SLOVENSKI STANDARD
SIST EN 253:2020

01-januar-2020

Nadomešča:
SIST EN 253:2009+A2:2015

Cevi za daljinsko ogrevanje - Poviti enocevni sistemi za neposredno vkopana vročevodna omrežja - Tovarniško izdelan cevni sestav iz jeklene delovne cevi, obdane s poliuretansko toplotno izolacijo in zaščitnim plaščem iz polietilena

District heating pipes - Bonded single pipe systems for directly buried hot water networks - Factory made pipe assembly of steel service pipe, polyurethane thermal insulation and a 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 pour les réseaux d'eau chaude enterrées directement - Assemblages de tubes de service en acier manufacturés, isolation thermique en polyuréthane et tube de protection en polyéthylène

Ta slovenski standard je istoveten z: **EN 253:2019**

ICS:

23.040.07	Cevovodi za daljinsko ogrevanje in njihovi deli	Pipeline and its parts for district heat
23.040.10	Železne in jeklene cevi	Iron and steel pipes
91.140.65	Oprema za ogrevanje vode	Water heating equipment

SIST EN 253:2020 **en,fr,de**

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 253

October 2019

ICS 23.040.07; 23.040.10

Supersedes EN 253:2009+A2:2015

English Version

District heating pipes - Bonded single pipe systems for directly buried hot water networks - Factory made pipe assembly of steel service pipe, polyurethane thermal insulation and a casing of polyethylene

Tuyaux de chauffage urbain - Systèmes bloqués de tuyaux pour les réseaux d'eau chaude enterrées directement - Assemblages de tubes de service en acier manufacturés, isolation thermique en polyuréthane et tube de protection en polyéthylène

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

This European Standard was approved by CEN on 26 August 2019.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No. EN 253:2019 E

Contents

Page

European foreword

This document (EN 253:2019) has been prepared by Technical Committee CEN/TC 107 “Prefabricated district heating and district cooling 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 April 2020, and conflicting national standards shall be withdrawn at the latest by April 2020.

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

This document supersedes EN 253:2009+A2:2015.

In comparison with the previous edition, the main changes in this new edition of EN 253 are:

— editorial changes to the new structure of standards prepared by the Technical Committee CEN/TC 107;

— specification of steel grade moved into EN 13941-1;

— added thermal insulation series;

— added linear water tightness: requirements and test method;

— revised description of expected thermal life and long term temperature resistance in balance with EN 13941-1;

— revised description on shear strength: requirements and test method;

— removed Tangential shear strength and long-term creep resistance and modulus;

— revised Annex A, “Relation between actual continuous operating condition and accelerated ageing test conditions”;

— removed Annex C, “Calculated Continuous Operating Temperature (CCOT)”.

According to the CEN-CENELEC Internal Regulations, the national standards organisations 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, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

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

The other standards from CEN/TC 107 covering this subject are:

— EN 448, *District heating pipes – Bonded single pipe systems for directly buried hot water networks – Factory made fitting assemblies of steel service pipes, polyurethane thermal insulation and a casing of polyethylene*;

— EN 488, *District heating pipes – Bonded single pipe systems for directly buried hot water networks – Factory made steel valve assembly for steel service pipes, polyurethane thermal insulation and a casing of polyethylene*;

— EN 489-1, *District heating pipes – Bonded single and twin pipe systems for directly buried hot water networks – Part 1: Joint casing assemblies and thermal insulation for hot water networks in accordance with EN 13941-1*;

— EN 13941-1, *District heating pipes – Design and installation of thermal insulated bonded single and twin pipe systems for directly buried hot water networks – Part 1: Design*;

— EN 13941-2, *District heating pipes – Design and installation of thermal insulated bonded single and twin pipe systems for directly buried hot water networks – Part 2: Installation*;

— EN 14419, *District heating pipes – Bonded single and twin pipe systems for directly buried hot water networks – Surveillance systems*;

— EN 15698-1, *District heating pipes – Bonded twin pipe systems for directly buried hot water networks – Part 1: Factory made twin pipe assembly of steel service pipes, polyurethane thermal insulation and one casing of polyethylene*;

— EN 15698-2, *District heating pipes – Bonded twin pipe systems for directly buried hot water networks – Part 2: Factory made fitting and valve assemblies of steel service pipes, polyurethane thermal insulation and one casing of polyethylene*;

— EN 17248, *District heating and district cooling pipe systems – Terms and definitions*.

