

SLOVENSKI STANDARD

SIST EN 253:2004

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Nadomešča:
SIST EN 253:2000

Cevi za daljinsko ogrevanje – Izolirani vezani cevni sistemi za podzemeljska toplovodna omrežja – Cevni sestav iz jeklene cevi, poliuretanske toplotne izolacije in zunanjega polietilenskega plašča

District heating pipes - Preinsulated bonded pipe systems for directly buried hot water networks - Pipe assembly of steel service pipe, polyurethane thermal insulation and outer casing of polyethylene

Fernwärmerohre - Werkmäßig gedämmte Verbundmantelrohrsysteme für direkt erdverlegte Fernwärmenetze - Verbund-Rohrsystem bestehend aus Stahl-Mediumrohr, Polyurethan-Wärmedämmung und Außenmantel aus Polyethylen

Tuyaux de chauffage urbain - Systemes bloqués de tuyaux pré-isolés pour les réseaux d'eau chaude enterrés directement - Tube de service en acier, isolation thermique en polyuréthane et tube de protection en polyéthylène

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23.040.10	Železne in jeklene cevi	Iron and steel pipes
91.140.65	Oprema za ogrevanje vode	Water heating equipment

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District heating pipes - Preinsulated bonded pipe systems for directly buried hot water networks - Pipe assembly of steel service pipe, polyurethane thermal insulation and outer casing of polyethylene

Tuyaux de chauffage urbain - Systèmes bloqués de tuyaux pré-isolés pour les réseaux d'eau chaude enterrés directement - Tube de service en acier, isolation thermique en polyuréthane et tube de protection en polyéthylène

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This European Standard was approved by CEN on 28 November 2002.

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Foreword

This document (EN 253:2003) has been prepared by Technical Committee CEN/TC 107 "Prefabricated district heating pipe systems", the secretariat of which is held by DS.

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of an identical text or by endorsement, at the latest by August 2003, and conflicting national standards shall be withdrawn at the latest by August 2003.

This document supersedes EN 253:1994.

Annexes A, B, D, E and H are informative.

Annexes C, F and G are normative.

This document includes a Bibliography.

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

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EN 253:2003 (E)

Introduction

The first edition of EN 253 was approved in 1990. The first edition was replaced by the second edition in 1994.

The main areas of the first revision were:

- the requirements for the PE quality have been updated;
- any reference to CFC has been deleted and alternative blowing agents have been taken into consideration. For further information see annex E.

The main areas of this second revision are:

- the title has been amended by "District heating pipes";
- the term "underground" in the title has been changed to "directly buried";
- the mentioning in the foreword of the production method "injected (poured)" has been deleted;
- the references to other standards have been changed to be in line with the latest versions of the standards;
- definitions have been added for terms "batch", "calculated continuous operating temperature (CCOT)", "creep", "foam density", "lot" and "thermal life";
- the definitions for the terms "overall density", "core density", "density of PE-raw material", "high density polyethylene (PE-HD)", "injected (poured) pipe assembly", "melt flow rate, MFR 190/5" have been deleted;
- the term "casing pipe" has been changed to "casing" to allow the use of PE casing continuously extruded directly onto the insulation and the requirements and tests have been amended accordingly;
- the requirements for the steel quality and dimensions of the steel service pipe have been changed as much as possible to be in line with European Standards. This includes references to the new European Standards EN 10216-2, EN 10217-2 and EN 10217-5;
- requirements on tolerances on the outside diameter, D_s , of the steel service pipe at the pipe ends have been introduced;
- requirements on tolerances on the actual wall thickness, T , of the steel service pipe have been introduced;
- service pipes with nominal diameters from DN 700 up to and including DN 1200 have been added and the requirements have been amended accordingly;
- requirements on 3.1.B certificates for the steel service pipe have been included;
- requirements and test methods for the dispersion of carbon black in the casing material have been introduced;
- the reference temperature for testing the induction time of the casing has been changed to 210 °C;
- casings with nominal outside diameters from 900 mm up to and including 1 400 mm have been added and the requirements have been amended accordingly;
- the requirement on the minimum time to failure of the casing when tested for long-term mechanical properties have been extended to 2 000 h;

