

SLOVENSKI STANDARD

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Cevi, fittingi, pribor in spoji iz nodularne litine za vodovodno omrežje - Zahteve in preskusne metode

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

Rohre, Formstücke, Zubehörtteile aus duktilem Gusseisen und ihre Verbindungen für Wasserleitungen - Anforderungen und Prüfverfahren

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

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

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This European Standard was approved by CEN on 12 August 2010.

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Contents

	Page
Foreword.....	6
1 Scope	7
2 Normative references	7
3 Terms and definitions	8
4 Technical requirements	12
4.1 General.....	12
4.2 Pressure class.....	13
4.3 Dimensional requirements.....	14
4.4 Material characteristics.....	18
4.5 Coatings and linings for pipes	19
4.6 Coatings for fittings and accessories.....	21
4.7 Marking of pipes, fittings and accessories	22
4.8 Leak tightness.....	23
5 Performance requirements for joints and pipe saddles	23
5.1 General.....	23
5.2 Flexible joints	23
5.3 Restrained flexible joints	25
5.4 Flanged joints as cast, screwed, welded and adjustable.....	25
5.5 Pipe saddles.....	26
6 Test methods.....	27
6.1 Pipe dimensions	27
6.2 Straightness of pipes	28
6.3 Tensile testing.....	28
6.4 Brinell hardness.....	30
6.5 Works leak tightness test for pipes and fittings.....	30
6.6 Zinc mass	30
6.7 Thickness of paint coatings	31
6.8 Thickness of cement mortar lining	31
7 Performance test methods	32
7.1 Compressive strength of the cement mortar lining	32
7.2 Leak tightness of flexible joints	32
7.3 Leak tightness and mechanical resistance of flanged joints.....	35
7.4 Leak tightness and mechanical resistance of pipe saddles	36
8 Tables of dimensions	37
8.1 Socket and spigot pipes	37
8.2 Flanged pipes.....	40
8.3 Fittings for socketed joints.....	40
8.4 Fittings for flanged joints.....	56
9 Evaluation of conformity.....	73
9.1 General.....	73
9.2 Initial performance testing.....	73
9.3 Factory production control (FPC)	75
Annex A (normative) Allowable pressures	80
A.1 General.....	80
A.2 Socket and spigot pipes (see 8.1)	80
A.3 Fittings for socketed joints (see 8.3)	80
A.4 Flanged pipes (see 8.2) and fittings for flanged joints (see 8.4).....	81
A.5 Accessories.....	81

Annex B (informative) Longitudinal bending resistance of pipes	82
Annex C (informative) Diametral stiffness of pipes	83
Annex D (informative) Specific coatings, field of use, characteristics of soils	86
D.1 Alternative coatings	86
D.2 Field of use in relation to the characteristics of soils	87
Annex E (informative) Field of use, water characteristics	89
Annex F (informative) Calculation method of buried pipelines, heights of cover	90
F.1 Calculation method	90
F.2 Heights of cover	92
Bibliography	93

Tables

Table 1 — Limit deviations on thickness of fittings	14
Table 2 — Limit deviation on internal diameter	15
Table 3 — Maximum DN for limit deviations on internal diameter for pressure classes	15
Table 4 — Standardized lengths of socket and spigot pipes	15
Table 5 — Standardized lengths of flange pipes	16
Table 6 — Permissible deviation on lengths of fittings	16
Table 7 — Limit deviations on length	18
Table 8 — Tensile properties	18
Table 9 — Thickness of cement mortar lining	21
Table 10 — DN groupings for performance tests	23
Table 11 — Performance tests for joints	24
Table 12 — Bending moments for flange joint performance tests	26
Table 13 — Performance tests for pipe saddles	27
Table 14 — Dimensions of test bar	29
Table 15 — Works test pressure for pipes not centrifugally cast, fittings and accessories	30
Table 16 — Dimensions of pipes of preferred pressure classes	38
Table 17 — Dimensions of pipes	39
Table 18 — Dimensions of flanged sockets	41
Table 19 — Dimensions of flanged spigots and collars	43
Table 20 — Dimensions of double socket 90° and 45° bends	45
Table 21 — Dimensions of double socket 22,5° and 11,25° bends	47
Table 22 — Dimensions of all socket tees	49
Table 23 — Dimensions of double socket tees with flanged branch, DN 40 to 250	51
Table 24 — Dimensions of double socket tees with flanged branch, DN 300 to DN 700	52
Table 25 — Dimensions of double socket tees with flanged branch, DN 800 to DN 2 000	53
Table 26 — Dimensions of double socket tapers	55
Table 27 — Dimensions of double flanged 90° and 90° duckfoot bends	57