1 Scope

This document specifies requirements and test methods for straight lengths of factory made thermally insulated bonded single pipe assemblies for hot water networks in accordance with EN 13941-1, comprising a steel service pipe, polyurethane foam thermal insulation and a casing of polyethylene.

The pipe assembly can also include the following additional elements: measuring wires, spacers and diffusion barriers.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 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 10220, *Seamless and welded steel tubes — Dimensions and masses per unit length*

EN 13941-1, *District heating pipes — Design and installation of thermal insulated bonded single and twin pipe systems for directly buried hot water networks — Part 1: Design*

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

EN 17248, *District heating and district cooling pipe systems — Terms and definitions*

EN ISO 845, *Cellular plastics and rubbers — Determination of apparent density (ISO 845)*

EN ISO 1133 (all parts), *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastic (ISO 1133 series)*

EN ISO 2505, *Thermoplastics pipes — Longitudinal reversion — Test method and parameters (ISO 2505)*

EN ISO 3126, *Plastics piping systems — Plastics components — Determination of dimensions (ISO 3126)*

EN ISO 4590, *Rigid cellular plastics — Determination of the volume percentage of open cells and of closed cells (ISO 4590)*

EN ISO 6259-1, *Thermoplastics pipes — Determination of tensile properties — Part 1: General test method (ISO 6259-1)*

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, *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)*

EN ISO 3127:2017, *Thermoplastics pipes — Determination of resistance to external blows — Round-the-clock method (ISO 3127:1994)*

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

EN ISO 11357-6, *Plastics — Differential scanning calorimetry (DSC) — Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT) (ISO 11357-6)*

EN ISO 12162, *Thermoplastics materials for pipes and fittings for pressure applications — Classification, designation and design coefficient (ISO 12162)*

EN ISO 844, *Rigid cellular plastics — Determination of compression properties*

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

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

ISO 11414:2009, *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)*

ISO 18553, *Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 17248 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

4 Requirements

4.1 General

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

For information on suitable guidelines for inspection, see Annex B.

4.2 Steel service pipe

4.2.1 Specification

Steel grades are specified in EN 13941-1.

All steel pipes and components used for manufacturing of pipe assemblies under the scope of this document 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.

In case a material related inspection certificate 3.1 according to EN 10204 is required by the client who orders the pipe assemblies, this request shall be given whilst placing the order with the manufacturer of the pipe assemblies.

NOTE Any later request for provision of such documentation could be too late and possibly can't be met by the manufacturer, since the manufacturer has to organize the assignment of 3.1 certificates to the steel service pipes before starting the production.

A length of pipe shall not include a circular weld.

4.2.2 Diameter

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

The tolerances on the outside diameter, d_O, of the steel service pipe at the pipe ends, shall be in accordance with EN 10216-2, EN 10217-2 or EN 10217-5. Diameter measurements shall be made using a circumferential tape. The diameter shall be calculated as the actual circumference divided by π. Outside diameter, d_O, 168,3 and smaller may be measured using a slide calliper.

The out-of-roundness shall be determined in accordance with EN 10216-2, EN 10217-2 or EN 10217-5.

4.2.3 Wall thickness

The wall thicknesses, *t*, and masses shall be in accordance with EN 10220 with a minimum as indicated in Table 1. The tolerances on the wall thickness of the steel service pipe, shall be in accordance with EN 10216-2, EN 10217-2 or EN 10217-5.

