



SLOVENSKI STANDARD
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Design and installation of preinsulated bonded pipe systems for district heating

Berechnung und Verlegung von werkmäßig gedämmten Verbundmantelrohren für die Fernwärme

Conception et installation des systemes bloqués de tuyaux pré-isolés pour les réseaux enterrés d'eau chaude

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ICS:

91.140.10	Sistemi centralnega ogrevanja	Central heating systems
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Design and installation of preinsulated bonded pipe systems for district heating

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Berechnung und Verlegung von werkmäßig gedämmten Verbundmantelrohren für die Fernwärme

This European Standard was approved by CEN on 27 December 2002.

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

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EN 13941:2003 (E)**Foreword**

This document (EN 13941:2003) has been prepared by Technical Committee CEN/TC 107 "Prefabricated district heating 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of an identical text or by endorsement, at the latest by September 2003, and conflicting national standards shall be withdrawn at the latest by September 2003.

Annex A is normative. Annexes B, C and D are informative.

This document includes a Bibliography.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

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Introduction

This standard has been prepared by JWG1, a joint working group with CEN/TC 267 "Industrial piping and pipelines"

According to the scope from CEN/TC 107

- The task of CEN/TC107/TC267/JWG1 is to specify rules for design, calculation and installation for preinsulated bonded pipe systems for underground hot water networks with pipe assemblies co-ordinated with EN 253, EN 448, EN 488 and EN 489.
- CEN/TC107/TC267/JWG1 can also specify rules for functional tests for preinsulated bonded pipe systems for underground hot water networks.
- The basic rules for design, calculation and installation should be based on functional requirements.
- The purpose of the work is to provide uniform basis for the design, construction and operation of district heating systems, to ensure that the system is reliable and efficient and safe for the surrounding area, the environment and public health.
- Joint assemblies for pipe systems dealt with should be co-ordinated with EN 489.

This standard takes account of experience acquired, of new knowledge available of the behaviour of material and of distribution of stresses and allowable deformations and also evolution in installation techniques.

When use is made of the standard, the different sections of which it is made up are interdependent and, because of this, cannot therefore be dissociated.

The standard consists of a main part and four annexes.

Depending on the character of the individual clauses, distinction is made in this standard between Principles and Application Rules.

The principles comprise:

- general statements, definitions and requirements, for which there is no alternative, as well as
- requirements and analytical models for which no alternative is permitted unless specifically stated.

The principles are printed in normal typeface (10 point font).

The application rules are generally recognised rules, which follow the principles and satisfy their requirements.

Application rule:

The application rules and comments to principles and application rules are printed in a 8 point font. This is an application rule.

Alternative design rules can be used instead of the application rules given in this standard, provided that it is shown that the alternative rule accords with the relevant principles and it is at least equivalent with regard to the resistance, serviceability and durability achieved by the system.

Annex A is part of the standard (principles). Annexes B, C and D have status as application rules.

This standard contains a number of requirements aimed at ensuring the sound execution of distribution networks for district heating. To the extent possible, the requirements specified in this standard are functional requirements.

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The requirements and regulations contained in this standard should be assessed and applied in compliance with the intentions of the standard and in due consideration of the development taking place in the field it concerns. It is therefore assumed that the user of the standard has the requisite technical insight and that the user of the standard has adequate knowledge of legal and other external regulations that are of consequence to the practical application of the standard.

Special cases can occur within the scope of this standard in which its contents do not cover. An evaluation whether the contents cover should be made in any specific case where the standard is used.

Presently CEN/TC 107 "Pre-fabricated district heating pipe systems" is preparing standards for preinsulated flexible pipes and surveillance systems.

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1 Scope

This European Standard specifies rules for design, calculation and installation for preinsulated bonded pipe systems for buried hot water distribution and transmission networks, see. Figure 2, with pipe assemblies in accordance with EN 253, for continuous operation with hot water at various temperatures up to 120 °C and occasionally with peak temperatures up to 140 °C and maximum internal pressure 25 bar (overpressure).

Application rule:

For larger pipe dimensions and pressures below 25 bar wall thickness bigger than specified in EN 253 can be required for straight pipes, bends and tees.

The principles of the standard can be applied to preinsulated pipe systems with pressures higher than 25 bar, provided that special attention is paid to the effects of pressure. Adjacent pipes belonging to the network (e.g. pipes in ducts, valve chambers, road crossings above ground etc.) can be designed and installed according to this standard.

