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Cevi, fitingi, pribor in spoji iz nodularne litine za plinovode - Zahteve in preskusne metode

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

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

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

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NORME EUROPÉENNE

EUROPÄISCHE NORM

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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

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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of an identical text or by endorsement, at the latest by September 2009, and conflicting national standards shall be withdrawn at the latest by December 2010.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.

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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.

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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.

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

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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)*

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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.

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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

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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

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[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

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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:

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

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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.

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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

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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.

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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:

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

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.

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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	≤ 6,0	– 1,3
	> 6,0	– (1,3 + 0,001 DN)
Pipes not centrifugally cast and fittings	≤ 7,0	– 2,3
	> 7,0	– (2,3 + 0,001 DN)

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

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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.

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4.2.2.2 Internal diameter

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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:

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— 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.

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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.

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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.

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