness profile of the cylindrical part of the test bar shall be such that Rz ≤ 6,3.

If the specified diameter of the test bar is greater than 60 % of the measured minimum thickness of the sample, it is allowed to machine a test bar with a smaller diameter or to cut another sample in a thicker part of the pipe.

Table 9 – Dimension of test bar

Dimensions in millimetres

Type of casting	Nominal diameter of the test bar	Limit deviations on diameter	Tolerance on shape [a]
Centrifugally cast pipes, with a wall thickness (mm) of:			
— less than 6	2,5	± 0,06	0,03
— 6 up to but not including 8	3,5		
— 8 up to but not including 12	5,0		
— 12 and over	6,0		
Pipes not centrifugally cast, fittings and accessories:			
— integrally cast samples	5,0	± 0,06	0,03
— separately cast samples:			
— sample thickness 12,5 mm	6,0	± 0,06	0,03
— for casting thickness less			
— than 12 mm			
— sample thickness 25 mm	12,0	± 0,09	0,04
— for casting thickness 12 mm	or		
— and over	14,0	± 0,09	0,04

[a] Maximum difference between the smallest and the largest measured diameter of the test bar.

The tensile strength shall be calculated either from the nominal diameter of the test bar when it has been machined to fulfil all the tolerances given in Table 9, or, if it is not the case, from the actual diameter of the test bar measured before the test; the actual diameter shall be measured with an error limit ≤ 0,5 % and shall be within ± 10 % of the nominal diameter.

6.3.3 Apparatus and test method

The tensile test shall be carried out in accordance to EN 10002-1.

6.3.4 Test results

Test results shall comply with Table 5. If they do not comply, the manufacturer shall:

a) in the case where the metal does not achieve the required mechanical properties, investigate the reason and ensure that all castings in the batch are either re-heat treated or rejected. Castings which have been re-heat treated are then re-tested in accordance with 6.3.

b) in the case of a defect in the test bar, carry out a further test. If it passes, the batch is accepted; if not, the manufacturer has the option to proceed as in a) above.

The manufacturer may limit the amount of rejection by making tests until the rejected batch of castings is bracketed, in order of manufacture, by a successful test at each end of the interval in question.

6.4 Brinell hardness

When Brinell hardness tests are carried out (see 4.3.2), they shall be performed either on the casting in dispute or on a sample cut from the casting. The surface to be tested shall be suitably prepared by local grinding to ensure a flat surface and the test shall be carried out in accordance with EN ISO 6506-1 using a ball of 2,5 mm or 5 mm or 10 mm diameter.

6.5 Works leak tightness test for pipes and fittings

6.5.1 General

Pipes and fittings shall be tested for leak tightness using air or water.

They shall be tested in accordance with 6.5.2 or 6.5.3 respectively. The type of test required shall be on the basis of this standard.

The test apparatus shall be suitable for applying the specified test pressures to the pipes and/or fittings. It shall be equipped with an industrial pressure gauge with an error limit ± 3 %.

6.5.2 Centrifugally cast pipes

When the internal hydrostatic pressure test is carried out, the pressure shall be raised steadily until it reaches the works hydrostatic test pressure given in Table 10, which is maintained for a sufficient time to allow visual inspection of the pipe barrel or fitting. The total duration of the pressure cycle shall be not less than 15 s, including 10 s at test pressure.

Table 10 – Works test pressure for pipes and fittings

Dimensions in bar

DN	Minimum works test pressure		
	Pipes centrifugally cast		Pipes not centrifugally cast and fittings [a]
	$K < 9$	$K \geq 9$	All thickness classes
40 to 300	$0,5\ (K + 1)^2$	50	25 [b]
350 to 600	$0,5\ K^2$	40	16

[a] The works hydrostatic test pressure is less for fittings than for pipes because the shape of the fittings makes it difficult to provide sufficient restraint to high internal pressure during the test.

[b] 16 bar for pipes and fittings with PN 10 flanges.

When the air test is carried out, it shall be with an internal pressure not less than 2 bar and an inspection time of not less than 30 s.

For leak detection, the pipes shall be either uniformly coated on their external surface by a suitable foaming agent or submerged in water.

6.5.3 Pipes not centrifugally cast and fittings

At the manufacturer's option, they shall be submitted to a hydrostatic pressure test, or to an air test of equivalent performance.

When the hydrostatic pressure test is carried out, it shall be in the same way as for centrifugally cast pipes (see 6.5.2), except for the test pressures which shall be as given in Table 10.

When the air test is carried out, it shall be with an internal pressure of at least 2 bar and a visual inspection time not less than 10 s; for leak detection, the castings shall be either uniformly coated on their external surface by a suitable foaming agent or submerged in water.

6.6 Zinc mass

A rectangular token of known weight per unit area shall be attached longitudinally along the axis of the pipe before passing it through the coating equipment. After zinc coating and trimming, the size of the token shall be 500 mm × 50 mm. It shall be weighed on a scale having an error limit ± 0,01 g.

The mean mass M of zinc per unit area shall be determined from the mass difference before and after zinc coating.

$$M = C\left(\frac{M_2 - M_1}{A}\right) \tag{2}$$

where

M is the mean mass of zinc in grammes per square metre;

M_1 and M_2 are the masses of the sample token, in grammes, before and after coating;

C is the predetermined correction factor, taking account of the nature of the token and of the difference in surface roughness between the token and the iron pipe;

A is the actual area of the trimmed token, in square metres.

The value of *C*, generally lying between 1 and 1,2, shall be given in the manufacturer's factory production control documentation.

The uniformity of the coating shall be checked by visual inspection of the token; in the event of a lack of uniformity, 50 mm × 50 mm pieces shall be cut from the token in the lighter mass zones and the mean mass of zinc determined on each piece by mass difference.

Alternatively the mass of zinc per unit area can be measured directly on the coated pipe by any method having proven correlation with the reference method described above, e.g. X-ray fluorescence or chemical analysis.

6.7 Thickness of paint coatings

The dry film thickness of paint coatings shall be measured by either of the three following methods:

— directly on the casting by means of suitable gauges, e.g. magnetic, or by using a 'wet film' thickness gauge where a correlation between wet film thickness and dry film thickness can be demonstrated; or

— indirectly on a token which is attached to the casting before coating and is used after coating to measure the dry film thickness by mechanical means, e.g. micrometer, or by a weight method similar to 6.6; or

— indirectly on a test plate made of steel or of ductile iron, which is coated by the same process as the castings to be controlled.

For each casting to be controlled at least three measurements shall be taken (either on the casting or on the token). The mean thickness is the average of all the measurements taken and the local minimum thickness is the lowest value of all the measurements taken.

7 Performance test methods

7.1 Leak tightness of flexible joints to positive internal pressure

The test shall be carried out on an assembled joint comprising two pipe sections, each at least 1 m long (see Figure 1).

The test apparatus shall be capable of providing suitable end and lateral restraints whether the joint is in the aligned position, or deflected, or subjected to a shear load. It shall be equipped with a pressure gauge with an error limit ≤ 3 %.

The vertical force W shall be applied to the spigot by means of a V shaped block with an angle of 120°, located at approximately 0,5 DN in millimetres or 200 mm from the socket face, whichever is the largest; the socket shall bear on a flat support. The vertical force W shall be such that the resultant shear force F across the joint is equal to the value specified in 5.2.3.3, taking into account the mass M of the pipe and the geometry of the test assembly:

$$W = \frac{F \cdot c - M\,(c - b)}{c - a} \quad (3)$$

where

a, b and c are as shown in Figure 1.

The air pressure in the test assembly shall be raised steadily until it reaches the test pressure given in 5.2.2. The test pressure shall be kept constant within ± 0,5 bar for at least 2 h during which the joint shall be thoroughly inspected every 15 min. The leak detection shall be carried out by spraying a suitable foaming agent or by submerging the test assembly in water. All necessary safety precautions shall be taken for the duration of the pressure test.

For a restrained joint, the test assembly, the test apparatus and the test procedure shall be identical except that there shall be no end restraint, so that the axial thrust is taken by the restrained joint under test. In addition, possible axial movement of the spigot shall be measured every 15 min.

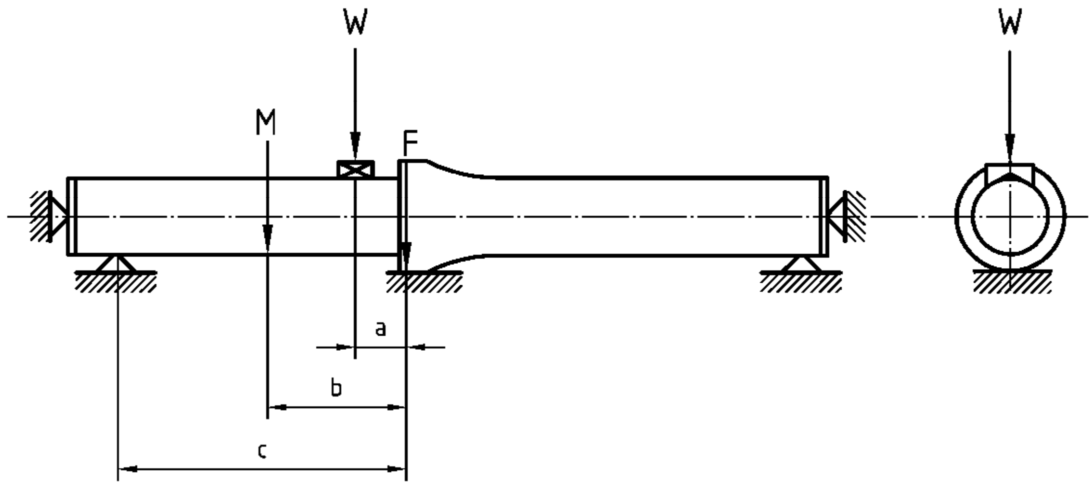

Figure 1 – Leak tightness of joints (internal pressure)

7.2 Leak tightness of flexible push-in joints to positive external pressure

The test assembly shall comprise two joints made with two pipe sockets welded together and one double-spigot piece (see Figure 2); it creates an annular chamber which allows testing one joint under internal pressure and one joint under external pressure.

