SLOVENSKI STANDARD
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Cevi za daljinsko hlajenje - Tovarniško izdelani sistemi gibkih cevi - 1. del: Razvrstitev, splošne zahteve in preskusne metode

District cooling pipes - Factory made flexible pipe systems - Part 1: Classification, general requirements and test methods

Fernkühlungsrohre - Werkmäßig gedämmte flexible Rohrsysteme - Teil 1: Klassifikation, allgemeine Anforderungen und Prüfung

Réseaux d'eau glacée - Systèmes de tuyaux flexibles manufacturés - Partie 1 : Classification, exigences générales et méthodes d'essai

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ICS:

23.040.99	Drugi sestavni deli za cevovode	Other pipeline components

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District cooling pipes - Factory made flexible pipe systems - Part 1: Classification, general requirements and test methods

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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 17414-1:2019) 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 flexible 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 17414, *District cooling pipes – Factory made flexible pipe systems*:

— *Part 1: Classification, general requirements and test methods* (this document)*;*

— *Part 2: Bonded system with plastic service pipes; requirements and test methods;*

— *Part 3: Non bonded system with plastic service pipes; requirements and test methods.*

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

— prEN 17415-1, *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*;

— prEN 17415-2, *District cooling pipes – Bonded single pipe systems for directly buried cold water networks Part 2: Factory made fitting assemblies of steel or plastic service pipe, polyurethane thermal insulation and a casing of polyethylene*[1)];

— prEN 17415-3, *District cooling pipes – Bonded single pipe systems for directly buried cold water networks Part 3: Factory made steel valve assembly for steel or plastic service pipe, polyurethane thermal insulation and a casing of polyethylene*[1)];

— prEN 17415-4, *District cooling pipes – Bonded single pipe systems for directly buried cold water networks Part 4: Joint casing assemblies of polyurethane thermal insulation and a casing of polyethylene for steel or plastic service pipes*[1)];

— 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 and test methods for factory made thermally insulated flexible pipe-in-pipe assemblies for directly buried district cooling distribution systems, comprising a service pipe from DN 15 to DN 200 and a casing of polyethylene. The pipe assembly may also include the following additional elements: measuring wires, spacers and diffusion barriers.

This document is intended to be used in conjunction with prEN 17414-2 or prEN 17414-3.

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 dependent on material specified.

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

This document does not cover surveillance systems.

NOTE For the transport of other liquids, for example potable water, additional requirements may be applicable.

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 1605, *Thermal insulating products for building applications - Determination of deformation under specified compressive load and temperature conditions*

EN 1606, *Thermal insulating products for building applications - Determination of compressive creep*

EN 12085, *Thermal insulating products for building applications - Determination of linear dimensions of test specimens*

EN 60811-100:2012, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 100: General*

EN 60811-406:2012, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 406: Miscellaneous tests - Resistance to stress cracking of polyethylene and polypropylene compounds*

EN 60811-511:2012, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 511: Mechanical tests - Measurement of the melt flow index of polyethylene compounds*

EN 60811-605:2012, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 605: Physical tests - Measurement of carbon black and/or mineral filler in polyethylene compounds*

EN 60811-607:2012, *Electric and optical fibre cables - Test methods for non-metallic materials - Part 607: Physical tests - Test for the assessment of carbon black dispersion in polyethylene and polypropylene*

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

3) Under development (WI 00107076).

prEN 17415-1:2019, *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*

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

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

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

EN ISO 9967, *Thermoplastics pipes - Determination of creep ratio (ISO 9967)*

EN ISO 9969, *Thermoplastics pipes - Determination of ring stiffness (ISO 9969)*

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 16871, *Plastics piping and ducting systems - Plastics pipes and fittings - Method for exposure to direct (natural) weathering (ISO 16871)*

EN ISO 23993, *Thermal insulation products for building equipment and industrial installations - Determination of design thermal conductivity (ISO 23993)*

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

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 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
ageing factor
f_a
factor without a dimension which expresses the ageing of the insulating layer in relation to the expected service life

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
casing joint
assembled product, consisting of at least insulating material and casing, designed to protect and thermally insulate a service pipe joint

3.5
compressive creep
slow progressive strain under the influence of stresses caused by compressive forces

3.6
flexibility
ability to withstand the flexibility test

3.7
insulation layer
layer which provides the designated thermal characteristics of the pipe assembly

3.8
maximum operating temperature
exceptionally high operating temperature occurring for short periods only

3.9
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

3.10
moisture factor
f_m
factor without a dimension for the influence of moisture on the insulating layer in relation to the expected service life

Note 1 to entry: The term 'moisture' as it is used here is not identical with the term 'moisture' as it is used in prEN UUUUU (WI 00107076).