- the requirements for the cell structure of the PUR foam insulation have been extended and a test method has been introduced;
- the requirements for "core density" and "overall density" have been deleted and substituted by requirements for "foam density" and the method for testing the "overall density" has been omitted;
- the "calculated continuous operating temperature (CCOT)" has been introduced. This includes the addition of the normative annex C;
- the requirements for "creep resistance" have been substituted by requirements for "creep behaviour" and a test method for creep behaviour at 140 °C has been introduced. This includes the addition of the normative annex F;
- requirements on "stress crack resistance" and a "notched constant load test" for the casing have been added;
- requirements for surface conditions at delivery have been added;
- requirements on marking of steel service pipes have been added;
- the former annexes C, D and E have been redesignated D, E and H respectively;
- a new test procedure for testing of thermal conductivity of preinsulated pipes has been introduced and included as annex G. The relevant requirements have been included in 4.5.5 and 5.4.5.

This specification is part of the standards for bonded systems using polyurethane foam thermal insulation applied to bond to a steel service pipe and a polyethylene casing.

The other standards from CEN/TC 107 are:

EN 448:2003, *District heating pipes – Preinsulated bonded pipe systems for directly buried hot water networks – Fitting assemblies of steel service pipes, polyurethane thermal insulation and outer casing of polyethylene.*

EN 488:2003, *District heating pipes – Preinsulated bonded pipe systems for directly buried hot water networks – Steel valve assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene.*

EN 489:2003, *District heating pipes – Preinsulated bonded pipe systems for directly buried hot water networks – Joint assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene.*

EN 13941:2003, *Design and installation of preinsulated bonded pipe systems for district heating.*

NOTE The following draft in connection with the above mentioned standards is under development:

prEN 14419, *District heating pipes – Preinsulated bonded pipe systems for directly buried hot water networks – Surveillance systems.*

EN 253:2003 (E)**1 Scope**

This European Standard specifies requirements and test methods for straight lengths of prefabricated thermally insulated pipe-in-pipe assemblies for directly buried hot water networks, comprising a steel service pipe from DN 20 to DN 1200, rigid polyurethane foam insulation and an outer casing of polyethylene.

This standard applies only to insulated pipe assemblies, for continuous operation with hot water at various temperatures up to 120 °C and occasionally with a peak temperature up to 140 °C.

The estimation of expected thermal life with continuous operation at various temperatures is outlined in annex B.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 728, *Plastics piping and ducting systems – Polyolefin pipes and fittings – Determination of oxidation induction time.*

EN 743, *Plastics piping and ducting systems – Thermoplastics pipes – Determination of the longitudinal reversion.*

EN 921, *Plastics piping systems – Thermoplastics pipes – Determination of resistance to internal pressure at constant temperature.*

EN 10204, *Metallic products – Types of inspection documents.*

EN 10216-2, *Seamless steel tubes for pressure purposes – Technical delivery conditions – Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties.*

EN 10217-2, *Welded steel tubes for pressure purposes – Technical delivery conditions – Part 2: Electric welded non-alloy and alloy steel tubes with specified elevated temperature properties.*

EN 10217-5, *Welded steel tubes for pressure purposes – Technical delivery conditions – Part 5: Submerged arc welded non-alloy and alloy steel tubes with specified elevated temperature properties.*

EN ISO 1133:1999, *Plastics – Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics (ISO 1133:1997).*

EN ISO 1872-2, *Plastics – Polyethylene (PE) moulding and extrusion materials – Part 2: Preparation of test specimens and determination of properties (ISO 1872-2:1997).*

EN ISO 8497:1996, *Thermal insulation – Determination of steady-state thermal transmission properties of thermal insulation for circular pipes (ISO 8497:1994).*

ENV 10220, *Seamless and welded steel tubes – Dimensions and masses per unit length.*

ISO 844, *Rigid cellular plastics – Determination of compression properties.*

ISO 845, *Cellular plastics and rubbers – Determination of apparent (bulk) density.*

ISO 1183:1987, *Plastics – Methods for determining the density and relative density of non-cellular plastics.*

ISO 3126, *Plastics pipes – Measurement of dimensions.*

ISO 3127:1994, *Thermoplastics pipes – Determination of resistance to external blows – Round-the-clock method.*