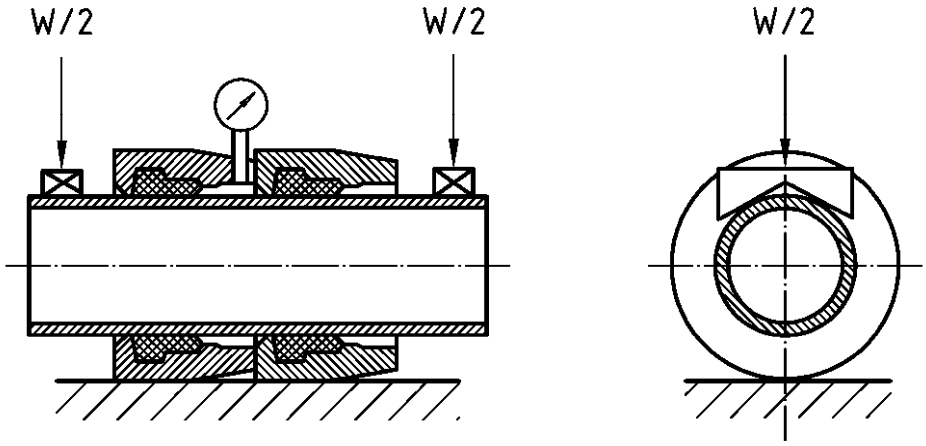

Figure 2 – Leak tightness of joints (external pressure)

The test assembly shall be subjected to a vertical force W equal to the shear force F defined in 5.2.3.3; one half of this load shall be applied to the spigot on each side of the test assembly, by means of a V shaped block with an angle of 120°, located at approximately 0,5 DN in millimetres or 200 mm from the ends of the sockets, whichever is the largest; the sockets shall bear on a flat support.

The test assembly shall be filled with water and suitably vented of air. The pressure shall be steadily increased until it reaches the test pressure of 2 bar. The latter shall be kept constant within ± 0,1 bar for at least 2 h during which the internal side of the joint subjected to external pressure shall be thoroughly inspected every 15 min.

For a restrained joint, the test assembly, the test apparatus and the test procedure shall be identical.

7.3 Leak tightness and mechanical resistance of flanged joints

The test assembly shall comprise two relevant pipes or fittings with identical flanges, assembled together by means of the relevant gasket and bolts defined by the manufacturer. Both ends of the test assembly shall be equipped with blank flanges. The bolts shall be tightened to the torque given by the manufacturer for the maximum PN of the DN under test. The bolt material grade, when not defined, shall be grade 4.6 of EN ISO 4016.

The test assembly shall be placed on two simple supports (see Figure 3) such that the assembled flanged joint is positioned at mid span. The minimum length of unsupported span shall be either 6 DN in millimetres or 4 000 mm, whichever is the smallest. This length can be obtained by a combination of pipes or fittings, but only the tested joint at mid span shall be considered.

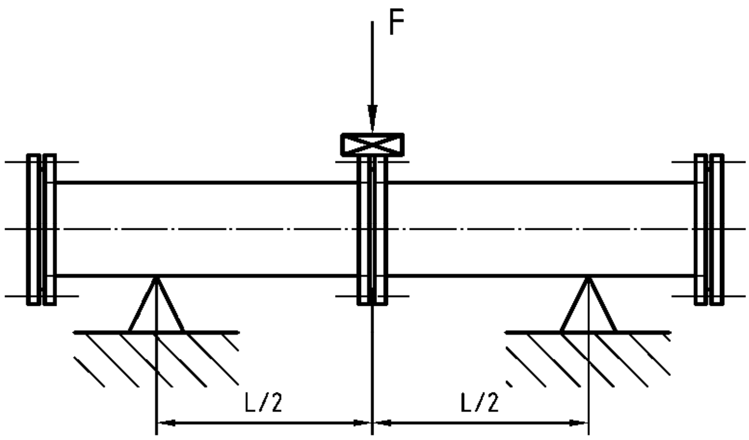

Figure 3 – Strength and leak tightness test for flanged joints

The pressure shall be raised steadily until it reaches the test pressure given in 5.4. The external load F shall be applied to the assembled flanged joint by means of a flat plate, in a direction perpendicular to the axis of the test assembly, so as to cause the bending moment given in Table 8.

The internal pressure and the external load shall be kept constant for 2 h during which the leak detection shall be carried out by spraying a suitable foaming agent or by submerging the test assembly in water.

All necessary safety precautions shall be taken for the duration of the pressure test.

8 Tables of dimensions

8.1 Socket and spigot pipes

The dimensions of socket and spigot pipes shall be as given in Table 11. The values of L_u are given in 4.2.3.1. For external and internal coatings, see 4.4.

The values of DE and their limit deviations also apply to the spigot ends of fittings (see 4.2.2.1).

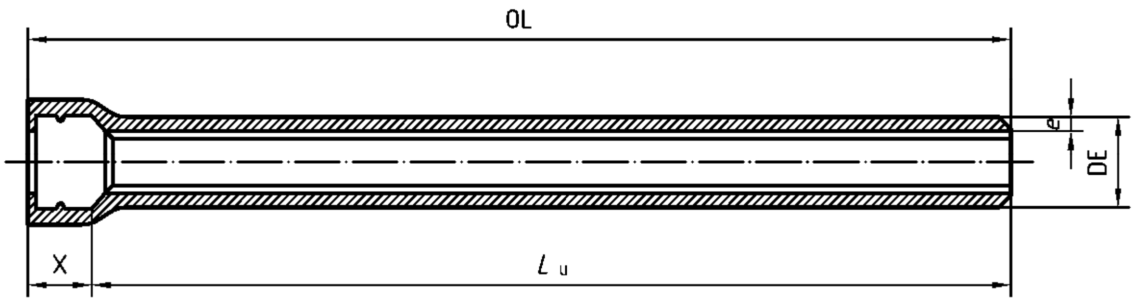

Figure 4 – Socket and spigot pipes

Table 11 – Dimensions of pipes

Dimensions in millimetres

DN	External diameter DE		Wall thickness *e*			
			K9		K10	
	Nominal	**Limit deviations**	**Nominal**	**Limit deviation** [a]	**Nominal**	**Limit deviation** [a]
40	56	+ 1/ – 1,2	6,0	– 1,3	6,0	– 1,3
50	66	+ 1/ – 1,2	6,0	– 1,3	6,0	– 1,3
60	77	+ 1/ – 1,2	6,0	– 1,3	6,0	– 1,3
65	82	+ 1/ – 1,2	6,0	– 1,3	6,0	– 1,3
80	98	+ 1/ – 2,7	6,0	– 1,3	6,0	– 1,3
100	118	+ 1/ – 2,8	6,0	– 1,3	6,0	– 1,3
125	144	+ 1/ – 2,8	6,0	– 1,3	6,2	– 1,3
150	170	+ 1/ – 2,9	6,0	– 1,3	6,5	– 1,3
200	222	+ 1/ – 3,0	6,3	– 1,5	7,0	– 1,5
250	274	+ 1/ – 3,1	6,8	– 1,6	7,5	– 1,6
300	326	+ 1/ – 3,3	7,2	– 1,6	8,0	– 1,6
350	378	+ 1/ – 3,4	7,7	– 1,7	8,5	– 1,7
400	429	+ 1/ – 3,5	8,1	– 1,7	9,0	– 1,7
450	480	+ 1/ – 3,6	8,6	– 1,8	9,5	– 1,8
500	532	+ 1/ – 3,8	9,0	– 1,8	10,0	– 1,8
600	635	+ 1/ – 4,0	9,9	– 1,9	11,0	– 1,9
[a] A negative tolerance only is given.						

8.2 Flanged pipes

8.2.1 General

Standardized thickness classes, DNs and PNs of flanged pipes are specified in the following three sub-clauses. The values of L are given in Table 2. For coatings and linings, see 4.4.

8.2.2 Centrifugally cast pipes with welded flanges

— DN 40 to DN 600: K9 for PN 10, PN 16.

8.2.3 Centrifugally cast pipes with screwed flanges

— DN 40 to DN 600: K9 or K10 for PN 10, PN 16.

8.2.4 Pipes with integrally cast flanges

— DN 40 to DN 600: K12 for PN 10 and PN 16.

8.3 Fittings for socketed joints

8.3.1 General

In the following tables, all the dimensions are nominal values and are given in millimetres. The values of L_u and l_u have been rounded off to the nearest multiple of five.

For coating and linings, see 4.5.

8.3.2 Flanged sockets

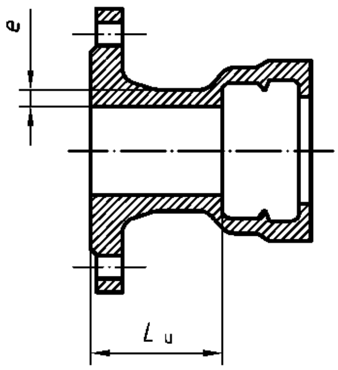

Figure 5 a – Flanged socket

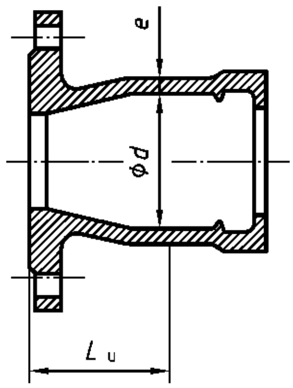

Figure 5 b – Flanged socket

Figure 5 – Flanged sockets

Table 12 – Dimensions of flanged sockets

DN	*e*	L_u series A	L_u series B	*d*
40	7,0	125	75	67
50	7,0	125	85	78
60	7,0	125	100	88
65	7,0	125	105	93
80	7,0	130	105	109
100	7,2	130	110	130
125	7,5	135	115	156
150	7,8	135	120	183
200	8,4	140	120	235
250	9,0	145	125	288
300	9,6	150	130	340
350	10,2	155	135	393
400	10,8	160	140	445
450	11,4	165	145	498
500	12,0	170	–	550
600	13,2	180	–	655

8.3.3 Flanged spigots

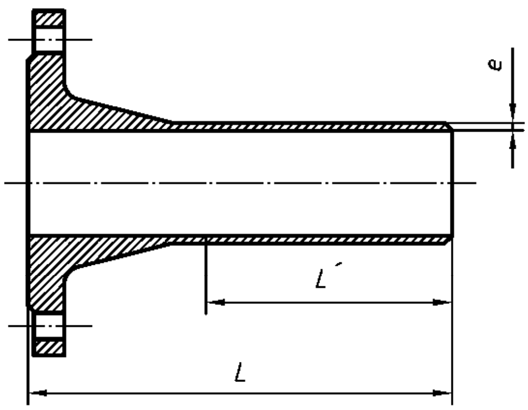

Figure 6 – Flanged spigot

8.3.4 Collars

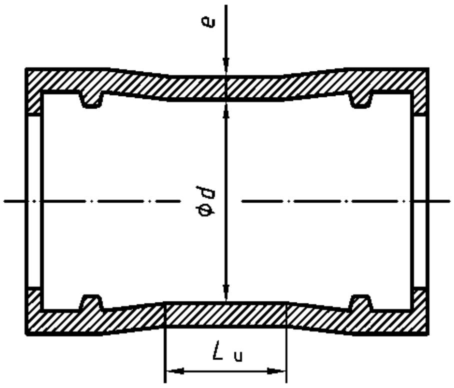

Figure 7 – Collar

Table 13 – Dimensions of flanged spigots and collars

DN	*e*	Flanged spigots			Collars		
		L series A	*L* series B	*L'*	L_u series A	L_u series B	*d*
40	7,0	335	335	200	155	155	67
50	7,0	340	340	200	155	155	78
60	7,0	345	345	200	155	155	88
65	7,0	345	345	200	155	155	93
80	7,0	350	350	215	160	160	109
100	7,2	360	360	215	160	160	130
125	7,5	370	370	220	165	165	156
150	7,8	380	380	225	165	165	183
200	8,4	400	400	230	170	170	235
250	9,0	420	420	240	175	175	288
300	9,6	440	440	250	180	180	340
350	10,2	460	460	260	185	185	393
400	10,8	480	480	270	190	190	445
450	11,4	500	500	280	195	195	498
500	12,0	520	–	290	200	–	550
600	13,2	560	–	310	210	–	655
NOTE The length *L'* is the length to which the value of DE and its tolerance, as given in Table 10, apply.							