EN 545:2010 (E)

Table 28 — Dimensions of double flanged 45° bends	59
Table 29 — Dimensions of double flanged 22,5° and 11,25° bends	61
Table 30 — Dimensions of all flanged tees, DN 40 to DN 250	62
Table 31 — Dimensions of all flanged tees, DN 300 to DN 700	63
Table 32 — Dimensions of all flanged tees, DN 800 to DN 2000	64
Table 33 — Dimensions of double flanged tapers	66
Table 34 — Dimensions of PN 10 and PN 16 blank flanges	68
Table 35 — Dimensions of PN 25 and PN 40 blank flanges	70
Table 36 — Dimensions of PN 10 and PN 16 reducing flanges	71
Table 37 — Dimensions of PN 25 and PN 40 reducing flanges	73
Table 38 — Number of test samples for initial performance testing	75
Table 39 — Minimum frequency of product testing as part of FPC	77
Table 40 — Maximum batch sizes for tensile testing.....	78
Table A.1 — Fittings pressure class	81
Table A.2 — Flanged pipe and fittings pressures	81
Table B.1 — Longitudinal bending moment resistance of pipes.....	82
Table C.1 — Diametral stiffness of pipes of preferred pressure classes	85
Table E.1 — Field of use for cement mortar linings	89
Table F.1 — Heights of cover for pipes of preferred pressure classes	92
 SIST EN 545:2011 https://standards.itech.ai/catalog/standards/sist/24c5f433-6e59-446b-b0a2-858b9163a2a6/sist-en-545-2011 	
Figures	
Figure 1 — Leak tightness test of joints (internal pressure).....	33
Figure 2 — Leak tightness test of joints (external pressure).....	34
Figure 3 — Strength and leak tightness test for flanged joints	35
Figure 4 — Leak tightness test for pipe saddles.....	36
Figure 5 — Socket and spigot pipes.....	37
Figure 6 — Flanged sockets	40
Figure 7 — Flanged spigots.....	42
Figure 8 — Collars	42
Figure 9 — Double socket 90° (1/4) bends	44
Figure 10 — Double socket 45° (1/8) bends	44
Figure 11 — Double socket 22°30' (1/16) bends	46
Figure 12 — Double socket 11°15' (1/32) bends	46
Figure 13 — All socket tees	48
Figure 14 — Double socket tees with flanged branch	50
Figure 15 — Double socket tapers.....	54
Figure 16 — Double flanged 90° (1/4) bends.....	56
Figure 17 — Double flanged duckfoot 90° (1/4) bends	57

Figure 18 — Double flanged 45° (1/8) bends	58
Figure 19 — Double flanged 22°30' (1/16) bends	60
Figure 20 — Double flanged 11°15' (1/32) bends	60
Figure 21 — All flanged tees	61
Figure 22 — Double flanged tapers	65
Figure 23 — Blank flanges PN 10	67
Figure 24 — Blank flanges PN 16	67
Figure 25 — Blank flanges PN 25	69
Figure 26 — Blank flanges PN 40	69
Figure 27 — Reducing flanges PN 10	70
Figure 28 — Reducing flanges PN 16	71
Figure 29 — Reducing flanges PN 25	72
Figure 30 — Reducing flanges PN 40	72

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[SIST EN 545:2011](https://standards.iteh.ai/catalog/standards/sist/24c5f433-6e59-446b-b0a2-858b9163a2a6/sist-en-545-2011)

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EN 545:2010 (E)**Foreword**

This document (EN 545:2010) 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 **March 2011**, and conflicting national standards shall be withdrawn at the latest by **March 2011**.

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 545:2006.

In this standard Annex A is normative and Annexes B, C, D, E and F are informative.

This standard is in conformity with the general requirements already established by CEN/TC 164 in the field of water supply.

In respect of potential adverse effects on the quality of water intended for human consumption, caused by the products covered by this standard:

- this standard provides no information as to whether the products may be used without restriction in any of the member states of the EU or EFTA;
- it should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or the characteristics of these products remain in force.

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, Croatia, 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 for the construction of pipelines outside buildings:

- to convey different types of water (e.g. raw water, treated water, re-used water) for all types of applications (e.g. water intended for human consumption, for fire protection, for snow making, for irrigation, for hydro-electricity etc.);
- with or without pressure;
- to be installed below or above ground.

