SLOVENSKI STANDARD
oSIST prEN 17415-1:2019

01-november-2019

Cevi za daljinsko hlajenje - Spojeni enocevni sistemi za neposredno vkopana hladnovodna omrežja - 1. del: Tovarniško izdelan cevni sestav iz jeklene ali plastične delovne cevi, poliuretanske toplotne izolacije in polietilenskega plašča

District cooling pipes - Bonded single pipe systems for directly buried cold water networks - Part 1: Factory made pipe assembly of steel or plastic service pipe, polyurethane thermal insulation and a casing of polyethylene

Fernkältesysteme - Verbundmantelrohrsysteme für direkt erdverlegte Fernkältenetze - Teil 1: Werkmäßig gedämmtes Verbund-Rohrsystem, bestehend aus Stahl oder Plastik Mediumrohr, Polyurethan-Wärmedämmung und einem Außenmantel aus Polyethylen

Réseaux d'eau glacée - Systèmes bloqués de tuyaux préisolés pour les réseaux d'eau glacée enterrés directement - Partie 1 : Tube de service en acier ou en matière plastique, isolation thermique en polyuréthane et protection en polyéthylène

Ta slovenski standard je istoveten z: **prEN 17415-1**

ICS:

23.040.99	Drugi sestavni deli za cevovode	Other pipeline components

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 107.

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

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European foreword

This document (prEN 17415-1:2019) has been prepared by Technical Committee CEN/TC 107 “Prefabricated district heating and cooling pipe systems”, the secretariat of which is held by DS.

This document is currently submitted to the CEN Enquiry.

Introduction

Factory made bonded single pipe systems for directly buried district cooling networks are of common technical usage. In order to assure quality including product-related service life, to assure safety in use, economical energy usage and to facilitate comparability in the market, CEN/TC 107 decided to set up standards for these products.

This document is one of a series of standards which form several parts of prEN 17415, *District cooling pipes – Bonded single pipe systems for directly buried cold water networks*:

— *Part 1: Factory made pipe assembly of steel or plastic service pipe, polyurethane thermal insulation and a casing of polyethylene* (this document);

— *Part 2: Factory made fitting assemblies of steel or plastic service pipe, polyurethane thermal insulation and a casing of polyethylene*[1)];

— *Part 3: Factory made steel valve assembly for steel or plastic service pipe, polyurethane thermal insulation and a casing of polyethylene*[1)];

— *Part 4: Joint casing assemblies of polyurethane thermal insulation and a casing of polyethylene for steel or plastic service pipes*[1)].

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

— prEN 17414-1, *District cooling pipes – Factory made flexible pipe systems – Part 1: Classification, general requirements and test methods*;

— prEN 17414-2, *District cooling pipes – Factory made flexible pipe systems – Part 2: Bonded system with plastic service pipes; requirements and test methods*;

— prEN 17414-3, *District cooling pipes – Factory made flexible pipe systems – Part 3: Non bonded system with plastic service pipes; requirements and test methods*;

— prEN ZZZZZ-1, *District cooling pipes – Design and installation of thermal insulated bonded single and twin pipe systems for directly buried cold water networks – Part 1: Design*[2)];

— prEN ZZZZZ-2, *District cooling pipes – Design and installation of thermal insulated bonded single and twin pipe systems for directly buried cold water networks – Part 2: Installation*[2)];

— prEN UUUUU, *District cooling pipes – Factory made bonded pipe systems for directly buried cold water networks – Surveillance systems*[2)].

1) Under development.
2) Under development.

1 Scope

This document specifies requirements, design and test methods for straight lengths of factory made thermally insulated pipe-in-pipe assemblies for directly buried district cooling distribution systems, comprising a service pipe from DN 15 to DN 1200, rigid polyurethane foam insulation and a casing of polyethylene. The pipe assembly may also include the following additional elements: measuring wires, spacers and diffusion barriers.

This document applies only to insulated pipe assemblies, for continuous operation with water at various temperatures (1 to 30) °C and a maximum operation pressure of 25 bar.

The design is based on an expected service life with continuous operation of a minimum 50 years.