8.3.5 Double socket 90° (1/4) bends

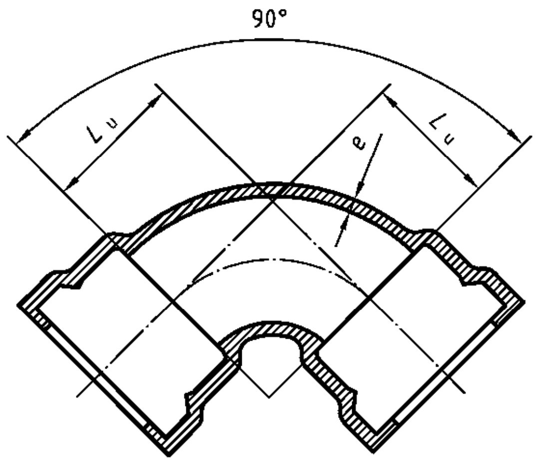

Figure 8 – Double socket 90° bend

8.3.6 Double socket 45° (1/8) bends

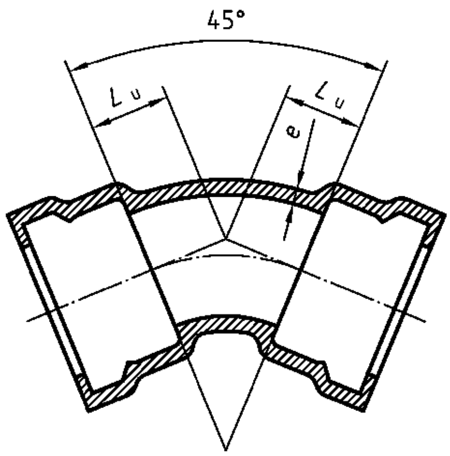

Figure 9 – Double socket 45° bend

Table 14 – Dimensions of double socket 90° and 45° bends

DN	e	90° (1/4) bends		45° (1/8) bends	
		L_u series A	L_u series B	L_u series A	L_u series B
40	7,0	60	85	40	85
50	7,0	70	85	40	85
60	7,0	80	90	45	90
65	7,0	85	90	50	90
80	7,0	100	85	55	50
100	7,2	120	100	65	60
125	7,5	145	115	75	65
150	7,8	170	130	85	70
200	8,4	220	160	110	80
250	9,0	270	240	130	135
300	9,6	320	280	150	155
350	10,2	–	–	175	170
400	10,8	–	–	195	185
450	11,4	–	–	220	200
500	12,0	–	–	240	–
600	13,2	–	–	285	–

8.3.7 Double socket 22°30' (1/16) bends

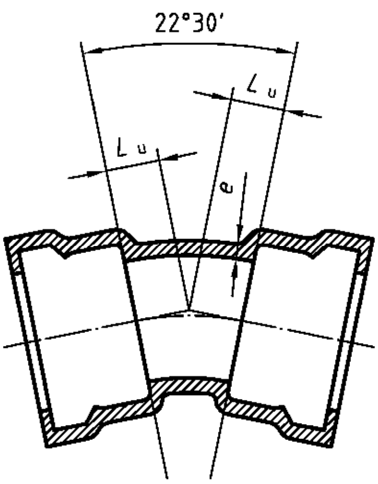

Figure 10 – Double socket 22°30' bend

8.3.8 Double socket 11°15' (1/32) bends

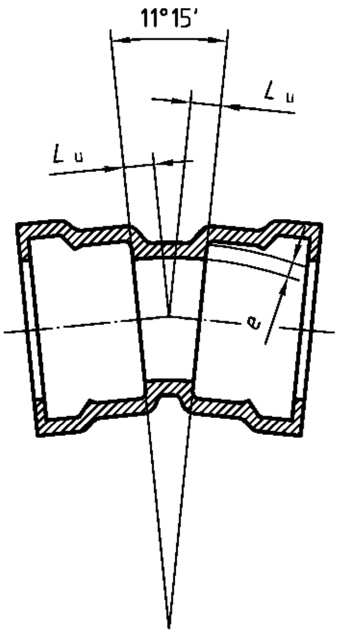

Figure 11 – Double socket 11°15' bend

Table 15 – Dimensions of double socket 22°30' and 11°25' bends

DN	*e*	22°30' (1/16) bends		11°15' (1/32) bends	
		L_u series A	L_u series B	L_u series A	L_u series B
40	7,0	30	30	25	25
50	7,0	30	30	25	25
60	7,0	35	35	25	25
65	7,0	35	35	25	25
80	7,0	40	40	30	30
100	7,2	40	50	30	30
125	7,5	50	55	35	35
150	7,8	55	60	35	40
200	8,4	65	70	40	45
250	9,0	75	80	50	55
300	9,6	85	90	55	55
350	10,2	95	100	60	60
400	10,8	110	110	65	65
450	11,4	120	120	70	70
500	12,0	130	–	75	–
600	13,2	150	–	85	–

8.3.9 All socket tees

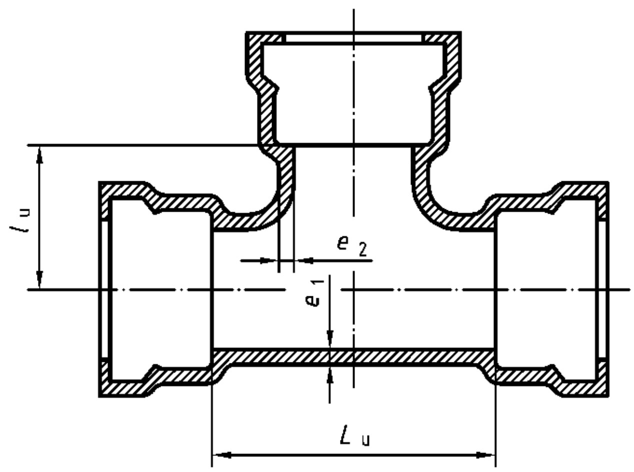

Figure 12 – All socket tees

Table 16 – Dimensions of all socket tees

DN × dn	Body			Branch		
	e_1	L_u series A	L_u series B	e_2	l_u series A	l_u series B
40 × 40	7,0	120	155	7,0	60	75
50 × 50	7,0	130	155	7,0	65	75
60 × 60	7,0	145	155	7,0	70	80
65 × 65	7,0	150	155	7,0	75	80
80 × 40	7,0	120	155	7,0	80	80
80 × 80	7,0	170	175	7,0	85	85
100 × 40	7,2	120	155	7,0	90	90
100 × 60	7,2	145	155	7,0	90	90
100 × 80	7,2	170	165	7,0	95	90
100 × 100	7,2	190	195	7,2	95	100
125 × 40	7,5	125	155	7,0	100	105
125 × 80	7,5	170	175	7,0	105	105
125 × 100	7,5	195	195	7,2	110	115
125 × 125	7,5	225	225	7,5	110	115
150 × 40	7,8	125	160	7,0	115	115
150 × 80	7,8	170	180	7,0	120	120
150 × 100	7,8	195	200	7,2	120	125
150 × 150	7,8	255	260	7,8	125	130
200 × 40	8,4	130	165	7,0	140	140
200 × 80	8,4	175	180	7,0	145	145
200 × 100	8,4	200	200	7,2	145	150
200 × 150	8,4	255	260	7,8	150	155
200 × 200	8,4	315	320	8,4	155	160
250 × 80	9,0	180	185	7,0	170	185
250 × 100	9,0	200	205	7,2	170	190
250 × 150	9,0	260	265	7,8	175	190
250 × 200	9,0	315	320	8,4	180	190
250 × 250	9,0	375	380	9,0	190	190
300 × 100	9,6	205	210	7,2	195	220
300 × 150	9,6	260	265	7,8	200	220
300 × 200	9,6	320	325	8,4	205	220
300 × 250	9,6	375	380	9,0	210	220
300 × 300	9,6	435	440	9,6	220	220

NOTE The main nominal size is designated DN and the nominal size of the branch is designated dn.

8.3.10 Double socket tees with flanged branch, DN 40 to DN 250

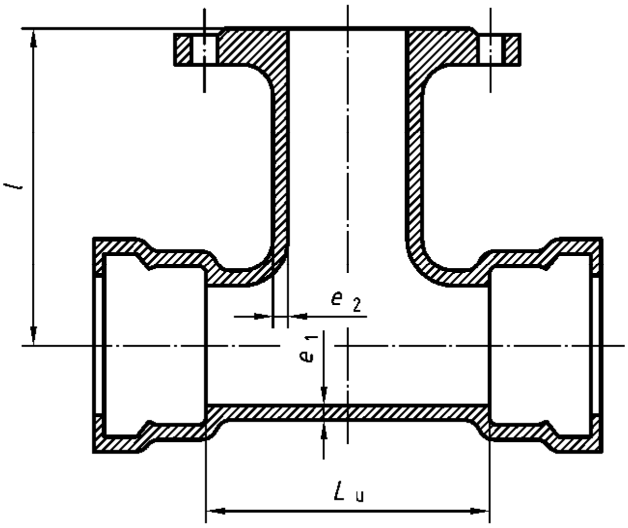

Figure 13 – Double socket tees with flanged branch

Table 17 – Dimensions of double socket tees with flanged branch, DN 40 to 250

DN × dn	Body			Branch		
	e_1	L_u series A	L_u series B	e_2	l series A	l series B
40 × 40	7,0	120	155	7,0	130	130
50 × 50	7,0	130	155	7,0	140	140
60 × 40	7,0	–	155	7,0	–	130
60 × 60	7,0	145	155	7,0	150	150
65 × 40	7,0	–	155	7,0	–	130
65 × 65	7,0	150	155	7,0	150	155
80 × 40	7,0	–	155	7,0	–	135
80 × 60	7,0	–	155	7,0	–	155
80 × 80	7,0	170	175	7,0	165	165
100 × 40	7,2	–	155	7,0	–	145
100 × 60	7,2	–	155	7,0	–	165
100 × 80	7,2	170	165	7,0	175	170
100 × 100	7,2	190	195	7,2	180	180
125 × 40	7,5	–	155	7,0	–	160
125 × 60	7,5	–	155	7,0	–	180
125 × 80	7,5	170	175	7,0	190	185
125 × 100	7,5	195	195	7,2	195	195
125 × 125	7,5	225	225	7,5	200	200
150 × 40	7,8	–	160	7,0	–	170
150 × 60	7,8	–	160	7,0	–	190
150 × 80	7,8	170	180	7,0	205	200
150 × 100	7,8	195	200	7,2	210	205
150 × 125	7,8	–	230	7,5	–	215
150 × 150	7,8	255	260	7,8	220	220
200 × 40	8,4	–	165	7,0	–	195
200 × 60	8,4	–	165	7,0	–	215
200 × 80	8,4	175	180	7,0	235	225
200 × 100	8,4	200	200	7,2	240	230
200 × 125	8,4	–	235	7,5	–	240
200 × 150	8,4	255	260	7,8	250	245
200 × 200	8,4	315	320	8,4	260	260
250 × 60	9,0	–	165	7,0	–	260
250 × 80	9,0	180	185	7,0	265	265
250 × 100	9,0	200	205	7,2	270	270
250 × 150	9,0	260	265	7,8	280	280
250 × 200	9,0	315	320	8,4	290	290
250 × 250	9,0	375	380	9,0	300	300
NOTE The main nominal size is designated DN and the nominal size of the branch is designated dn.						