ISO 4590:2002, *Rigid cellular plastics – Determination of the volume percentage of open cells and of closed cells.*

ISO 6761, *Steel tubes – Preparation of ends of tubes and fittings for welding.*

ISO 8501-1:1988, *Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings.*

ISO/DIS 16770, *Plastics – Determination of environmental stress cracking (ESC) of polyethylene (PE) – Full notch creep test (FNCT).*

3 Terms and definitions

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

3.1

ageing

keeping the service pipe at a certain, elevated temperature for a certain time while the casing is exposed to room temperature

3.2

batch

specified quantity of raw material made under the same uniform production conditions in one production run by one manufacturer

3.3

bonded system

service pipe, insulating material and casing which are bonded by the insulating material

3.4

calculated continuous operating temperature (CCOT)

temperature for which the thermal life of 30 years can be calculated assuming an Arrhenius relationship between temperature and thermal life

3.5

casing

outer protection layer made of polyethylene to protect the insulation and the service pipe from ground water, moisture and mechanical damage

3.6

centre line deviation

deviation between the centre line of the service pipe and the centre line of the casing

3.7

continuous temperature

temperature at which the hot water network is designed to operate continuously

3.8

creep

slow progressive strain under the influence of stresses

3.9

density

mass of a body of a material divided by the volume of the body

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EN 253:2003 (E)**3.10****foam density**

apparent density of the foam of the insulating layer at any position

3.11**insulation material**

material which reduces the heat loss

3.12**lot**

agreed number of uniform components delivered or to be delivered by a manufacturer

3.13**MDI-index (Polymeric Methylendiphenyl Diisocyanate-Index)**

quotient of the actual amount of isocyanate used and the stoichiometrically required amount, multiplied by 100

3.14**peak temperature**

highest temperature at which a system is designed to operate occasionally, see annex B

3.15**pipe assembly**

assembled product, consisting of a service pipe, insulating material and a casing

3.16**polyurethane rigid foam (PUR)**

material resulting from the chemical reaction of polyisocyanates with hydroxyl containing compounds in the presence of catalysts, the foaming being assisted by a blowing agent. These foams have a mainly closed cell structure

3.17**room temperature**

(23 ± 2) °C

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3.18**service pipe**

steel pipe that contains the water

3.19**shear strength**

ability of the pipe assembly to withstand a shear force acting between the casing and the service pipe

3.20**thermal life**

time elapsed before the tangential shear stress at 140 °C falls below 0,13 MPa when exposing the pipe continuously to the ageing temperature

NOTE The limit value for the tangential shear strength, 0,13 MPa, used in the definition of the thermal life is clearly higher than the shear strength level necessary in service. As a consequence the useful service life of the pipe system can be expected to exceed the thermal life value.

4 Requirements**4.1 General**

Unless otherwise specified, the requirements shall be valid for each single measurement.

For information on suitable guidelines for inspection of manufactured preinsulated pipes see annex D.

4.2 Steel service pipe

4.2.1 Quality

The technical delivery conditions of the steel service pipe shall be in accordance with:

- EN 10216-2¹⁾ for seamless steel pipes
 EN 10217-2²⁾ for electric welded steel pipes
 EN 10217-5³⁾ for submerged arc welded pipes

The steel quality for the steel service pipe shall be Grade P235GH⁴⁾ according to EN 10216-2, EN 10217-2 or EN 10217-5.

All steel pipes and components used for fabrication of pipe assemblies under the scope of this standard shall as a minimum be delivered with a 3.1.B certificate according to EN 10204.

The manufacturer shall keep documentation of the certificates.

A length of pipe shall not include a circular joint.

4.2.2 Diameter

The diameter shall be in accordance with Table 1 which is derived from ENV 10220.

The tolerances on the outside diameter, D_s , of the steel service pipe at the pipe ends, shall be in accordance with Table 2.

NOTE To avoid stresses due to temperature differences and misalignment, the tolerances given in Table 2 are more stringent than the tolerances for D_s given in EN 10216-2, EN 10217-2 or EN 10217-5.

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4.2.3 Wall thickness

The nominal wall thicknesses, T , and masses shall be in accordance with ENV 10220 with a minimum as indicated in Table 1.

