SLOVENSKI STANDARD
SIST EN 17415-1:2020

01-oktober-2020

Cevi za daljinsko hlajenje - Vezani enocevni sistemi za neposredno vkopana hladnovodna omrežja - 1. del: Tovarniško izdelan cevni sestav iz delovne cevi iz jekla ali polimernih materialov, 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: **EN 17415-1:2020**

ICS:

23.040.99	Drugi sestavni deli za cevovode	Other pipeline components

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This European Standard was approved by CEN on 22 June 2020.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 17415-1:2020) 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of an identical text or by endorsement, at the latest by January 2021, and conflicting national standards shall be withdrawn at the latest by January 2021.

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.

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Introduction

Factory made bonded single pipe systems for directly buried district cooling networks are of common technical usage. In order to ensure quality including product-related service life, to ensure 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 EN 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];

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

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

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

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

— EN 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*[1];

— EN 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*[1];

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

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

Waste management and recycling of materials is dealt with in Annex C.

[1] 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 can 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, *Plastics piping systems for water supply, and for drainage and sewerage under pressure — Polyethylene (PE) — Part 5: Fitness for purpose of the system*

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

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

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

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 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 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)*

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

3.2
insulation material
material which reduces the heat loss

3.3
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

3.4
pipe assembly
assembled product, consisting of at least one service pipe, insulating material and casing

3.5
standard dimension ratio
SDR
numerical designation of a pipe series, which is a convenient round number, approximately equal to the dimension ratio of the nominal outside diameter and the minimum wall thickness

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

[a] Equivalent or higher steel grades according to approved European standards may be used by agreement.

[b] 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 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 client who orders the pipe assemblies.

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 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_o, 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_o, 168,3 mm 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.

4.2.1.3 Wall thickness

The 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 tolerances on the wall thickness 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_o 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:

a) 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.

b) 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.

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

4.2.1.5 Pipe ends

All steel service pipes used for manufacturing of pipe assemblies shall be delivered with pipe ends prepared for welding. For this, the relevant order option in accordance with the respective pipe standard as given in Table 1 shall be agreed.

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,

or alternatively,

— PP, PB, PE-X, PE-RT or multilayer plastics service pipes in accordance with the respective pipe standard as given in EN 17414-2.

A length of pipe shall not include a circular joint.

4.2.2.2 Diameter

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

The nominal outside diameter and diameter tolerances of the PP, PB, PE-X, PE-RT and multilayer plastics service pipe shall be in accordance with the respective pipe standard as given in EN 17414-2.

4.2.2.3 Wall thickness

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

Table 3 defines the maximum SDR ratios of the service pipe required to withstand different operating pressures.

Table 3 — Maximum SDR ratios for different operating pressures

Service pipe	Operating pressure bar				
	6	10	16	20	25
PE 100	21	13,6	9	7,4	6
PE 80	17	11	7,4	6	–

NOTE The maximum SDR numbers given in Table 3 have been calculated based on EN ISO 15494 with the safety factor 1,25 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 D.

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 PE plastic service pipe shall be in accordance with EN 12201-2.

The wall thickness and the tolerance on the actual wall thickness of the PP, PB, PE-X, PE-RT and multilayer plastics service pipe shall be in accordance with the respective pipe standard as given in EN 17414-2. The SDR numbers for the PP, PB, PE-X, PE-RT and multilayer plastics service pipes shall be in accordance with EN 17414-2.

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.

4.3 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 (2,0 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 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 or A3 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 ≤ 1,0 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 if fusion compatibility has been demonstrated by the manufacturer of the pipe assembly. This shall be done by preparing a butt fusion joint using the parameters as specified in ISO 11414:2009, Annex A. The requirement of fusion compatibility is a ductile failure mode of the joint when tested at 23 °C in accordance with ISO 13953.