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 10216-1:2013, *Seamless steel tubes for pressure purposes – Technical delivery conditions – Part 1: Non-alloy steel tubes with specified room temperature properties*

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 10217-1:2019, *Welded steel tubes for pressure purposes - Technical delivery conditions - Part 1: Electric welded and submerged arc welded 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 12201-2, *Plastics piping systems for water supply, and for drainage and sewerage under pressure – Polyethylene (PE) – Part 2: Pipes*

EN 12201-5:2011, *Plastics piping systems for water supply, and for drainage and sewerage under pressure – Polyethylene (PE) – Part 5: Fitness for purpose of the system*

prEN UUUUU, *District cooling pipes – Factory made bonded pipe systems for directly buried cold water networks – Surveillance systems*[3])

EN ISO 845, *Cellular plastics and rubbers – Determination of apparent density (ISO 845:2006)*

3) Under development (WI 00107076).

EN ISO 1133-1, *Plastics - Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics - Part 1: Standard method (ISO 1133-1)*

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

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

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

EN ISO 4590:2016, *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 6259-3, *Thermoplastics pipes – Determination of tensile properties – Part 3: Polyolefin pipes (ISO 6259-3)*

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)*

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)*

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 and designation – Overall service (design) coefficient (ISO 12162)*

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

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

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 following terms and definitions 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

3.1
batch
specified quantity of raw material made under the same uniform production conditions in one production run by one manufacturer

3.2
bonded system
service pipe, insulating material and casing which are bonded by the insulating material

3.3
casing
outer layer of polyethylene, which may contain a diffusion barrier, intended to protect the thermal insulation and service pipe from the effects of ground water, moisture and mechanical damage

3.4
centre line deviation
deviation between the centre line of the service pipe and the centre line of the casing

3.5
continuous operating temperature
temperature at which the cold water network is designed to operate continuously

3.6
compressive creep
slow progressive strain under the influence of stresses caused by compressive forces

3.7
density
mass of a body of a material divided by the volume of the body

3.8
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

3.9
foam density
apparent density of the foam of the insulating layer at any position

3.10
fusion compatibility
ability of two PE materials to be fused together to form a joint which conforms to the performance requirements of this document

3.11
insulation material
material which reduces the heat loss

3.12
melt mass-flow rate
MFR
rate of extrusion of molten resin through a die of specified length and diameter under prescribed conditions of temperature, load and piston position in the barrel of an extrusion plastometer, the rate being determined as the mass extruded over a specified time

3.13
Polymeric Methylendiphenyl Diisocyanate-Index
MDI-index
quotient of the actual amount of isocyanate used and the stoichiometrically required amount, multiplied by 100

3.14
physical blowing agent
additive in the mixture of isocyanate and polyole which evaporate without reacting during the polymerisations

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 having mainly closed cell structure

Note 1 to entry: The foaming can be assisted by a physical blowing agent.

3.17
rework material
material to which reprocessable or recyclable material has been added

3.18
service life
span of time during which the pipeline is expected to function

3.19
service pipe
steel or plastic pipe that contains the water

3.20
shear strength
ability of the pipe assembly to withstand a shear force acting between the casing and the service pipe

3.21
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 factory made pipe assemblies, see Annex A.

4.2 Service pipes

4.2.1 Steel service pipes

4.2.1.1 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	≤ DN 300	EN 10216-1	P235TR1[a]
Seamless	All	EN 10216-1	P235TR2
Seamless	All	EN 10216-2	P235GH
ERW	≤ DN 300	EN 10217-1	P235TR1[a]
ERW	All	EN 10217-1	P235TR2
ERW	All	EN 10217-2	P235GH
SAW	All	EN 10217-5	P235GH

[a] If P235TR1 material is used, an impact test at 0 °C, according to EN 10216-1:2013, Table 5, or EN 10217-1:2019, Table 4, as specified for P235TR2 shall be performed and specific inspection in accordance with EN 10216-1 or EN 10217-1, Option 9 shall be carried out.