8.3.11 Double socket tees with flanged branch, DN 300 to DN 600

Table 18 – Dimensions of double socket tees with flanged branch, DN 300 to 600

DN × dn	Body			Branch		
	e_1	L_u series A	L_u series B	e_2	l series A	l series B
300 × 60	9,6	–	165	7,0	–	290
300 × 80	9,6	180	185	7,0	295	295
300 × 100	9,6	205	210	7,2	300	300
300 × 150	9,6	260	265	7,8	310	310
300 × 200	9,6	320	325	8,4	320	320
300 × 250	9,6	–	380	9,0	–	330
300 × 300	9,6	435	440	9,6	340	340
350 × 60	10,2	–	170	7,0	–	320
350 × 80	10,2	–	185	7,0	–	325
350 × 100	10,2	205	210	7,2	330	330
350 × 150	10,2	–	270	7,8	–	340
350 × 200	10,2	325	325	8,4	350	350
350 × 250	10,2	–	385	9,0	–	360
350 × 350	10,2	495	500	10,2	380	380
400 × 80	10,8	185	190	7,0	355	355
400 × 100	10,8	210	210	7,2	360	360
400 × 150	10,8	270	270	7,8	370	370
400 × 200	10,8	325	330	8,4	380	380
400 × 250	10,8	–	385	9,0	–	390
400 × 300	10,8	440	445	9,6	400	400
400 × 400	10,8	560	560	10,8	420	420
450 × 100	11,4	–	215	7,2	–	390
450 × 150	11,4	–	270	7,8	–	400
450 × 200	11,4	–	330	8,4	–	410
450 × 250	11,4	–	390	9,0	–	420
450 × 300	11,4	–	445	9,6	–	430
450 × 400	11,4	–	560	10,8	–	450
450 × 450	11,4	–	620	11,4	–	460
500 × 100	12,0	215	–	7,2	420	–
500 × 200	12,0	330	–	8,4	440	–
500 × 400	12,0	565	–	10,8	480	–
500 × 500	12,0	680	–	12,0	500	–
600 × 200	13,2	340	–	8,4	500	–
600 × 400	13,2	570	–	10,8	540	–
600 × 600	13,2	800	–	13,2	580	–

NOTE The main nominal size is designated DN and the nominal size of the branch is designated dn.

8.3.12 Double socket tapers

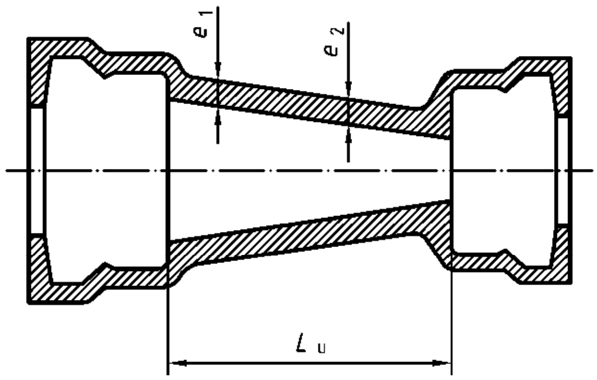

Figure 14 – Double socket tapers

Table 19 – Dimensions of double socket tapers

DN × dn	e_1	e_2	L_u series A	L_u series B
50 × 40	7,0	7,0	70	75
60 × 50	7,0	7,0	70	75
65 × 50	7,0	7,0	80	75
80 × 40	7,0	7,0	–	80
80 × 60	7,0	7,0	90	80
80 × 65	7,0	7,0	80	80
100 × 60	7,2	7,0	–	120
100 × 80	7,2	7,0	90	85
125 × 60	7,5	7,0	–	190
125 × 80	7,5	7,0	140	135
125 × 100	7,5	7,2	100	120
150 × 80	7,8	7,0	190	190
150 × 100	7,8	7,2	150	150
150 × 125	7,8	7,5	100	115
200 ×100	8,4	7,2	250	250
200 × 125	8,4	7,5	200	230
200 × 150	8,4	7,8	150	145
250 × 125	9,0	7,5	300	335
250 × 150	9,0	7,8	250	250
250 × 200	9,0	8,4	150	150
300 × 150	9,6	7,8	350	370
300 × 200	9,6	8,4	250	250
300 × 250	9,6	9,0	150	150
350 × 200	10,2	8,4	360	370
350 × 250	10,2	9,0	260	260
350 × 300	10,2	9,6	160	160
400 × 250	10,8	9,0	360	380
400 × 300	10,8	9,6	260	260
400 × 350	10,8	10,2	160	155
450 × 350	11,4	10,2	260	270
450 × 400	11,4	10,8	160	160
500 × 350	12,0	10,2	360	–
500 × 400	12,0	10,8	260	–
600 × 400	13,2	10,8	460	–
600 × 500	13,2	12,0	260	–
NOTE The larger end is designated DN and the smaller end is designated dn.				

8.4 Fittings for flanged joints

In the following tables, all the dimensions are nominal values and are given in millimetres. For coatings and linings, see 4.5.

8.4.1 Double flanged 90° (1/4) bends

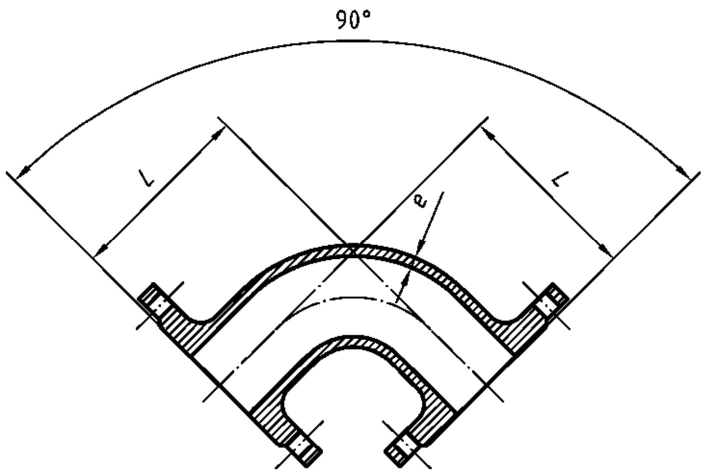

Figure – 15 Double flanged 90° bend

8.4.2 Double flanged duckfoot 90° (1/4) bends

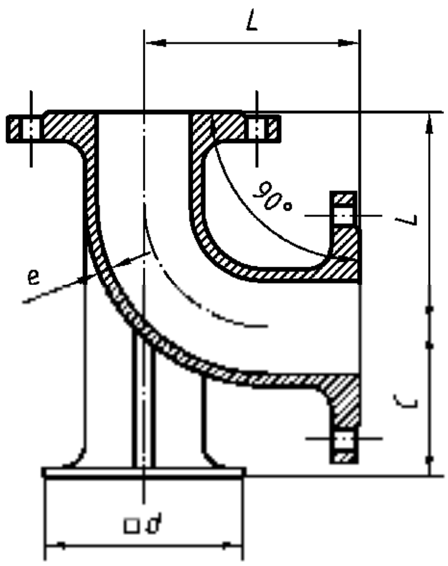

Figure 16 – Double flanged duckfoot 90° bend

Table 20 – Dimensions of double flanged 90° and 90° duckfoot bend

DN	A and B series				
	e	90° (1/4) bends	90° (1/4) duckfoot bends		
		L	*L*	*c*	*d*
40	7,0	140	–	–	–
50	7,0	150	150	95	150
60	7,0	160	160	100	160
65	7,0	165	165	100	165
80	7,0	165	165	110	180
100	7,2	180	180	125	200
125	7,5	200	200	140	225
150	7,8	220	220	160	250
200	8,4	260	260	190	300
250	9,0	350	350	225	350
300	9,6	400	400	255	400
350	10,2	450	450	290	450
400	10,8	500	500	320	500
450	11,4	550	550	355	550
500	12,0	600	600	385	600
600	13,2	700	700	450	700

8.4.3 Double flanged 45° (1/8) bends

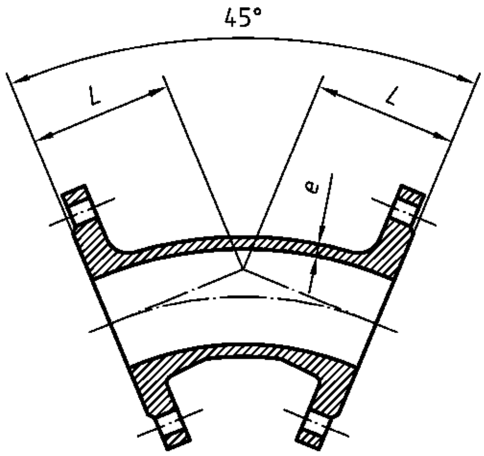

Figure 17 – Double flanged 45° bend

Table 21 – Dimensions of double flanged 45° bends

DN	*E*	*L* series A	*L* series B
40	7,0	140	140
50	7,0	150	150
60	7,0	160	160
65	7,0	165	165
80	7,0	130	130
100	7,2	140	140
125	7,5	150	150
150	7,8	160	160
200	8,4	180	180
250	9,0	350	245
300	9,6	400	275
350	10,2	298	300
400	10,8	324	325
450	11,4	350	350
500	12,0	375	–
600	13,2	426	–

