SLOVENSKI STANDARD
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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 - Systèmes bloqués de tuyaux préisolés pour les réseaux d'eau chaude enterrés directement - Tube de service en acier, isolation thermique en polyuréthane et tube de protection en polyéthylène

Ta slovenski standard je istoveten z: EN 253:2009

ICS:

23.040.10	Železne in jeklene cevi	Iron and steel pipes
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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

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This European Standard was approved by CEN on 5 December 2008.

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Contents

Foreword

This document (EN 253:2009) 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of an identical text or by endorsement, at the latest by July 2009, and conflicting national standards shall be withdrawn at the latest by July 2009.

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 253:2003.

Annex H provides details of significant technical changes between this European Standard and the previous editions.

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.

Introduction

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 covering this subject are:

EN 448, *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, *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, *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, *Design and installation of preinsulated bonded pipe systems for district heating;*

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

EN 15698-1, *District heating pipes – Preinsulated bonded twin pipe systems for directly buried hot water networks – Part 1: Twin pipe assembly of steel service pipe, polyurethane thermal insulation and outer casing of polyethylene*

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 15 to DN 1200, rigid polyurethane foam insulation and an outer casing of polyethylene. The pipe assembly may also include the following additional elements: measuring wires, spacers and diffusion barriers.

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

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 489, *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 728, *Plastics piping and ducting systems – Polyolefin pipes and fittings – Determination of oxidation induction time*

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 10217-1, *Welded steel tubes for pressure purposes – Technical delivery conditions - Part 1: Non-alloy steel tubes with specified room 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 10220, *Seamless and welded steel tubes – Dimensions and masses per unit length*

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

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

EN ISO 1133:2005, *Plastics – Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics (ISO 1133:2005)*

EN ISO 2505, *Thermoplastics pipes – Longitudinal reversion – Test methods and parameters (ISO 2505:2005)*

EN ISO 3126, *Plastics piping systems – Plastics components – Determination of dimensions (ISO 3126:2005)*

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

EN ISO 8501-1:2007, *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 8501-1:2007)*

EN ISO 9080, *Plastics piping and ducting systems – Determination of the long-term hydrostatic strength of thermoplastic materials in pipe form by extrapolation (ISO 9080:2003)*

EN ISO 9692-1, *Welding and allied processes – Recommendations for joint preparation – Part 1: Manual metal-arc welding, gas-shielded metal-arc welding, gas welding, TIG welding and beam welding of steels (ISO 9692-1:2003)*

EN ISO 12162, *Thermoplastics materials for pipes and fittings for pressure applications – Classification and designation – Overall service (design) coefficient (ISO 12162:1995)*

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

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

ISO 6964, *Polyolefin pipes and fittings – Determination of carbon black content by calcination and pyrolysis – Test method and basic specification*

ISO 11414:1996, *Plastics pipes and fittings -- Preparation of polyethylene (PE) pipe/pipe or pipe/fitting test piece assemblies by butt fusion*

ISO 13953, *Polyethylene (PE) pipes and fittings – Determination of the tensile strength and failure mode of test pieces from a butt-fused joint*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1133:2005 and the following apply.

3.1
ageing
keeping the service pipe at a certain, elevated temperature for a certain time while the casing is exposed to a temperature of (23 ± 2) °C

3.2
artificial ageing
keeping the complete pipe assembly at a certain, elevated temperature for a certain time

3.3
batch
specified quantity of raw material made under the same uniform production conditions in one production run by one manufacturer

3.4
bonded system
service pipe, insulating material and casing which are bonded by the insulating material

3.5
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

3.6
casing
outer layer made of polyethylene to protect the insulation and the service pipe from ground water, moisture and mechanical damage

3.7
centre line deviation
deviation between the centre line of the service pipe and the centre line of the casing

3.8
continuous temperature
temperature at which the hot water network is designed to operate continuously

3.9
creep
slow progressive strain under the influence of stresses

3.10
density
mass of a body of a material divided by the volume of the body

3.11
diffusion barrier
layer in the pipe assembly of another material than PE, installed between the thermal insulation and the PE casing, with the aim to restrict the diffusion of gases through the casing

3.12
foam density
apparent density of the foam of the insulating layer at any position

3.13
fusion compatibility
ability of two PE materials to be fused together to form a joint which conforms to the performance requirements of this European Standard

3.14
insulation material
material which reduces the heat loss

3.15
Polymeric Methylendiphenyl Diisocyanate-Index
MDI-index
quotient of the actual amount of isocyanate used and the stoichiometrically required amount, multiplied by 100

3.16
peak temperature
highest temperature at which a system is designed to operate occasionally, see Annex B

3.17
physical blowing agent
additive in the mixture of isocyanate and polyole which evaporate without reacting during the polymerisations

3.18
pipe assembly
assembled product, consisting of a service pipe, insulating material and a casing

3.19
polyurethane rigid foam
PUR
material resulting from the chemical reaction of polyisocyanates with hydroxyl containing compounds in the presence of catalysts having mainly closed cell structure

NOTE: The foaming can be assisted by a physical blowing agent

3.20
service pipe
steel pipe that contains the water

3.21
shear strength
ability of the pipe assembly to withstand a shear force acting between the casing and the service pipe

3.22
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.