The standard assumes use of treated water, which by softening, demineralisation, deaeration, adding of chemicals, or otherwise has been treated to prevent internal corrosion and deposits in the pipes.

This standard is not applicable for such units as

- pumps,
- exchangers,
- boiler installations, tank installations,
- consumer installations.

However, the full functional ability and durability of such units should be ensured in consideration of the impacts from the district heating system and other impacts occurring from the conditions under which they have been installed.

Guidelines for product quality inspection and in situ tests of joints are given in annex A of EN 448:2003, annex D of EN 253:2003, annex A of EN 488:2003 and annex B of EN 489:2003.

Guidelines for welding of polyethylene casing are given in annex B of EN 448:2003.

The estimation of expected life with continuous operation at various temperatures is outlined in annex B of EN 253:2003

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 253	2003	<i>District heating pipes – Preinsulated bonded pipe systems for directly buried hot water networks – Pipe assembly of steel service pipe, polyurethane thermal insulation and outer casing of polyethylene.</i>
EN 287-1		<i>Approval testing of welders – Fusion welding – Part 1: Steels.</i>
EN 288-1	1992	<i>Specification and qualification of welding procedures for metallic materials – Part 1: General rules for fusion welding.</i>
EN 288-2		<i>Specification and approval of welding procedures for metallic materials – Part 2: Welding procedure specification for arc welding.</i>
EN 288-3		<i>Specification and approval of welding procedures for metallic materials – Part 3: Welding procedure tests for the arc welding of steels.</i>
EN 444		<i>Non-destructive testing - General principles for radiographic examination of metallic materials by X- and gamma-rays.</i>

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EN 448	2003	<i>District heating pipes – Preinsulated bonded pipe systems for directly buried hot water networks – Fitting assemblies of steel service pipes, polyurethane thermal insulation and outer casing of polyethylene.</i>
EN 488	2003	<i>District heating pipes – Preinsulated bonded pipe systems for directly buried hot water networks – Steel valve assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene.</i>
EN 489	2003	<i>District heating pipes – Preinsulated bonded pipe systems for directly buried hot water networks – Joint assembly for steel service pipes, polyurethane thermal insulation and outer casing of polyethylene.</i>
EN 571-1		<i>Non destructive testing - Penetrant testing - Part 1: General principles.</i>
EN 583-1		<i>Non-destructive testing - Ultrasonic examination - Part 1: General principles.</i>
EN 719	1994	<i>Welding coordination – Tasks and responsibilities.</i>
EN 729-1		<i>Quality requirements for welding – Fusion welding of metallic materials – Part 1: Guidelines for selection and use.</i>
EN 729-2		<i>Quality requirements for welding – Fusion welding of metallic materials – Part 2: Comprehensive quality requirements.</i>
EN 729-3		<i>Quality requirements for welding – Fusion welding of metallic materials – Part 3: Standard quality requirements.</i>
EN 729-4		<i>Quality requirements for welding - Fusion welding of metallic materials - Part 4: Elementary quality requirements.</i>
EN 970		<i>Non-destructive examination of fusion welds - Visual examination.</i>
EN 1289		<i>Non-destructive examination of welds - Penetrant testing of welds - Acceptance levels.</i>
EN 1290		<i>Non-destructive examination of welds - Magnetic particle examination of welds</i>
EN 1291		<i>Non-destructive examination of welds - Magnetic particle testing of welds - Acceptance levels.</i>
EN 1418		<i>Welding personnel - Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials.</i>
EN 1435		<i>Non-destructive examination of welds - Radiographic examination of welded joints.</i>
EN 1594		<i>Gas supply systems - Pipelines for maximum operating pressure over 16 bar – Functional requirements.</i>
EN 1712		<i>Non-destructive examination of welds - Ultrasonic examination of welded joints - Acceptance levels.</i>
EN 1714		<i>Non-destructive examination of welds - Ultrasonic examination of welded joints.</i>
EN 10204		<i>Metallic products – Types of inspection documents.</i>
EN 10216-2		<i>Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties.</i>