8.4.4 Double flanged 22°30' (1/16) bends

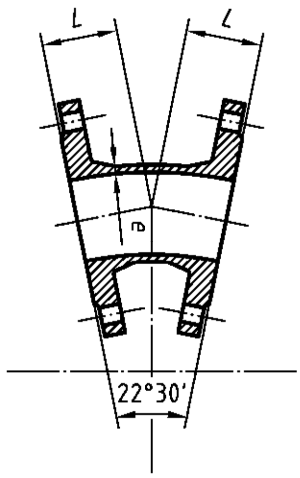

Figure 18 – Double flanged 22°30' bend

8.4.5 Double flanged 11°15' (1/32) bends

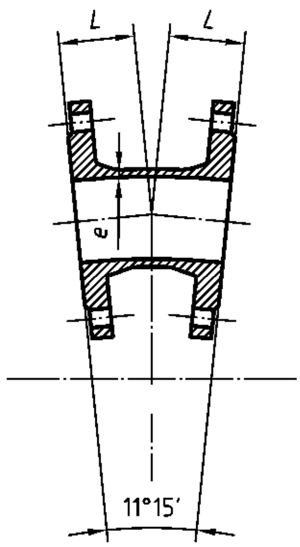

Figure 19 – Double flanged 11°15' bend

Table 22 – Dimensions of double flanged 22°30' and 11°15' bends

DN	22°30' (1/16) bends			11°15' (1/32) bends		
	e	*L* series A	*L* series B	*e*	*L* series A	*L* series B
40	7,0	94	85	7,0	99	80
50	7,0	104	95	7,0	109	90
60	7,0	114	105	7,0	119	100
65	7,0	119	110	7,0	124	105
80	7,0	105	120	7,0	113	110
100	7,2	110	130	7,2	115	115
125	7,5	105	140	7,5	111	120
150	7,8	109	150	7,8	113	130
200	8,4	131	170	8,4	132	145
250	9,0	190	190	9,0	165	165
300	9,6	210	210	9,6	175	175
350	10,2	210	230	10,2	191	190
400	10,8	239	250	10,8	205	205
NOTE Double flanged 22°30' and 11°15' bends of sizes larger than DN 400 are available, but with a range of effective lengths, depending on the manufacturer.						

8.4.6 All-flanged tees, DN 40 to DN 250

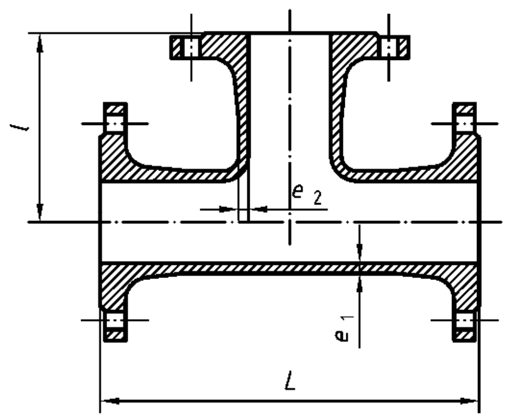

Figure 20 – All flanged tee

Table 23 – Dimensions of all flanged tees

DN × dn	Body			Branch		
	e_1	L series A	L series B	e_2	l series A	l series B
40 × 40	7,0	280	255	7,0	140	130
50 × 50	7,0	300	280	7,0	150	140
60 × 40	7,0	300	–	7,0	130	–
60 × 60	7,0	320	300	7,0	160	150
65 × 65	7,0	330	305	7,0	165	150
80 × 40	7,0	–	310	7,0	–	135
80 × 60	7,0	–	310	7,0	–	155
80 × 80	7,0	330	330	7,0	165	165
100 × 40	7,2	–	320	7,0		145
100 × 60	7,2	–	320	7,0		165
100 × 80	7,2	360	330	7,0	175	170
100 × 100	7,2	360	360	7,2	180	180
125 × 40	7,5	–	330	7,0	–	160
125 × 60	7,5	–	330	7,0	–	180
125 × 80	7,5	400	350	7,0	190	185
125 × 100	7,5	400	370	7,2	195	195
125 × 125	7,5	400	400	7,5	200	200
150 × 40	7,8	-	340	7,0	-	170
150 × 60	7,8	-	340	7,0	-	190
150 × 80	7,8	440	360	7,0	205	200
150 × 100	7,8	440	380	7,2	210	205
150 × 125	7,8	440	410	7,5	215	215
150 × 150	7,8	440	440	7,8	220	220
200 × 40	8,4	–	365	7,0	–	195
200 × 60	8,4	–	365	7,0	–	215
200 × 80	8,4	520	380	7,0	235	225
200 × 100	8,4	520	400	7,2	240	230
200 × 125	8,4	-	435	7,5	-	240
200 × 150	8,4	520	460	7,8	250	245
200 × 200	8,4	520	520	8,4	260	260
250 × 60	9,0	–	385	7,0	–	260
250 × 80	9,0	–	405	7,0	–	265
250 × 100	9,0	700	425	7,2	275	270
250 × 150	9,0	–	485	7,8	–	280
250 × 200	9,0	700	540	8,4	325	290
250 × 250	9,0	700	600	9,0	350	300

NOTE The main nominal size is designated DN and the nominal size of the branch is designated dn.

8.4.7 All-flanged tees, DN 300 to DN 600

Table 24 – Dimensions of all flanged tees DN 300 to 600

DN × dn	Body			Branch		
	e_1	L series A	L series B	e_2	l series A	l series B
300 × 60	9,6	–	405	7,0	–	290
300 × 80	9,6	–	425	7,0	–	295
300 × 100	9,6	800	450	7,2	300	300
300 × 150	9,6	–	505	7,8	–	310
300 × 200	9,6	800	565	8,4	350	320
300 × 250	9,6	–	620	9,0	–	330
300 × 300	9,6	800	680	9,6	400	340
350 × 60	10,2	–	430	7,0	–	320
350 × 80	10,2	–	445	7,0	–	325
350 × 100	10,2	850	470	7,2	325	330
350 × 150	10,2	–	530	7,8	–	340
350 × 200	10,2	850	585	8,4	325	350
350 × 250	10,2	–	645	9,0	–	360
350 × 350	10,2	850	760	10,2	425	380
400 × 80	10,8	–	470	7,0	–	355
400 × 100	10,8	900	490	7,2	350	360
400 × 150	10,8	–	550	7,8	–	370
400 × 200	10,8	900	610	8,4	350	380
400 × 250	10,8	–	665	9,0	–	390
400 × 300	10,8	–	725	9,6	–	400
400 × 400	10,8	900	840	10,8	450	420
450 × 100	11,4	950	515	7,2	375	390
450 × 150	11,4	-	570	7,8	-	400
450 × 200	11,4	950	630	8,4	375	410
450 × 250	11,4	–	690	9,0	–	420
450 × 300	11,4	–	745	9,6	–	430
450 × 400	11,4	–	860	10,8	–	450
450 x 450	11,4	950	920	11,4	475	460
500 × 100	12,0	1 000	535	7,2	400	420
500 × 200	12,0	1 000	650	8,4	400	440
500 × 400	12,0	1 000	885	10,8	500	480
500 × 500	12,0	1 000	1 000	12,0	500	500
600 × 200	13,2	1 100	700	8,4	450	500
600 × 400	13,2	1 100	930	10,8	550	540
600 × 600	13,2	1 100	1 165	13,2	550	580
NOTE The main nominal size is designated DN and the nominal size of the branch is designated dn.						

8.4.8 Double flanged tapers

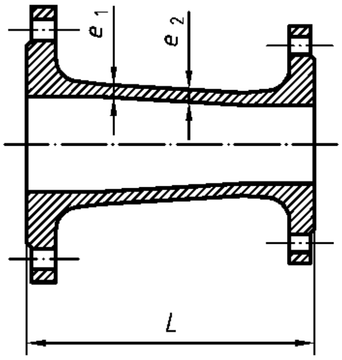

Figure 21 – Double flanged tapers

Table 25 – Dimensions of double flanged tapers

DN × dn	e_1	e_2	L series A	L series B
50 × 40	7,0	7,0	150	165
60 × 50	7,0	7,0	160	160
65 × 50	7,0	7,0	200	190
80 × 60	7,0	7,0	200	185
80 × 65	7,0	7,0	200	190
100 × 80	7,2	7,0	200	195
125 × 100	7,5	7,2	200	185
150 × 125	7,8	7,5	200	190
200 × 150	8,4	7,8	300	235
250 × 200	9,0	8,4	300	250
300 × 250	9,6	9,0	300	265
350 × 300	10,2	9,6	300	290
400 × 350	10,8	9,6	300	305
450 × 400	10,8	10,2	300	320
500 × 400	11,4	10,8	600	–
600 × 500	12,0	10,8	600	–
NOTE The larger nominal size is designated DN and the smaller nominal size is designated dn.				

8.4.9 Blank flanges PN 10

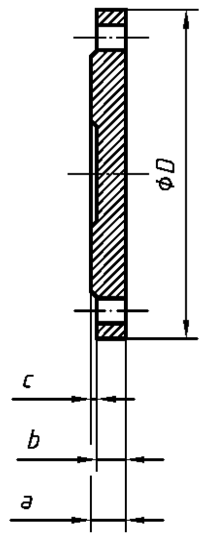

Figure 22 – Blank flanges PN 10

8.4.10 Blank flanges PN 16

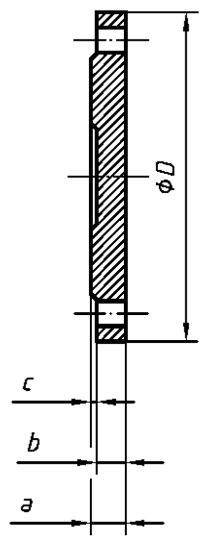

Figure 23 – Blank flange PN 16

Table 26 – Dimensions of PN 10 and PN 16 blank flanges

DN	PN 10				PN 16			
	D	*a*	*b*	*c*	*D*	*a*	*b*	*c*
40	150	19	16	3	150	19	16	3
50	165	19	16	3	165	19	16	3
60	175	19	16	3	175	19	16	3
65	185	19	16	3	185	19	16	3
80	200	19	16	3	200	19	16	3
100	220	19	16	3	220	19	16	3
125	250	19	16	3	250	19	16	3
150	285	19	16	3	285	19	16	3
200	340	20	17	3	340	20	17	3
250	400	22	19	3	400	22	19	3
300	455	24,5	20,5	4	455	24,5	20,5	4
350	505	24,5	20,5	4	520	26,5	22,5	4
400	565	24,5	20,5	4	580	28	24	4
450	615	25,5	21,5	4	640	30	26	4
500	670	26,5	22,5	4	715	31,5	27,5	4
600	780	30	25	5	840	36	31	5
NOTE For flanges of nominal diameter greater than or equal to DN 300, the centre of blank flanges may be dished.								