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

- manufactured with socketed, flanged or spigot ends;
- supplied externally and internally coated;
- suitable for fluid temperatures between 0 °C and 50 °C, excluding frost;
- not intended for use in areas subject to reaction to fire regulations.

This does not preclude special arrangements for the products to be used at higher temperatures.

This European Standard covers pipes and fittings cast by any type of foundry process or manufactured by fabrication of cast components, as well as corresponding joints and accessories, in a size range extending from DN 40 to DN 2 000, 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 shapes are outside the scope of this standard.

In addition, reference is made to the minimum performance requirements of couplings, flange adaptors and saddles manufactured for use with ductile iron pipes and fittings.

NOTE 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 196-1, *Methods of testing cement — Part 1: Determination of strength*

EN 197-1, *Cement – Part 1: Composition, specifications and conformity criteria for common cements*

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

EN 805:2000, *Water supply — Requirements for systems and components outside buildings*

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

EN 545:2010 (E)

EN 1333:2006, *Flanges and their joints — Pipework components — Definition and selection of PN*

EN 14901, *Ductile iron pipes, fittings and accessories — Epoxy coating (heavy duty) of ductile iron fittings and accessories — Requirements and test methods*

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 6892-1, *Metallic materials – Tensile testing – Part 1: Method of test at room temperature (ISO 6892-1:2009)*

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

EN ISO 9001:2000, *Quality management systems — Requirements (ISO 9001:2000)*

3 Terms and definitions

For the purposes of this document, 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 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

NOTE In addition flanged socket pieces, flanged spigot pieces and collars are also classified as fittings.

3.4 accessory
any casting/fabrication other than a pipe or fitting which is intended for use in a ductile iron pipeline including:

- Glands and bolts for mechanical flexible joints (see 3.14);
- Glands, bolts and locking rings for restrained flexible joints (see 3.15);
- Pipe saddles for service pipe connections;
- Adjustable flanges and flanges to be welded or screwed;
- Flange adaptors for use with ductile iron pipes and fittings (see 4.1.3.2);
- Couplings for use with ductile iron pipes and fittings (see 4.1.3.2)

NOTE 1 Valves of all types are not covered by the term accessory.

NOTE 2 Wide tolerance flange adaptors and couplings are covered by EN 14525.

3.5**component**

any product defined in 3.2 to 3.4

3.6**flange**

end of a pipe, fitting or accessory extending perpendicular to its axis, with bolt holes equally spaced on a circle

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

3.7**spigot**

male end of a pipe or fitting

3.8**spigot end**

maximum insertion depth of the spigot plus 50 mm

3.9**socket**

female end of a component to make the connection with the spigot of the next component

3.10**gasket**

sealing component of a joint

3.11**joint**

connection between the ends of two components in which a gasket is used to effect a seal

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3.12**flexible joint**

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

3.13**push-in flexible joint**

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

3.14**mechanical flexible joint**

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

3.15**restrained flexible joint**

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

3.16**flanged joint**

joint between two flanged ends

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EN 545:2010 (E)**3.17****nominal size****DN**

alphanumerical designation of size for components of a pipework system, to be used for reference purposes, which 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]

3.18**nominal pressure****PN**

alphanumerical designation related to a combination of mechanical and dimensional characteristics of a component of a pipework system, to be used for reference purposes, which comprises the letters PN followed by a dimensionless number

[EN 1333:2006]

NOTE All components of the same nominal size DN and designated by the same PN number have compatible mating dimensions.

3.19**leak tightness test pressure**

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

3.20**allowable operating pressure****PFA**

maximum hydrostatic pressure that a component is capable of withstanding continuously in service

[EN 805:2000]

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3.21**pressure class****C**

alphanumerical designation of a family of components, including their joints, relating to their operating pressures as verified by all the performance tests described in this standard, which includes the letter C followed by a dimensionless number equal to the maximum PFA in bars of the family of components

3.22**allowable maximum operating pressure****PMA**

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

[EN 805:2000]

3.23**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

[EN 805:2000]

NOTE This test pressure is different from the system test pressure (STP), which is related to the design pressure of the pipeline and is intended to ensure its integrity and leak tightness.

3.24**diametral stiffness of a pipe**

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

3.25**performance test**

proof of design test which is done once and must be repeated after each change of design

3.26**laying length**

length by which a pipeline progresses when an additional pipe or fitting is installed

NOTE For socketed pipes and fittings the laying length L_e is equal to the overall length (OL) minus the maximum spigot insertion depth (X) as given by the manufacturer. For flanged pipes and fittings, the laying length is equal to the overall length.

