SLOVENSKI STANDARD
SIST EN 17414-1:2020

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Cevi za daljinsko hlajenje - Tovarniško izdelani gibki cevni sistemi - 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

Ta slovenski standard je istoveten z: **EN 17414-1:2020**

ICS:

23.040.99	Drugi sestavni deli za cevovode	Other pipeline components

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EUROPEAN STANDARD
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English Version

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

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

Fernkälterohre - Werkmäßig gefertigte flexible Rohrsysteme - Teil 1: Klassifikation, allgemeine Anforderungen und Prüfung

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Contents

Page

European foreword

This document (EN 17414-1:2020) has been prepared by Technical Committee CEN/TC 107 “Prefabricated district heating and district cooling pipe system”, 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of an identical text or by endorsement, at the latest by January 2021, and conflicting national standards shall be withdrawn at the latest by January 2021.

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Introduction

Factory made flexible 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 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:

— EN 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*;

— EN 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];

— EN 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];

— 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*;

[1] Under preparation.

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

This document is intended to be used in conjunction with EN 17414-2 or EN 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. For pipe systems with plastic service pipes, the respective temperature profiles are defined in EN 17414-2 and EN 17414-3.

NOTE For the transport of other liquids, for example potable water, additional requirements could 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 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 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 17415-1:2020, *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 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)*

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

3.2
flexibility
ability to withstand the flexibility test

3.3
insulation layer
layer which provides the designated thermal characteristics of the pipe assembly

3.4
insulation material
material which reduces the heat loss

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

3.6
pipe assembly
assembled product, consisting of at least one service pipe, insulating material and casing

3.7
single pipe system
SPS
pipe system with two single service pipes (one supply pipe and one return pipe)

3.8
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

3.9
twin pipe system
TPS
pipe assembly with two service pipes in one casing

4 Symbols, indices and abbreviations

For the purposes of this document, symbols, indices and abbreviations given in Tables 1, 2 and 3 apply.

Table 1 — Symbols, definitions and dimensions

Symbol	Description	Unit
A	projected area of the service pipe (length × width)	mm^2
d_1	inner diameter of the service pipe	mm
D	actual diameter of casing, measured with circumference tape	mm
D_e	deviation of service pipe	%
D_{min}	minimum casing diameter, measured with calliper	mm
D_{max}	maximum casing diameter, measured with calliper	mm
$d_{1,p}$	inner diameter of the service pipe at the peak 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
$d_{2,p}$	outer diameter of the service pipe at the peak 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
$d_{3,p}$	inner diameter of the casing at the peak of a corrugation	mm
$d_{3,t}$	inner diameter of the casing at the trough of a corrugation	mm
d_4	outer diameter of the casing	mm
$d_{4,p}$	outer diameter of the casing at the peak 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	/

Symbol	Description	Unit
f_{cor}	correction factor for differences between calculated and measured thermal conductivities or correction factor for existing open splits, thermal bridges or change of the factor for shape caused by influence of laying in the ground and the relevant factors set up by EN ISO 23993	/
F_{exp}	force resulting from heat expansion	N
f_m	moisture factor	/
F_{weight}	force resulting from weight in N	N
g	acceleration due to gravity	m/s^2
H	soil cover above pipe	m
L	length of the test specimen	m
M	mass of the service pipe including the water inside	kg
O	ovality	%
P_{exp}	area related load on the insulation resulting from heat expansion of the service pipe	MPa
P_{test}	area related test load	MPa
P_{weight}	area related load on the cross section of the test specimen of the insulation material	MPa
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	heat flow	W
r	bending radius in the axis of the pipe	mm
R	radial thermal resistance	m·K/W
R_0	thermal resistance from earth surface to ambient air	m^2·K/W
R_{design}	design value for the radial resistance	m·K/W
R_f	radial thermal resistance of the supply pipe	m·K/W
R_r	radial thermal resistance of the return pipe	m·K/W
R_{soil}	radial thermal resistance of the soil	m·K/W
s	thickness	mm
s_i	thickness of insulation, mean value of 4 measurements at 3,6,9 and 12 o'clock position at test piece end	mm
s_{iB}	maximum thickness of the insulation	mm
s_{STB}	thickness of test piece after load testing and temperature testing	mm
τ_{ax}	axial shear stress	MPa

Symbol	Description	Unit
t	thickness of the casing	mm
U	coefficient of heat flow	W/(m·K)
U_f	coefficient of heat flow for buried single pipe system in the supply pipe	W/(m·K)
U_r	coefficient of heat flow for buried single pipe system in the return pipe	W/(m·K)
Z	depth of burial (measured to centreline of pipe assembly)	m
Z_c	corrected value of depth Z	mm
λ_{15}	thermal conductivity at 15 °C	W/(m·K)
λ_C	thermal conductivity of the casing	W/(m·K)
λ_{design}	calculation value of the thermal conductivity of the insulation material	W/(m·K)
λ_I	thermal conductivity of the insulation	W/(m·K)
λ_{soil}	thermal conductivity of the soil	W/(m·K)
λ_S	thermal conductivity of the service pipe	W/(m·K)
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_3	temperature at the inner diameter of the casing	K
ϑ_4	temperature at the outer diameter of the casing	K
ϑ_{amb}	ambient temperature	K
ϑ_f	supply temperature	K
$\vartheta_{i,\,mean}$	mean temperature of the insulation	K
ϑ_r	return temperature	K
Σ	compression of the thermal insulation	%

Table 2 — Indices

Symbol	Definition
0	thermal transmittance (from earth surface to ambient air)
1	position at the inner diameter of the service pipe
2	position at the outer diameter of the service pipe
3	position at the inner diameter of the casing
4	position at the outer diameter of the casing
15	at 15 °C
a	ageing
amb	ambient
C	casing
cor	corrective
design	design
exp	expansion
f	flow (supply)
I	insulation
m	moisture
mean	mean
min	minutes
p	peak of corrugation
r	return
s	service pipe
soil	soil
STB	stability
t	trough of a corrugation
test	test
weight	weight
x	placeholder for 1, 2, 3 or 4