8.4.11 Reducing flanges PN 10

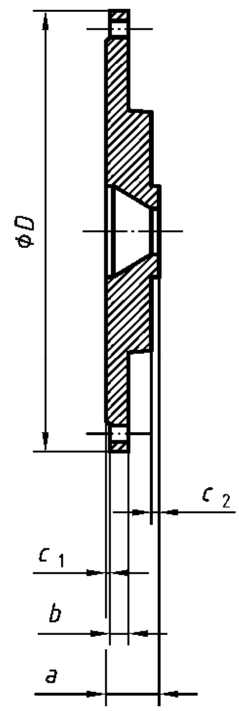

Figure 24 – Reducing flange PN 10

8.4.12 Reducing flanges PN 16

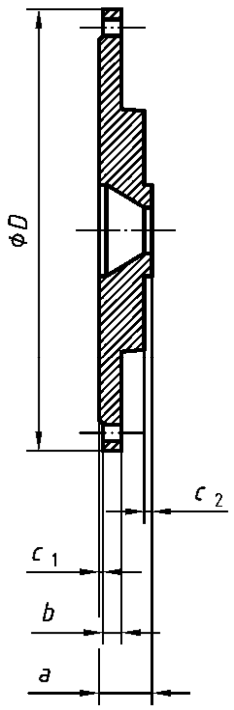

Figure 25 – Reducing flange PN 16

Table 27 – Dimensions of PN10 and PN 16 reducing flanges

DN × dn	PN 10					PN 16				
	D	*a*	*b*	c_1	c_2	*D*	*a*	*b*	c_1	c_2
200 × 80	340	40	17	3	3	340	40	17	3	3
200 × 100	340	40	17	3	3	340	40	17	3	3
200 × 125	340	40	17	3	3	340	40	17	3	3
350 × 250	505	48	20,5	4	3	520	54	22,5	4	3
400 × 250	565	48	20,5	4	3	580	54	24	4	3
400 × 300	565	49	20,5	4	4	580	55	24	4	4

NOTE The larger nominal size is designated DN and the smaller nominal size is designated dn.

9 Evaluation of conformity

9.1 General

The conformity of ductile iron pipes, fittings, accessories and their joints with the requirements of this standard and with the declared values (including classes) shall be demonstrated by:

- initial performance testing;
- factory production control by the manufacturer, including product assessment.

For the purposes of testing, the products may be grouped into families (see 5.1), where it is considered that the results for one or more characteristics from any product within the family are representative for the same characteristics for all products within that family.

9.2 Initial performance testing

9.2.1 General

Initial performance testing shall be performed to show conformity with this standard. Tests previously performed in accordance with the provisions of this standard (same product, same characteristic(s), test method, sampling procedure, system of attestation of conformity, etc.) may be taken into account. In addition, initial performance testing shall be performed at the beginning of the production of a new type of product or at the beginning of a new method of production (where this may affect the stated properties).

Where components are used whose characteristics have already been determined by the component manufacturer, on the basis of conformity with other product standards, these characteristics need not be reassessed provided that the components' performance or method of assessment remain the same, that the characteristics of the component are suitable for the intended end use of the finished product, and insofar as the manufacturing process does not have a detrimental effect on the determined characteristics.

Components and raw materials CE marked in accordance with appropriate harmonised European specifications may be presumed to have the performances stated with the CE marking, although this does not replace the responsibility on the manufacturer of ductile iron pipeline products to ensure that the product as a whole is correctly designed and its component products have the necessary performance values to meet the design.

9.2.2 Characteristics

All characteristics in Clause 5 shall be subject to initial performance testing except for the release of dangerous substances which may be assessed indirectly by controlling the content of the substance concerned.

Whenever a change occurs in the product, the raw material or supplier of the components, or the production process (subject to the definition of a family), which would change significantly one or more of the characteristics, the performance tests shall be repeated for the appropriate characteristics.

9.2.3 Treatment of calculated values and design

In those cases where conformity with this standard is based on calculations, performance testing will be limited to the verification of the calculations made and that the resulting products correspond to the assumptions made in the design.

9.2.4 Sampling, testing and conformity criteria

9.2.4.1 Sampling procedure

Initial performance testing shall be performed on samples of products representative for the manufactured product type.

The random sampling method shall be used, except for the assessment of the leak tightness of joints which requires samples at the extreme of tolerances (see 5.2 and 5.3).

9.2.4.2 Testing and compliance criteria

The number of test samples to be tested (or assessed) shall be in accordance with Table 28.

The results of all performance tests shall be recorded and held by the manufacturer for at least 10 years after the last date or production of the product(s) to which they apply.

Table 28 – Number of test samples for initial performance testing

Items to be tested	**Number of samples (minimum)**		**Test method in accordance with**	**Requirements in accordance with**
Internal pressure strength	1 per DN		Calculation Annex A.2 of EN 545	4.2.1
Longitudinal bending of pipes	1 per DN		Calculation Annex A	Annex A
Diametral stiffness of pipes	1 per DN		Calculation Annex B	Annex B
Leak tightness of flexible joints	1 of each DN grouping			
To internal pneumatic pressure	DN 80 to DN 250	DN 300 to DN 600	7.1	5.2
To positive external hydrostatic pressure	DN 80 to DN 250	DN 300 toDN 600	7.2	5.3
Strength and leak tightness of flanged joints	1 of each DN grouping			
	DN 80 to DN 250	DN 300 to DN 600	7.3	5.4

9.3 Factory production control (FPC)

9.3.1 General

The manufacturer shall establish, document and maintain an FPC system to ensure that the products placed on the market conform to the declared performance characteristics and to all requirements of this standard. The FPC system shall consist of procedures (works' manual), regular inspections and tests and/or assessments and the use of the results to control raw and other incoming materials or components, equipment, the production process and the product. Records shall remain legible, readily identifiable and retrievable.

The FPC system may be part of a Quality Management System, e.g. in accordance with EN ISO 9001:2008.

An FPC system conforming with the requirements of EN ISO 9001:2008, and made specific to the requirements of this standard, shall be considered to satisfy the above requirements.

The results of inspections, tests or assessments requiring action shall be recorded, as shall any action taken. The action to be taken when control values or criteria are not met shall be recorded and retained for the period specified in the manufacturer's FPC procedures.

If the manufacturer has the component designed, manufactured, assembled, packed, processed and/or labelled by subcontracting, FPC of the original manufacturer may be taken into account. However, where subcontracting takes place, the manufacturer shall retain the overall control of the component and ensure that he receives all the information that is necessary to fulfil his responsibilities according to this European Standard.

9.3.2 FPC requirements for all manufacturers

9.3.2.1 General

The manufacturer shall establish procedures to ensure that the production tolerances allow for the products performances to be in conformity with the declared values, derived from initial performance testing.

The characteristics, and the means of verification, are given in Table 29. The minimum testing frequencies apply to permanent production in large quantities with a stable process. The actual testing frequencies to be used in order to ensure permanent conformity of the products shall be fixed by the manufacturer's FPC, taking into account the production rate and the process control measures which are implemented.

The manufacturer shall record the results of the tests specified above. These records shall at least include the following information:

- identification of the product tested;
- date of sampling and testing;
- test methods performed;
- test results.

Table 29 – Minimum frequency of product testing as part of FPC

Items to be tested	Test method in accordance with	Requirements in accordance with	Minimum frequency of test
Dimensions			
Wall thickness	6.1.1	4.2.1	1 per shift
External diameter of spigots	6.1.2	4.2.2.1	10 %
Internal diameter	6.1.3	4.2.2.2	1 per shift
Length of pipes	6.1.4	4.2.3	1 per week
Straightness of pipes	6.2	4.2.4	1 %
Material characteristics			
Tensile testing	6.3	4.3.1	see 9.3.2.2
Brinell hardness	6.4	4.3.2	1 per week
Coatings and linings of pipes			
Zinc coating mass	6.6	4.4.2.2	1 per shift
Thickness of paint coatings	6.7	4.4.2.2	1 per shift
Coatings of fittings and accessories			
Paint coating	6.7	4.5.2.2	1 per shift
Leak tightness for pipes and fittings			
Works leak tightness test	6.5	4.7	100 %

9.3.2.2 FPC for tensile testing

During the manufacturing process the manufacturer shall carry out suitable tests in order to verify the tensile properties specified in 4.3.1. These tests may be:

a) a batch[1] sampling system whereby samples are obtained from the pipe spigot or, for fittings, from samples cast separately or attached with the castings concerned. Test bars are machined from these samples and tensile tested in accordance with 6.3; or

b) a system of process control (e.g. by non-destructive testing) where a positive correlation can be demonstrated with the tensile properties specified in Table 5. Testing verification procedures are based on the use of comparator samples having known and verifiable properties. This system is supported by tensile testing in accordance with 6.3.

The frequency of testing is related to the system of production and quality control used by the manufacturer. The maximum batch sizes shall be as given in Table 30.

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1 Batch is the quantity of castings from which a sample is taken for testing purposes during manufacture.

Table 30 – Maximum batch sizes for tensile testing

Type of casting	DN	Maximum batch size	
		Batch sampling system	**Process control system**
Centrifugally cast pipes	40 to 300	200 pipes	1 200 pipes
	350 to 600	100 pipes	600 pipes
Pipes not centrifugally cast, fittings and accessories	40 to 600	4 t [a]	48 t [a]
[a] Weight of crude castings, excluding the risers.			

9.3.3 Manufacturer-specific FPC system requirements

9.3.3.1 Personnel

The responsibility, authority and the relationship between personnel that manages, performs or verifies work affecting product conformity, shall be defined. This applies in particular to personnel that need to initiate actions preventing product non-conformities from occurring, actions in case of non-conformities and to identify and register product conformity problems. Personnel performing work affecting product conformity shall be competent on the basis of appropriate education, training, skills and experience for which records shall be maintained.

9.3.3.2 Equipment

All weighing, measuring and testing equipment necessary to achieve, or produce evidence of, conformity shall be calibrated or verified and regularly inspected according to documented procedures, frequencies and criteria. Control of monitoring and measuring devices shall comply with the appropriate clause of EN ISO 9001:2008.

All equipment used in the manufacturing process shall be regularly inspected and maintained to ensure use, wear or failure does not cause inconsistency in the manufacturing process.

Inspections and maintenance shall be carried out and recorded in accordance with the manufacturer’s written procedures and the records retained for the period defined in the manufacturer's FPC procedures.

9.3.3.3 Design process

The factory production control system shall document the various stages in the design of the products, identify the checking procedure and those individuals responsible for all stages of design.

During the design process itself, a record shall be kept of all checks, their results, and any corrective actions taken. This record shall be sufficiently detailed and accurate to demonstrate that all stages of the design phase, and all checks, have been carried out satisfactorily. Compliance with EN ISO 9001:2008, 7.3, shall be deemed to satisfy the requirements of this sub-clause.

9.3.3.4 Raw materials and components

The specifications of all incoming raw materials and components shall be documented, as shall the inspection scheme for ensuring their conformity. The verification of conformity of the raw materials with the specification shall be in accordance with EN ISO 9001:2008, 7.4.3.

9.3.3.5 In-process control

The manufacturer shall plan and carry out production under controlled conditions. Compliance with EN ISO 9001:2008, 7.5.1 and 7.5.2, shall be deemed to satisfy the requirements of this sub-clause.