3.23
virgin material
material in a form such as granules that has not been subjected to use or processing other than that required for its manufacture and to which no reprocessable or recyclable material has been added.

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 Specification

The technical delivery conditions of the steel service pipe shall be in accordance with Table 1.

Table 1 — Steel service pipe specification

Type of pipe	Diameter	EN standard	Material
Seamless	All	EN 10216-2	P235GH
ERW	≤ 323,9 mm	EN 10217-1 or EN 10217-2	P235TR1 or P235TR2 or P235GH
ERW	> 323,9 mm	EN 10217-2	P235GH
SAW	All	EN 10217-5	P235GH

For the calculation of the yield stress $R_{p0,2}$, at the design temperature in the temperature range up to 50 °C, the value of $R_{p0,2}$ for room temperature shall be used for P235TR1, P235TR2 and P235GH.

For the calculation of the yield stress $R_{p0,2}$, at the design temperature in the temperature range 50 < T ≤ 140 °C, the following formula shall be used for P235TR1, P235TR2 and P235GH:

$$R_e = 227 - 0{,}28(T - 50)\ \text{N/mm}^2 \qquad (1)$$

All steel pipes and components used for manufacturing of pipe assemblies under the scope of this standard shall as a minimum be delivered *to the manufacturer* with an inspection certificate 3.1 according to EN 10204. *The inspection certificate shall on request be passed on to the customer.*

The manufacturer shall keep documentation of the inspection certificates.

A length of pipe shall not include a circular joint.

4.2.2 Diameter

The diameter shall be in accordance with Table 2 which is derived from EN 10220.

The tolerances on the outside diameter, D_s, of the steel service pipe at the pipe ends, shall be in accordance with Table 3.

The tolerance for out of roundness shall be as specified in EN 10216-2, EN 10217-1, EN 10217-2 or EN 10217-5 with influence of what is specified for the tolerance on D_s in EN 253.

NOTE To avoid stresses due to temperature differences and misalignment, the tolerances given in Table 3 are more stringent than the tolerances for D_s given in EN 10216-2, EN 10217-1, EN 10217-2 or EN 10217-5.

4.2.3 Wall thickness

The nominal wall thicknesses, T, and masses shall be in accordance with EN 10220 with a minimum as indicated in Table 2.

Subject to design considerations, cf. EN 13941, other wall thicknesses may be used, but in no case shall these be less than the minima indicated in Table 2.

The tolerance on the actual wall thickness, T, of the steel service pipe shall be in accordance with Table 4.

NOTE To avoid stresses due to temperature differences and misalignment, the tolerances given in Table 4 are more stringent than the tolerances for T given in EN 10216 2, EN 10217-1, EN 10217 2 or EN 10217 5.

Table 2 — Steel service pipe dimensions

Nominal diameter DN	Outside diameter D_s mm	Minimum nominal wall thickness T mm
15	21,3	2,0
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 3 — Tolerances on outside diameter D_s at pipe ends

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

Table 4 — 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

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 EN ISO 8501-1:2007, without pitting.

4.3 Casing

4.3.1 Material properties

4.3.1.1 Material composition

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

The pipe material shall be black coloured PE virgin or rework material containing only those anti-oxidants, UV-stabilizers and carbon black necessary for the manufacture and end use of pipes to this specification. The black coloured PE material to be extruded shall be tested in accordance with EN ISO 9080 and classified at least a PE 80 material in accordance with EN ISO 12162.

The carbon black content shall, when tested in accordance with ISO 6964, be (2,5 ± 0,5) % by mass.

The carbon black shall be finely dispersed in the material. When tested in accordance with 5.2.3, the following requirements shall be met:

Carbon black agglomerates, bubbles, voids or foreign matter shall not exceed 100 µm in diameter. No white or black stripes or smears may occur.

4.3.1.2 Melt mass-flow rate

The melt mass-flow rate (MFR), in g/10 min, of black PE materials used for the manufacturing of casings shall lie within 0,2 ≤ MFR ≤ 1,4 g/10 min determined in accordance with EN ISO 1133, condition T (5kg, 190 °C).

Black coloured PE materials conforming to 4.3.1.1, which do not differ more than 0,5 g/10 min in MFR shall be considered fusible to each other.

Casings made of PE materials outside this MFR range of 0,5 g/10 min may be fusion welded provided that the pipe manufacturer has demonstrated fusion compatibility by preparing a but fusion joint using the parameters as specified in Annex A of ISO 11414:1996.The requirement of fusion compatibility is a ductile failure mode of the joint when tested at 23 °C in accordance with ISO 13953.

4.3.1.3 Thermal stability

The thermal stability is determined by oxygen induction time (OIT) of the black coloured PE material and shall be at least 20 min when tested at 210 °C according to EN 728.

4.3.1.4 Use of rework material

Only clean, not degraded, rework material, generated from the manufacturer's own production of pipes, shall be used.

4.3.2 Casing properties

4.3.2.1 Nominal outside diameter

The nominal outside diameter of the casing should be selected from Table 5.

The actual outside diameter shall be measured in accordance with EN ISO 3126.

4.3.2.2 Wall thickness

The wall thickness of the casing shall be in accordance with Table 5.

The actual wall thickness shall be measured in accordance with EN ISO 3126.