For the calculation of the yield strength $R_{p0,2}$, at the design temperature in the temperature range up to 30 °C, the value of $R_{p0,2}$ for room temperature shall be used for P235TR1, P235TR2 and P235GH.

For higher steel grades than those given in Table 1 the yield strength is defined in their related standards. If such higher steel grades are used for medium pipes, it shall be verified that all components used in the involved part of the system are compatible to the higher yield strength of the pipes.

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.

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

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

A length of pipe shall not include a circular weld.

ERW pipes supplied shall not include the welds used to join together the strip prior to forming.

4.2.1.2 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 the respective pipe standard as given in Table 1. Diameter measurements shall be made using a circumferential tape. The diameter shall be calculated as the actual circumference divided by π. Outside diameter, D_S, 168,3 and smaller may be measured using a slide calliper.

The out-of-roundness shall be determined in accordance with the respective pipe standard as given in Table 1 and shall be within the limits given in these standards.

4.2.1.3 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, other wall thicknesses may be used, but in no case they shall 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 the respective pipe standard as given in Table 1.

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

4.2.1.4 Surface condition

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

The outer surface of the pipe shall comply with rust grade A, B or C according to EN ISO 8501-1:2007, without pitting.

Prior to insulation, the outer surface of the pipe shall be cleaned by a suitable method in accordance with EN ISO 8501-1:2007, Clause 3, to ensure that it is free from rust, mill scale, oil, grease, dust, paint, moisture and other contaminants.

It is recommended to clean the surface to Sa 2 according to EN ISO 8501-1:2007.

4.2.2 Plastic service pipes

4.2.2.1 Specification

Plastics service pipes shall be polyethylene pipes PE 80 or PE 100 in accordance with EN 12201-2.

A length of pipe shall not include a circular joint.

4.2.2.2 Diameter

The nominal outside diameter and diameter tolerances of the plastic service pipe shall be in accordance with EN 12201-2.

4.2.2.3 Wall thickness

The wall thickness of the plastic service pipe shall be in accordance with EN 12201-2 and the SDR numbers given in Table 3.

Table 3 — SDR ratios required for different operating pressures

Service pipe	Operating pressure bar				
	6	10	16	20	25
PE 100	SDR 21	SDR 13,6	SDR 9	SDR 7,4	SDR 6
PE 80	SDR 13,6	SDR 11	SDR 7,4	SDR 6	–

NOTE The SDR numbers given in Table 3 have been calculated for a continuous operating temperature of 30 °C and a service life of 50 years. Other temperature/time profiles can be applied in accordance with EN ISO 13760 (Miner's Rule). Further information is given in Annex E.

Due to welding requirements, PE 100 and PE 80 shall not be combined in the same system.

The tolerance on the actual wall thickness of the plastic service pipe shall be in accordance with EN 12201-2.

4.2.2.4 Surface condition

In order to ensure proper bonding between the plastic service pipe and the thermal 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, oil, grease, dust, paint, moisture and other contaminants.

Surface treatment to improve the shear strength between the thermal insulation and plastic service pipe is permissible provided that the treated pipe assembly still complies with the specification.

4.2.2.5 Oxygen tightness

The oxygen diffusion of service pipes shall not exceed 0,32 mg/m²d at 40 °C when tested in accordance with ISO 17455.

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 casing material shall be black PE virgin compound or manufacturer's own reprocessed PE in accordance with 4.3.1.4 that does not include any PU insulation material or other materials, and containing only those anti-oxidants, UV-stabilizers and carbon black necessary for the manufacture and end use of pipes. The black coloured PE material to be extruded shall be 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 (2,0 to 2,5) % by mass.

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

The carbon black shall be finely dispersed in the material. When tested in accordance with ISO 18553 as specified in 5.2.3, the following requirements shall be met:

— Carbon black agglomerates and particles shall be grade ≤ 3.

— Dispersion appearance rating not worse than A1, A2, A3 or B in ISO 18553.

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 1133-1, 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 pipe manufacturer 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 reprocessed material

Only clean, not degraded, reprocessed material, generated from the manufacturer's own production of pipes that does not include any PU insulation material 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 4.

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