3.11
non bonded system
service pipe, insulating material and casing which are not bonded by the insulating material

3.12
operating pressure
pressure at which the cold water network is designed to operate continuously

3.13
ovality
difference between the maximum and minimum diameter at a cross section expressed as a percentage of the minimum diameter

3.14
pipe assembly
assembled product, consisting of at least one service pipe, insulating material and casing

3.15
pipe system
pipe assembly, plus service pipe fittings, casing joints, and other components like surveillance elements

3.16
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, d_n, and the nominal wall thickness, e_n

3.17
service pipe
medium carrying pipe which is in contact with cold water

3.18
single pipe system
SPS
pipe system with one service pipe

3.19
twin pipe system
TPS
pipe system with two service pipes

4 Symbols, indices and abbreviations

Table 1 — Symbols, definitions and dimensions

Symbol	Description	Unit
A	projected area of the service pipe	mm^2
d_1	inner diameter of the service pipe	mm
$d_{1,c}$	inner diameter of the service pipe at the crest of a corrugation	mm
$d_{1,t}$	inner diameter of the service pipe at the trough of a corrugation	mm
d_2	outer diameter of the service pipe	mm
$d_{2,c}$	outer diameter of the service pipe at the crest of a corrugation	mm
$d_{2,t}$	outer diameter of the service pipe at the trough of a corrugation	mm
d_3	inner diameter of the casing	mm
$d_{3,c}$	inner diameter of the casing at the crest of a corrugation	mm
$d_{3,t}$	inner diameter of the casing at the trough of a corrugation	mm

Symbol	Description	Unit
d_4	outer diameter of the casing	mm
$d_{4,c}$	outer diameter of the casing at the crest of a corrugation	mm
$d_{4,t}$	outer diameter of the casing at the trough of a corrugation	mm
F	force	N
f_a	ageing factor	/
f_{cor}	corrective factor for differences between calculated and measured thermal conductivities	/
F_{exp}	force resulting from heat expansion	N
f_m	moisture factor	/
F_{weight}	weight force	N
g	acceleration due to gravity	m/s^2
H	earth covering	m
L	length of the test specimen	m
M	mass of the pipe inclusively the water inside	kg
P_{exp}	area related load on the insulation resulting from heat expansion of the service pipe	Pa
P_{test}	test load	Pa
P_{weight}	area related load on the cross section of the test specimen of the insulation material	Pa
q	heat flow rate	W/m
q_f	radial heat flow rate for buried single pipe system in the supply pipe	W/m
q_{f+r}	radial heat flow rate for buried single pipe system in the supply and return pipe	W/m
q_r	radial heat flow rate for buried single pipe system in the return pipe	W/m
q_{TPS}	radial heat flow rate for buried twin pipe system	W/m
Q	heat flow	W
r	bending radius in the axis of the pipe	m
R	radial thermal resistance	mK/W
R_0	thermal transmittance factor from earth surface to ambient air	m^2K/W
R_{design}	design value for the radial resistance	mK/W
R_f	radial thermal resistance of the supply pipe	mK/W
R_r	radial thermal resistance of the return pipe	mK/W
R_s	radial thermal resistance of the soil	mK/W
R_{TPS}	radial thermal resistance of a twin pipe system	mK/W
s	thickness	mm

Symbol	Description	Unit
s_{STB}	thickness of test piece after load testing and temperature testing	mm
τ_{ax}	axial shear stress	MPa
t	thickness of the casing	mm
U	coefficient of heat flow	W/(mK)
U_f	coefficient of heat flow for buried single pipe system in the supply pipe	W/(mK)
U_r	coefficient of heat flow for buried single pipe system in the return pipe	W/(mK)
U_{TPS}	coefficient of heat flow in a twin pipe system	W/(mK)
Z	depth of laying distance from the centre line of the pipe to the surface	m
Z_{cor}	corrected minimum value for thermal transmittance on the surface of the earth	m
λ_{10}	thermal conductivity at 10 °C	W/(mK)
λ_C	thermal conductivity of the casing	W/(mK)
λ_{decl}	declared thermal conductivity of a pipe system	W/(mK)
λ_{design}	calculation value of the thermal conductivity of the insulation material	W/(mK)
λ_I	thermal conductivity of the insulation	W/(mK)
λ_{soil}	thermal conductivity of the soil	W/(mK)
λ_S	thermal conductivity of the service pipe	W/(mK)
ϑ_1	temperature at the inner diameter of the service pipe	K
$\vartheta_{1,f}$	temperature at the inner diameter of the service supply pipe	K
$\vartheta_{1,r}$	temperature at the inner diameter of the service return pipe	K
ϑ_2	temperature at the outer diameter of the service pipe	K
ϑ_4	temperature at the outer diameter of the casing	K
ϑ_{amb}	ambient temperature	K
ϑ_{av}	average temperature	K
ϑ_f	flow temperature	K
$\vartheta_{i,\,mean}$	mean temperature of the insulation	K
ϑ_r	return temperature	K
ϑ_s	temperature of the soil	K
Σ	compression	mm