EN 10217-2		<i>Welded steel tubes for pressure purposes - Technical delivery conditions – Part 2: Electric welded non-alloy and alloy steel tubes with specified elevated temperature properties.</i>
EN 10217-5		<i>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.</i>
EN 13018		<i>Non-destructive testing - Visual testing - General principles.</i>
EN 25817		<i>Arc-welded joints in steel – Guidance on quality levels for imperfections (ISO 5817:1992).</i>
EN 29692		<i>Metal-arc welding with covered electrode, gas-shielded metal-arc welding and gas welding – Joint preparations for steel (ISO 9692:1992).</i>
ISO 1000		<i>SI units and recommendations for the use of their multiples and of certain other units.</i>
ISO 3419		<i>Non-alloy and alloy steel butt-welding fittings.</i>
ISO/TR 15608	2000	<i>Welding - Guidelines for a metallic material grouping system (ISO/TR 15608:2000).</i>

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3 Units and symbols

3.1 Units

The unit system applied in this standard is the SI system (Système International d'Unités), see ISO 1000 and others.

The following units and their multiples are used:

Length	m	(metre)
	mm	(millimetre)
Mass	kg	(kilogram)
Force	N	(Newton)
Stress	N/mm ²	(Newton per square millimetre)
Pressure	Pa	(Pascal = Newton per square metre)

Other units applied:

Temperature	°C	(degree centigrade)
Pressure	bar	(1 bar = 10 ⁵ Pa = 0,1 N/mm ²)

3.2 Symbol

<i>A</i>	Area
<i>c</i>	Cohesion of the soil, fabrication tolerance
<i>D</i>	Diameter of casing
<i>d</i>	Diameter of service pipe
<i>E</i>	Modulus of elasticity
<i>F</i>	Friction force
<i>f</i>	Design stress, friction force per area unit, deflection
<i>G</i>	Selfweight
<i>I</i>	Momentum of inertia
<i>i</i>	Stress intensification factor
<i>L</i>	Friction length
<i>l</i>	Length
<i>M</i>	Bending moment
<i>N</i>	Normal force, number of full action cycles
<i>n</i>	Number
<i>p</i>	Internal pressure
<i>R_e</i>	Specified minimum upper yield strength
<i>R_m</i>	Tensile strength
<i>R</i>	Bend radius
<i>r</i>	Pipe radius
<i>T</i>	Temperature
<i>t</i>	Pipe wall thickness
<i>W</i>	Section modulus
<i>Z</i>	Depth of burial (measured to centreline of pipe)
<i>α</i>	Coefficient of thermal expansion
<i>γ</i>	Specific gravity, partial safety coefficient
<i>δ</i>	Friction angle between pipe and soil, displacement from thermal expansion
<i>ε</i>	Strain
<i>θ</i>	Angle
<i>λ</i>	Coefficient of thermal conductivity
<i>μ</i>	Coefficient of friction between pipe and soil
<i>ρ</i>	Density
<i>σ</i>	Normal stress
<i>τ</i>	Shear stress

ν	Poisson's ratio
φ	Internal friction angle of soil

Indices

a	Action
b	Branch pipe (at tee connections)
c	Casing
d	Design
fat	Fatigue
i	Inner, inside
j	Reference
m	Mean, membrane, material
min	Minimum
n	Nominal, number (of fatigue cycles)
o	Outer, outside
r	Run pipe (at tees)
res	Resulting
u	Fracture
v	Vertical

Separate symbol lists are found in annex A, B and C.

4 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 253:2003 and the following apply.

4.1

action

set of concentrated or distributed forces acting on the pipe system (force-controlled action), or the cause of imposed or constrained deformations in the system (displacement-controlled action). Actions are often referred to as "loads"

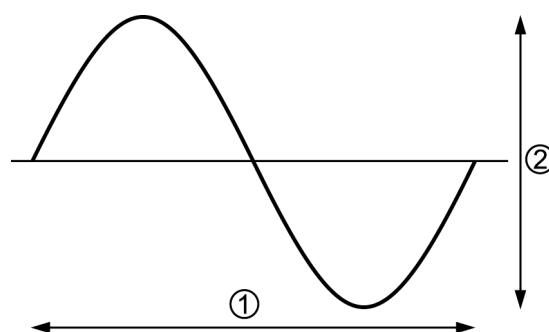
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4.2

action cycle

one action cycle is one impact with a given stress range. An action cycle comprises one full action course (which is twice the action amplitude calculated from an average value)

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Key

- 1 One action cycle
- 2 Temperature or stress range

Figure 1 - Action cycle