9.3.3.6 Non-conforming products

The manufacturer shall have written procedures which specify how non-conforming products shall be dealt with. Any such events shall be recorded as they occur and these records shall be kept for the period defined in the manufacturer's written procedures. Compliance with EN ISO 9001:2008, 8.3, shall be deemed to satisfy the requirements of this sub-clause.

9.3.3.7 Corrective action

The manufacturer shall have documented procedures that instigate action to eliminate the cause of non-conformities in order to prevent recurrence. Compliance with EN ISO 9001:2008, 8.5.2, shall be deemed to satisfy the requirements of this sub-clause.

Annex A
(normative)

Longitudinal bending resistance of pipes

Pipes with an aspect ratio (length/diameter) equal to or greater than 25 may be subjected to high stresses due to bending moments caused for example by ground subsidence or by differential settlement.

In order to provide a high degree of safety in such situations, ductile iron pipes shall withstand the bending moments given in Table A.1, with no visible damage to the pipe wall and to the external and internal coatings. These bending moments have been calculated assuming a pipe of minimum wall thickness for its class and a bending stress in the metal equal to 250 MPa using the following formula:

$$M = 0{,}785 \times 10^{-6} \times e \times R_f \times D^2 \quad \text{(A.1)}$$

where

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

R_f is the allowable bending stress, in MPa;

D is the mean diameter of the pipe (DE- *e*), in millimetres.

Table A.1 – Longitudinal bending resistance of pipes

DN	Bending moments (kN·m)	
	K9	**K10**
40	2,4	2,4
50	3,4	3,4
60	4,8	4,8
65	5,5	5,5
80	8,0	8,0
100	11,8	11,8
125	17,9	18,2
150	25,2	26,7
200	44,4	50,6

NOTE 1 These bending moments, expressed in kilonewton metres, correspond to a load of the same value, expressed in kilonewtons, applied at mid-point of a 4 m span.

NOTE 2 Bending moments that can cause failure of the pipes are at least 1,7 times higher than the given values.

Annex B
(normative)

Diametral stiffness of pipes

Ductile iron pipes can undergo large ovalizations in operation while keeping all their functional characteristics. Allowable pipe ovalizations, when the pipeline is in service, shall be given in Table B.1.

NOTE 1 The ovalization is one hundred times the vertical pipe deflection in millimetres divided by the initial pipe external diameter in millimetres.

In order to withstand large heights of cover and/or heavy traffic loads in a wide range of installation conditions, ductile iron pipes shall have the minimum diametral stiffness values given in Table B.1.

The diametral stiffness S of a pipe is given by the formula:

$$S = 1\,000\,\frac{E \cdot I}{D^3} = 1\,000\,\frac{E}{12}\left(\frac{e_{calc}}{D}\right)^3 \qquad \text{(B.1)}$$

where

S is the diametral stiffness, in kilonewtons per square metre;

E is the modulus of elasticity of the material, in megapascals (170 000 MPa);

I is the second moment of area of the pipe wall per unit length, in millimetres to the third power;

e_{calc} is the wall thickness of the pipe, in millimetres;

D is the mean diameter of the pipe (DE $-$ e), in millimetres;

DE is the nominal pipe external diameter, in millimetres.

NOTE 2 The values of S have been calculated assuming a pipe wall thickness, e_{calc}, equal to the minimum thickness plus half of the tolerance, in order to take account that there are only a few points with a thickness equal or close to the minimum thickness.

Table B.1 – Diametral stiffness pipes

DN	Minimum diametral stiffness *S* kN/m²		Allowable pipe ovalization %	
	K9	**K10**	**K9**	**K10**
40	16 500	16 500	0,45	0,45
50	9 500	9 500	0,55	0,55
60	5 500	5 500	0,65	0,65
65	4 800	4 800	0,70	0,70
80	2 700	2 700	0,85	0,85
100	1 500	1 500	1,05	1,05
125	810	880	1,30	1,20
150	480	600	1,55	1,40
200	230	340	1,90	1,70
250	160	220	2,20	2,00
300	110	160	2,50	2,25
350	89	120	2,70	2,45
400	72	100	2,90	2,60
450	61	86	3,05	2,75
500	52	74	3,25	2,90
600	41	58	3,55	3,20

Annex C
(informative)

Field of use, characteristics of soils

Ductile iron pipes complying with 4.4.2 and ductile iron fittings and accessories complying with 4.5.2 can be buried in contact with a large number of soils, which can be identified by soil studies on site, except:

- soils with a low resistivity, less than 1 500 Ω.cm when laid above the water table or less than 2 500 Ω·cm when laid below the water table;
- mixed soils, i.e. comprising two or more soil natures;
- soils with a pH below 6 and a high reserve of acidity;
- soils containing refuse, cinders, slags or polluted by wastes or industrial effluents.

In such soils, and also in the occurrence of stray currents, it is recommended that an additional protection is used (such as polyethylene sleeving) or other types of external coatings as appropriate (see 4.4.1 and 4.5.1).

An increase of the mass of the zinc coating (e.g. 200 g/m^2) combined with a thicker finishing layer (e.g. 100 µm polyurethane or epoxy) may extend the field of use to a resistivity of 1 500 Ω·cm when laid below the water table.

Ductile iron pipes and fittings with the following external coatings are designed to be buried in soils of all levels of corrosivity:

- extruded polyethylene coating in accordance with EN 14628;
- polyurethane coating in accordance with EN 15189;
- epoxy coating (fittings) in accordance with EN 14901;
- cement mortar coating in accordance with EN 15542;
- adhesive tapes.

Annex D
(informative)

Calculation method of buried pipelines, heights of cover

D.1 Calculation method

D.1.1 Calculation formula

The method is based on an ovalization calculation according to the formula below:

$$\Delta = \frac{100K\left(P_e + P_t\right)}{8S + \left(f \cdot E'\right)} \tag{D.1}$$

where

Δ is the pipe ovalization (%);

K is the bedding factor;

P_e is the pressure from earth loading, in kilonewtons per square metre;

P_t is the pressure from traffic loading, in kilonewtons per square metre;

S is the pipe diametral stiffness, in kilonewtons per square metre, see Table B.1;

f is the factor of lateral pressure (f = 0,061);

E' is the modulus of soil reaction, in kilonewtons per square metre.

The ovalization calculated by means of this formula should not exceed the allowable ovalization shown in Table B.1. The allowable ovalization increases with DN, it provides a safety factor of 1,5 with respect to the elastic limit of ductile iron in bending (500 MPa minimum) by limiting the stress in the pipe wall at 330 MPa.

D.1.2 Pressure from earth loading

The pressure P_e, uniformly distributed at the top of the pipe over a distance equal to the external diameter, is calculated according to the earth prism method by the formula below:

$$P_e = \gamma H \tag{D.2}$$

where

P_e is the pressure from earth loading, in kilonewtons per square metre;

γ is the unit weight of backfill, in kilonewtons per cubic metre;

H is the height of cover, in metres, that is the distance from the top of the pipe to the ground surface.

In the absence of other data, the unit weight of the soil is taken as being equal to 20 kN/m^3 in order to cover the vast majority of cases. If a preliminary geotechnical survey confirms that the actual unit weight of the backfill will be less than 20 kN/m^3, the actual value may be used for determining P_e.

If, however, it appears that the actual value will be more than 20 kN/m^3, the actual value should be used.

D.1.3 Pressure from traffic loading

The pressure P_t, uniformly distributed at the top of the pipe over a distance equal to the external diameter, is calculated by means of the formula below:

$$P_t = 40 \cdot \left(1 - 2 \cdot 10^{-4} \cdot DN\right) \frac{\beta}{H} \quad \text{(D.3)}$$

where

P_t is the pressure from traffic loading in kilonewtons per square metre;

β is the traffic load factor.

This formula is not valid for $H < 0{,}3$ m.

Three types of traffic loading are to be considered:

— traffic areas with main roads, β = 1,5: this is the general case of all roads, except access roads;

— traffic areas with access roads, β = 0,75: roads where lorry traffic is prohibited;

— rural areas, β = 0,5: all other cases.

It should be noted that all pipelines should be designed for at least β = 0,5 even where they are not expected to be exposed to traffic loading. In addition, pipelines laid in the verge and embankment of roads should be designed to withstand the full traffic loading expected on these roads. Finally, for pipelines which may be exposed to particularly high traffic loading, a factor β = 2 should be adopted.

D.1.4 Bedding factor, *K*

The bedding factor K, depends upon the soil pressure distribution at the top of the pipe (over a distance equal to the external diameter) and at the invert of the pipe (over a distance corresponding to the theoretical bedding reaction angle 2α).

K normally varies from 0,11 for 2α = 20° to 0,09 for 2α = 120°. The value of 20° corresponds to a pipe which is simply laid on the flat trench bottom, with no compaction effort.

D.1.5 Factor of lateral pressure, *f*

The factor of lateral pressure, f, is equal to 0,061; this corresponds to a parabolic distribution of the lateral soil pressure over an angle of 100°, according to the IOWA-Spangler model.

D.1.6 Modulus of soil reaction, *E'*

The modulus of soil reaction E' depends upon the nature of soil used in the pipe zone and upon the laying conditions.

In a given situation, the modulus of reaction which is required can be determined by means of the formula below:

$$E' = \frac{4000K}{\delta \cdot f}\left(\frac{\beta}{H}\left(1 - 2 \cdot 10^{-4}\ \mathrm{DN}\right) + 0{,}5\ H\right) - \frac{8\ S}{f} \qquad \text{(D.4)}$$

where

E' is the modulus of soil reaction, in kilonewtons per square metre;

δ is the allowable ovalization, in %.

In Table D.1, values of E' equal to 1 000 kN/m^2, 2 000 kN/m^2 and 5 000 kN/m^2 are taken as guidelines; they correspond to a compaction level which is respectively nil, low and good. The value E' = 0 has also been shown as the limit case for unfavourable laying conditions in poor soils (no compaction, water table above the pipe, trench shoring removed after backfilling or embankment conditions).

If a preliminary geotechnical survey allows the determination of the value of the modulus of soil reaction, this value should be taken into account in the calculations.

D.2 Heights of cover

Table D.1 give the most pessimistic range of values of the allowable heights of cover for each group of diameters. These values can be used without any additional calculation: they are given in metres, with E' in kilonewtons per square metre.

For heights of cover outside the ranges given in Table D.1, and for better laying conditions, a verification can be made using the formulae given in D.1.