Table 1 — Steel service pipe dimensions

Nominal diameter DN	Outside diameter d_o mm	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

4.2.4 Surface condition

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

Prior to thermal 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 steel service pipe, the outer surface shall comply with rust grade A, B or C according to EN ISO 8501-1, without pitting.

4.3 Casing

4.3.1 Material properties

4.3.1.1 Material composition

The casing 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 use of pipe assemblies 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 casing may be a separately manufactured pipe or be applied directly onto the PUR thermal insulation by extrusion.

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 and particles shall be grade ≤ 3.

— Dispersion rating shall be A1, A2 or A3 according to ISO 18553.

NOTE The required carbon black content ensures UV stability for the service life.

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 ≤ 1,0 g/10 min determined in accordance with EN ISO 1133 (all parts), condition 5 kg, 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 manufacturer of the pipe assembly has demonstrated fusion compatibility by preparing a butt fusion joint using the parameters as specified in Annex A of ISO 11414:2009. 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 ISO 11357-6.

4.3.1.4 Use of rework material

Only clean, not degraded, rework material, generated from the manufacturer's own production, 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 2.

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

4.3.2.2 Wall thickness

If the casing includes a diffusion barrier the wall thickness of one single PE layer of the casing shall be in accordance with Table 2.

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

Table 2 — Casing dimensions

Nominal outside diameter D_C mm	**Minimum wall thickness** e_{min} **mm**
90	3,0
110	3,0
125	3,0
140	3,0
160	3,0
180	3,0
200	3,2
225	3,4
250	3,6
280	3,9
315	4,1
355	4,5
400	4,8
450	5,2
500	5,6
560	6,0
630	6,6
710	7,2
800	7,9
900	8,7
1 000	9,4
1 100	10,2
1 200	11,0
1 400	12,5

4.3.2.3 Appearance, surface finish, casing ends

The internal and external surfaces of the casing shall be clean and free from such grooving or other defects that might impair its functional properties (see 5.2.1).

The casing ends shall be cleanly cut and shall be square within 2,5° with the axis of the pipe.

Surface treatment to improve the shear strength between the PUR foam and casing is permissible provided that the treated pipe assembly still complies with the specification.

4.3.2.4 Elongation at break

The elongation at break determined in accordance with 5.2.2 shall not be less than 350 %.

4.3.2.5 Heat reversion

When tested in accordance with EN ISO 2505, the longitudinal length at any position on the casing shall not change by more than 3 %. On inspection after testing, the casing shall not show any faults, cracks, cavities or blisters.

4.3.2.6 Stress crack resistance

When tested in accordance with 5.2.4, the time to failure shall not be less than 300 h.

4.4 Polyurethane (PUR) foam thermal insulation

4.4.1 Composition

The manufacturer of the pipe assembly shall be responsible for the choice of raw materials, composition and manufacturing conditions.

The manufacturer shall keep records, documenting the raw materials used, the prescribed mixing ratio and the tests performed.

The records shall demonstrate that the PUR foam from production of pipe assemblies is of the same composition as the foam sample used for the ageing test in 5.4.2 and meets the requirements of 4.4.

4.4.2 Cell structure

4.4.2.1 General appearance

The PUR foam shall have a uniform cell structure free from smears.

4.4.2.2 Cell size

The average cell size of the cells in a radial direction shall be less than 0,5 mm, determined in accordance with 5.3.2.1.

4.4.2.3 Closed cell content

The closed cell content determined in accordance with 5.3.2.2 shall be not less than 88 %.

4.4.2.4 Voids and bubbles

The average area of voids and bubbles determined on the five cross sections in accordance with 5.3.2.3 shall not constitute more than 5 % of the cross sectional area of the PUR foam. No single void shall be larger than 2/3 of the insulation thickness between the steel service pipe and the casing at the position of the void.

4.4.3 Compressive strength

The compressive strength or the compressive stress at 10 % relative deformation as defined in EN ISO 844 shall be not less than 0,3 MPa in a radial direction when tested in accordance with 5.3.3.