3.27**standardized length**

length of pipe barrel and fitting body or branch, as specified in this standard (see 4.3.3)

NOTE For socketed pipes (see Figure 5) and socketed fittings, the standardized length, L_u (l_u for branches), is equal to the overall length (OL) minus the depth of the socket (DOS) as given by the manufacturer. For flanged pipes and fittings, the standardized length, L (l for branches), is equal to the overall length.

3.28**deviation**

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

3.29**ovality**

out of roundness of a pipe section

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NOTE 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.

3.30**pipe minimum thickness**

minimum thickness at any point of the pipe (see Tables 16 and 17) used in the calculation of its PFA and pressure class

3.31**thickness for pipe stiffness calculation**

thickness based on the pipe minimum thickness and the DN used in the calculation of the pipe diametral stiffness

EN 545:2010 (E)**4 Technical requirements****4.1 General****4.1.1 Ductile iron pipes, fittings and accessories**

Nominal sizes, pressure classes, thicknesses, lengths and coatings are specified in 4.1.1.1, 4.2, 4.3.1, 4.3.3, 4.5 and 4.6 respectively. When pipes, fittings and accessories with different pressure 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.

Non-centrifugally cast pipes shall be considered as fittings.

NOTE 1 Other types of fittings include angle branches, tees and tapers with other combinations DN x dn, draining tees, 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, 600, 700, 800, 900, 1 000, 1 100, 1 200, 1 400, 1 500, 1 600, 1 800, 2 000.

The allowable pressures of ductile iron pipes and fittings shall be as given in Annex A.

NOTE 2 Annexes B and C give respectively the longitudinal bending resistance and the diametral stiffness of ductile iron pipes.

NOTE 3 When installed and operated under the conditions for which they are designed (see Annexes D, E and F), ductile iron pipes, fittings, accessories and their joints maintain all their functional characteristics over their reasonable economic 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

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Pipes, fittings and accessories shall be free from defects and surface imperfections which can 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 Clauses 4 and 5.

4.1.3 Types of joints and interconnection**4.1.3.1 General**

Elastometric gasket materials shall comply with the requirements of EN 681-1, type WA. When materials other than rubber are necessary (e.g. for high temperature flanged joints), they shall comply with the appropriate European Technical Specification or where no European Technical Specification exists, the appropriate International Standard.

4.1.3.2 Flexible joints

Components with flexible joints shall comply with 4.3.2.1 for their spigot external diameter DE and their limit deviations. This offers the possibility of interconnection between components equipped with different types of flexible joints.

The design of the sockets and the gaskets for use with the above spigots shall throughout all possible tolerance combinations:

- ensure leak tightness at minimum compression under shear and/or angular deflection;
- ensure both leak tightness and satisfactory anchorage (restrained joint) under shear and/or angular deflection.

In addition, each type of flexible joint shall be designed to fulfil the performance requirements of Clauses 5 and 7, and in particular in case of interconnexion of components from different suppliers such joints shall meet these performance requirements.

Couplings and flange adaptors manufactured for use with ductile iron pipes and fittings shall meet the performance requirements of flexible joints as detailed in Clauses 5 and 7.

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 4.3.2.1, the manufacturer's guidance should be followed as to the appropriate means of interconnection (e.g. adaptors).

4.1.3.3 Flanged joints

Flanges shall be designed such 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 whether his products are normally delivered with fixed flanges or adjustable flanges.

Flange gaskets may be one of any type given in EN 1514 (all parts).

4.1.3.4 Pipe saddles

Pipe saddles for service connections manufactured for use with ductile iron pipes shall meet the performance requirements as detailed in Clauses 5 and 7.

4.1.4 Materials in contact with water intended for human consumption

Components of a pipe system include several materials given in this standard. When used under the conditions for which they are designed, in permanent or in temporary contact with water intended for human consumption, the components shall not change the quality of that water to such an extent that it fails to comply with the requirements of national regulations.

For this purpose, reference shall be made to the relevant national regulations and standards, transposing EN standards when available, dealing with the influence of materials on water quality and to the requirements for external systems and components as given in EN 805.

4.2 Pressure class

In accordance with 3.21, the pressure class of a component is defined by a combination of its structural performance and the performance of its non-restrained flexible joint.

Restrained joints may reduce the PFA; in this case the PFA shall be declared by the manufacturer.

Annex A gives the PFA, PMA and PEA of the components and their pressure classes.