Table D.1 – Heights of cover for K9 pipes

DN		**40 to 200**	**250 and 300**	**350 to 450**	**500 to 600**
K(2α)		**0,110 (20°)**	**0,110 (20°)**	**0,105 (45°)**	**0,103 (60°)**
β = 0,50 Rural areas	E' = 0	0,3 to 15,4	0,3 to 9,9	0,3 to 6,9	0,3 to 2,2
	E' = 1 000	0,3 to 15,9	0,3 to 10,6	0,3 to 7,8	0,3 to 3,5
	E' = 2 000	0,3 to 16,4	0,3 to 11,3	0,3 to 8,7	0,3 to 4,7
	E' = 5 000	0,3 to 17,9	0,3 to 13,4	0,3 to 11,4	0,3 to 8,3
β = 0,75 Access roads	E' = 0	0,3 to 15,3	0,3 to 9,8	0,3 to 6,8	0,5 to 2,0
	E' = 1 000	0,3 to 15,8	0,3 to 10,5	0,3 to 7,7	0,3 to 3,4
	E' = 2 000	0,3 to 16,4	0,3 to 11,2	0,3 to 8,7	0,3 to 4,6
	E' = 5 000	0,3 to 17,9	0,3 to 13,3	0,3 to 11,3	0,3 to 8,2
β = 1,50 Main roads	E' = 0	0,3 to 15,2	0,3 to 9,7	0,4 to 6,6	[a]
	E' = 1 000	0,3 to 15,8	0,3 to 10,4	0,4 to 7,6	0,6 to 3,0
	E' = 2 000	0,3 to 16,3	0,3 to 11,1	0,3 to 8,5	0,5 to 4,4
	E' = 5 000	0,3 to 17,8	0,3 to 13,2	0,3 to 11,2	0,3 to 8,1
[a] Not recommended; only a specific calculation for each case can provide an adequate answer.					
NOTE The values given for the heights of cover have been established for the class K9; they are also valid for classes K ≥ 10.					

Annex ZA
(informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU Directives

ZA.1 Scope and relevant characteristics

This European standard has been prepared under the mandate M/131 'Pipes, tanks and ancillaries not in contact with water intended for human consumption' given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European standard shown in this annex meet the requirement of the mandate given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of ductile iron pipes and fittings, their joints and accessories covered by this annex for the intended uses indicated herein. Reference shall be made to the information accompanying the CE-marking.

WARNING — Other requirements and other EU Directives, not affecting the fitness for intended uses, can be applicable to the ductile iron pipes and fittings, their joints and accessories, falling within the scope of this European standard.

NOTE 1 In addition to any specific clause relating to dangerous substances contained in this standard, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

NOTE 2 An informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA (accessed through http://ec.europa.eu/enterprise/construction/internal/dangsub/dangmain_en.htm.

This Annex has the same scope as Clause 1 of this standard. It establishes the conditions for the CE marking of ductile iron pipes and fittings, their joints and accessories intended for the uses indicated in the relevant clauses applicable (see Table ZA.1).

Table ZA.1 – Relevant clauses for ductile iron pipes, fittings, accessories and their joints for gas applications

Product: Ductile iron pipes, fittings, accessories and their joints **Intended use(s)**: Gas applications		
Essential characteristics requirement	**Requirement clauses in this European Standard**	**Notes**
Dimension tolerances (on external diameter DE for compatibility purposes)	4.2.2.1 External diameter	Pass/Fail
Internal pressure strength (tensile strength)	4.3 Material characteristics and Table 5	6.3 Tensile testing (420 MPa – threshold value). By calculation considering the tensile characteristics of the material
Impact resistance	4.3.1 Tensile properties 4.3.2 Hardness	As tensile strength Threshold (230 HBW for pipes) Threshold (250 HBW for fittings)
Longitudinal bending strength	Annex A Longitudinal bending of pipes	Bending moment (kN/m^2), by calculation according to Annex A
Maximum load for admissible deformation	Annex B Diametral stiffness of pipes	Diametral stiffness of pipes (kN.m²), by calculation according to Annex B
Tightness: gas and liquid	5.2 Flexible joints and Table 7: - internal pneumatic pressure - positive external pressure	 Threshold (1,5 PFA) Threshold (2 bar)
Durability aspects		
External coating for pipes	4.4.2 External coating of zinc with finishing layer	Threshold (130 g/m²)
Internal lining for pipes and fittings	4.5.2 Paint coatings	Threshold (50 µm)
Dangerous substances	ZA.1	

The requirement on a certain characteristic is not applicable in those Member States (MSs) where there are no regulatory requirements on that characteristic for the intended use of the product In this case, manufacturers placing their products on the market of these MSs are not obliged to determine nor declare the performance of their products with regard to this characteristic and the option 'No performance determined' (NPD) in the information accompanying the CE marking (see Clause ZA.3) may be used. The NPD option may not be used, however, where the characteristic is subject to a threshold level.

ZA.2 Procedure for attestation of conformity of ductile iron pipes, fittings, accessories and their joints for gas applications.

ZA.2.1 System of attestation of conformity

The system of attestation of conformity of ductile iron pipes, fittings, accessories and their joints indicated in Table ZA.1, in accordance with the Decision of the Commission 99/472/EC (published the 17.07.99 under L184) amended by the Commission decision 01/596/EC of 8 January 2001(published the 2.08.01 under L209) and as given in Annex III of the mandate M/131 for 'pipes, tanks and ancillaries not in contact with water intended for human consumption, is shown in Table ZA.2 for the indicated intended use(s) and relevant level(s) or class(es):

Table ZA.2 – System of attestation of conformity

Product(s)	Intended use(s)	Level(s) or class(es)	Attestation of conformity system(s)
Pipes, fittings, accessories and their joints	In installations for the transport/distribution/storage of gas intended for the supply of building heating/cooling systems, from the external storage reservoir or the last pressure reduction unit of the network to the inlet of the boiler/heater/cooler system(s) of the building(s).	–	System 3
System 3: See CPD (Directive 89/109/ECC) Annex III.2.(ii), second possibility.			

The attestation of conformity of the ductile iron pipes, fittings, accessories and their joints for the gas pipelines in Table ZA.1 shall be based on the evaluation of conformity procedures indicated in Table ZA.3 resulting from application of the clauses of this or other European standard indicated therein.

Table ZA.3 – Assignment of evaluation of conformity tasks for ductile iron pipes, fittings, accessories and their joints for gas applications under system 3

Tasks		Content of the task	Evaluation of conformity clauses to apply
Task under the responsibility of the manufacturer	Factory production control (F.P.C)	Parameters related to all characteristics of Table ZA.1	9.3
	Initial performance testing by a notified test laboratory	All characteristics of Table ZA.1	9.2

ZA.2.2 Declaration of conformity

When compliance with the conditions of this annex is achieved, the manufacturer or his agent established in the EEA (European Economic Area / Espace économique européen) shall prepare and retain a declaration of conformity (EC Declaration of conformity), which entitles the manufacturer to affix the CE marking. This declaration shall include:

— name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;

NOTE 1 The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for CE marking.

- description of the product (type, identification, use, etc.), and a copy of the information accompanying the CE marking;

NOTE 2 Where some of the information required for the Declaration is already given in the CE marking information, it does not need to be repeated.

- provisions to which the product conforms (e.g. Annex ZA of this EN) and a reference to the initial performance testing report(s) and factory production control records (if appropriate);
- particular conditions applicable to the use of the product, (e.g. provisions for use under certain conditions);
- name an address of the notified laboratory(ies);
- name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or his authorised representative.

The above-mentioned declaration and certificate shall be presented in the official language or languages of accepted in the Member State in which the product is to be used.

ZA.3 CE marking and labelling

For all ductile iron pipes, fittings and accessories the manufacturer or his authorised representative established within the EEA is responsible for the affixing of the CE marking. The CE marking symbol shall be in accordance with Directive 93/68/EC and shall be shown on the ductile iron pipes and fittings.

The following information shall appear legibly and indelibly on the product (see also 4.6):

- CE marking symbol;
- name or identifying mark of the manufacturer or his authorised representative;
- last two digits of the year of affixing the CE marking.

The following information shall appear on the commercial documents and shall accompany the CE marking:

- CE marking symbol;
- name or identifying mark and registered address of the manufacturer or his authorised representative;
- last two digits of the year of affixing the CE marking;
- reference to this European Standard, EN 969 (only if all the requirements specified in this standard are fulfilled);
- description of the product: generic name, material, dimensions, intended use and place of installation;
- characteristics covered by EN 969:
  - internal pressure strength;
  - maximum load for admissible deformation;
  - dimension tolerance on the external diameter;
  - tightness;

— impact resistance;

— longitudinal bending strength;

— durability (external coatings for pipes and internal linings for pipes and fittings).

The “No performance determined" (NPD) option may not be used where the characteristic is subject to a threshold level. Otherwise, the NPD option may be used when and where the characteristic, for a given intended use, is not subject to regulatory requirements.

Figure ZA.1 gives an example of the information to be given on the product.

CE	CE conformity marking consisting of the ‘CE’-symbol given in Directive 93/68/EEC, and name or identifying mark of manufacturer; and
09	last two digits of year in which marking was affixed
XX co Ltd	Name or identifying mark of manufacturer.

Figure ZA.1 – Example of CE marking information for marking on the product

Figure ZA.2 gives an example of the information to be given on the accompanying documents

CE	CE conformity marking consisting of the 'CE'-symbol given in Directive 93/68/EEC.
XX co Ltd, CEDEX, F-2351	Name, or identifying mark and registered address, of manufacturer
09	Last two digits of year in which marking was affixed
EN 969:200x	Dated version of No. of European Standard
DN 150 zinc coated ductile iron pipe for gas x 6m	Description of product and information on regulated characteristics

— Internal pressure strength	Pass
— Dimension tolerance on the external diameter	Pass
— Tightness (gas and liquid)	
- internal pressure	**6 bar**
- external pressure	**2 bar**
— Impact resistance	Pass
— Longitudinal bending strength	Pass
— Maximum load for admissible deformation	Pass
— Durability	
- external coating	**130 g/m^2**
- internal coating	**50 µm**

Figure ZA.2 – Example of information on the accompanying documents

In addition to any specific information relating to dangerous substances shown above, the product should also be accompanied, when and where required and in the appropriate form, by documentation listing any other legislation on dangerous substances for which compliance is claimed, together with any information required by that legislation.

NOTE 1 European legislation without national derogations need not be mentioned. [18]

NOTE 2 Affixing the CE marking symbol means, if a product is subject to more than one directive, that it complies with all applicable directives.

Bibliography

[1] EN 1333, *Flanges and their joints - Pipework components - Definition and selection of PN*

[2] EN 1514 (all parts), *Flanges and their joints — Dimensions of gaskets for PN-designated flanges*

[3] EN 45011, *General requirements for bodies operating product certification systems (ISO/IEC Guide 65:1996)*

[4] EN 45012, *General requirements for bodies operating assessment and certification/registration of quality systems (ISO/IEC Guide 62:1996)*

[5] EN ISO 6708, *Pipework components — Definition and selection of DN (nominal size) (ISO 6708:1995)*

[6] EN ISO 9001, *Quality management systems — Requirements (ISO 9001:2008)*

[7] ISO 2531, *Ductile iron pipes, fittings, accessories and their joints for water or gas applications*

[8] EEC Directive 89/106/EEC of 12 December 1989, known as "*Construction Products Directive*"

[9] Directive 93/68/EC, *Description of the CE marking*

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