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**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 (vključno z dopolnilom A1)**

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 - Einzelrohr-Verbundsysteme für direkt erdverlegte Fernwärmenetze -  
Werkmäßig gefertigte Verbundrohrsysteme, bestehend aus Stahl-Mediumrohr, einer  
Wärmedämmung aus Polyurethan und einer Ummantelung 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

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This European Standard was approved by CEN on 26 August 2019 and includes Amendment approved by CEN on 1 October 2023.

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## Contents

Page

European foreword.....	4
Introduction .....	5
1 Scope .....	6
2 Normative references .....	6
3 Terms and definitions .....	7
4 Requirements .....	7
4.1 General.....	7
4.2 Steel service pipe.....	8
4.2.1 Specification.....	8
4.2.2 Diameter.....	8
4.2.3 Wall thickness .....	8
4.2.4 Surface condition .....	9
4.2.5 <b>A1</b> Pipe ends.....	9
4.3 Casing.....	10
4.3.1 Material properties .....	10
4.3.2 Casing properties .....	10
4.4 Polyurethane (PUR) foam thermal insulation .....	12
4.4.1 Composition .....	12
4.4.2 Cell structure .....	12
4.4.3 Compressive strength.....	12
4.4.4 Foam density.....	13
4.4.5 Water absorption at elevated temperature.....	13
4.5 Pipe assembly .....	13
4.5.1 General.....	13
4.5.2 Thermal insulation series .....	13
4.5.3 Pipe ends without thermal insulation .....	14
4.5.4 Diameter and wall thickness of the casing.....	14
4.5.5 Centre line deviation.....	15
4.5.6 Expected thermal life and long term temperature resistance.....	15
4.5.7 Thermal conductivity in unaged condition.....	16
4.5.8 Thermal conductivity at artificially aged condition .....	16
4.5.9 Impact resistance .....	16
4.5.10 Surface conditions at delivery.....	16
4.5.11 Measuring wires for surveillance systems.....	17
4.5.12 Linear water tightness .....	17
5 Test methods .....	17
5.1 General conditions and test specimens .....	17
5.1.1 General conditions.....	17
5.1.2 Test specimens.....	17
5.2 Casing.....	18
5.2.1 Appearance and surface finish.....	18
5.2.2 Elongation at break .....	18
5.2.3 Carbon black dispersion, homogeneity.....	19
5.2.4 Stress crack resistance test .....	19
5.3 Polyurethane (PUR) foam thermal insulation .....	20

5.3.1	Composition.....	20
5.3.2	Cell structure.....	20
5.3.3	Compressive strength .....	21
5.3.4	Foam density .....	21
5.3.5	Water absorption.....	21
5.4	Pipe assembly .....	22
5.4.1	Axial shear strength.....	22
5.4.2	Shear strength of the pipe assembly after ageing.....	24
5.4.3	Thermal conductivity in unaged condition .....	24
5.4.4	Thermal conductivity at artificially aged condition .....	25
5.4.5	Impact resistance.....	25
5.4.6	Linear water tightness .....	25
6	Marking .....	27
6.1	General .....	27
6.2	Steel service pipe .....	28
6.3	Casing .....	28
6.4	Pipe assembly .....	28
<b>Annex A (informative) Relation between actual continuous operating conditions and accelerated ageing test conditions.....</b>		<b>29</b>
<b>Annex B (informative) Guidelines for inspection and testing .....</b>		<b>33</b>
<b>Annex C (normative) Thermal conductivity of factory made pipe assemblies — Test procedure .....</b>		<b>38</b>
<b>Annex D (informative) Waste treatment and recycling.....</b>		<b>43</b>
<b>Bibliography .....</b>		<b>44</b>

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**EN 253:2019+A1:2023 (E)****European foreword**

This document (EN 253:2019+A1:2023) 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 June 2024, and conflicting national standards shall be withdrawn at the latest by June 2024.

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 A1 EN 253:2019 A1.

This document includes Amendment 1 approved by CEN on 01 October 2023.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1.

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)”.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

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, Türkiye 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.*

**EN 253:2019+A1:2023 (E)****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 - Bonded single and twin pipe systems for 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 845:2006)*

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)*

**A1** EN ISO 1923, *Cellular plastics and rubbers - Determination of linear dimensions (ISO 1923:1981)* **A1**

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

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

EN ISO 4590, *Rigid cellular plastics - Determination of the volume percentage of open cells and of closed cells (ISO 4590:2016)*

EN ISO 6259-1, *Thermoplastics pipes - Determination of tensile properties - Part 1: General test method (ISO 6259-1:2015)*

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 8501-1:2007)*

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 9080:2012)*

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 11357-6:2018)*

EN ISO 12162, *Thermoplastics materials for pipes and fittings for pressure applications - Classification, designation and design coefficient (ISO 12162:2009)*

EN ISO 844, *Rigid cellular plastics - Determination of compression properties (ISO 844:2021)*

**A1** Deleted text **A1**

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 <https://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.

**EN 253:2019+A1:2023 (E)****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  $\pi$ . 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**

**A1**) The wall thicknesses,  $t$ , shall be in accordance with EN 10220 with a minimum as indicated in Table 1 **A1**). 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

Nominal diameter DN	Outside diameter $d_o$ mm	Wall thickness $t$ mm
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

**[A1]** NOTE The nominal diameter DN 15 is not relevant for factory made pipe, fitting and valve assemblies of the European Standards EN 253, 448 and 488-series. The European Standards EN 15698 for pipe, fitting and valve assemblies take reference to this nominal diameter. **[A1]**

#### 4.2.4 Surface condition

**[A1]** The outer surface of the steel service pipe shall comply with rust grade A, B or C according to EN ISO 8501-1, without pitting.

In order to ensure bonding between the steel service pipe and the thermal insulation prior to thermal insulation, the outer surface of the pipe should be clean from rust, mill scale, oil, grease, dust, paint, moisture and other contaminants. **[A1]**

#### 4.2.5 **[A1]** Pipe ends

Steel service pipes used for the manufacturing of pipe assemblies shall be delivered with bevelled ends according to EN 10217-2, EN 10216-2 and EN 10217-5. The bevel shall have an angle  $\alpha$  of  $30_0^{+5^\circ}$  with a root face of  $1,6 \text{ mm} \pm 0,8 \text{ mm}$ .

Bevelling is applicable for specified nominal wall thicknesses  $\geq 3,2 \text{ mm}$ .

For this, the relevant order options according to EN 10216-2, EN 10217-2 or EN 10217-5 should be agreed. **[A1]**

**EN 253:2019+A1:2023 (E)****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.

**A1** The casing may be separately manufactured or be applied directly onto the PUR thermal insulation by extrusion. **A1**

**A1** The carbon black content shall, when tested according to ISO 6964, be (2,0 to 2,5) % by mass. **A1**

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  $\leq 3$ .
- **A1** Dispersion appearance rating not worse than A3 according to ISO 18553 **A1**.

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  $0,2 < \text{MFR} \leq 1,0$  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.