Subject to design considerations other wall thicknesses may be used, but in no case shall these be less than the minima indicated in Table 1.

The tolerance on the actual wall thickness, T , of the steel service pipe shall be in accordance with Table 3.

NOTE To avoid stresses due to temperature differences and misalignment, the tolerances given in Table 3 are more stringent than the tolerances for T given in EN 10216-2, EN 10217-2 or EN 10217-5.

¹⁾ Other steel qualities or standards can be used by agreement.

²⁾ Other steel qualities or standards can be used by agreement.

³⁾ Other steel qualities or standards can be used by agreement.

⁴⁾ Other steel qualities or standards can be used by agreement.

Table 1 — Steel service pipe dimensions

Nominal diameter DN	Outside diameter D_s mm	Minimum nominal wall thickness T mm
20	26,9	2,0
25	33,7	2,3
32	42,4	2,6
40	48,3	2,6
50	60,3	2,9
65	76,1	2,9
80	88,9	3,2
100	114,3	3,6
125	139,7	3,6
150	168,3	4,0
200	219,1	4,5
250	273,0	5,0
300	323,9	5,6
350	355,6	5,6
400	406,4	6,3
450	457,0	6,3
500	508,0	6,3
600	610,0	7,1
700	711,0	8,0
800	813,0	8,8
900	914,0	10,0
1 000	1 016,0	11,0
1 200	1 219,0	12,5

Table 2 — Tolerances on outside diameter D_s at pipe ends

Welded pipe		Seamless pipe	
D_s mm	Tolerance mm	D_s mm	Tolerance mm
$D_s \leq 48,3$	$\pm 0,3$	$D_s \leq 114,3$	$\pm 0,4$
$48,3 < D_s \leq 168,3$	$\pm 0,005 D_s$	$114,3 < D_s \leq 219,1$	$\pm 0,005 D_s$
$168,3 < D_s \leq 323,9$	$\pm 1,0$	$219,1 < D_s \leq 711,0$	$\pm 0,006 D_s$
$323,9 < D_s \leq 1219,0$	$\pm 1,6$		

Table 3 — Tolerances on the actual wall thickness

Welded pipe		Seamless pipe		
T mm	$\pm \Delta T$ mm	T mm	$+ \Delta T$ mm	$- \Delta T$ mm
2,0	0,3	2,0	0,3	0,2
2,3	0,3	2,3	0,4	0,2
2,6	0,3	2,6	0,4	0,3
2,9	0,3	2,9	0,4	0,3
3,2	0,3	3,2	0,4	0,4
3,6	0,4	3,6	0,5	0,5
4,0	0,5	4,0	0,5	0,5
4,5	0,5	4,5	0,6	0,6
5,0	0,5	5,0	1,0	0,6
5,6	0,5	5,6	1,1	0,7
6,3	0,5	6,3	1,3	0,9
7,1	0,5	7,1	1,4	1,1
8,0	0,5	8,0	1,4	1,1
8,8	0,5	8,8	1,4	1,1
10,0	0,5	10,0	1,4	1,1
11,0	0,5	11,0	1,4	1,1
12,5	0,5	12,5	1,4	1,1

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4.2.4 Surface condition

In order to ensure proper bonding between the steel service pipe and the PUR-foam insulation, the following procedure shall be followed:

Prior to insulation, the outer surface of the pipe shall be cleaned so that it is free from rust, mill scale, oil, grease, dust, paint, moisture and other contaminants.

Before cleaning the pipe, the outer surface of the pipe shall comply with rust grade A, B or C according to ISO 8501-1:1988, without pitting.

4.3 Casing

4.3.1 Material properties

4.3.1.1 Density and composition

The casing may be a separately manufactured pipe or be applied directly onto the insulation by extrusion.

The density of the PE-raw material shall be determined in accordance with ISO 1183:1987 method A or D on the extruded material from the melt flow rate measurement.

When tested in accordance with 5.2.1, the base material from which the casing is produced shall be PE of a density not less than 935 kg/m³ to which shall be added only those anti-oxidants, UV-stabilizers and carbon black, necessary for the manufacture and end use of pipes to this specification.