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Naļrtovanje in vgradnja izoliranih vezanih cevnih sistemov za daljinsko ogrevanje

Design and installation of preinsulated bonded pipe systems for district heating

Auslegung und Installation von werkmäßig gedämmten Verbundmantelrohren für die Fernwärme

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

Ta slovenski standard je istoveten z: EN 13941:2009

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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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 13941:2009) 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of an identical text or by endorsement, at the latest by January 2010, and conflicting national standards shall be withdrawn at the latest by January 2010.

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This document supersedes EN 13941:2003.

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Introduction

The 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/TC 107/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/TC 107/TC267/JWG1 may 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 must be interpreted as being interdependent and, because of this, cannot 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.

It is permissible to use alternative design rules from 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.

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 may occur within the scope of this standard in which its contents do not cover. An evaluation whether the contents cover shall 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.

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 (cf. 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:

a) pumps,

b) exchangers,

c) boiler installations, tank installations,

d) 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 448:2009, Annex D of EN 253:2009, Annex A of EN 488:2009 and Annex B of EN 489:2009.

Guidelines for welding of polyethylene casing are given in Annex B of EN 448:2009.

The estimation of expected life with continuous operation at various temperatures is outlined in Annex B of EN 253:2009.

2 Normative references

The following referenced documents are indispensable for the application 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 253:2009, *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*

EN 287-1, *Qualification test of welders – Fusion welding – Part 1: Steels*

EN 444, *Non-destructive testing – General principles for radiographic examination of metallic materials by X- and gamma-rays*

EN 448:2009, *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*

EN 473, *Non-destructive testing – Qualification and certification of NDT personnel – General principles*

EN 488, *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*

EN 489:2009, *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*

EN 571-1, *Non destructive testing – Penetrant testing – Part 1: General principles*

EN 583-1, *Non-destructive testing – Ultrasonic examination – Part 1: General principles*

EN 970, *Non-destructive examination of fusion welds – Visual examination*

EN 1289, *Non-destructive examination of welds – Penetrant testing of welds – Acceptance levels*

EN 1290, *Non-destructive examination of welds – Magnetic particle examination of welds*

EN 1291, *Non-destructive examination of welds – Magnetic particle testing of welds – Acceptance levels*

EN 1418, *Welding personnel – Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials*

EN 1435, *Non-destructive examination of welds – Radiographic examination of welded joints*

EN 1712, *Non-destructive examination of welds – Ultrasonic examination of welded joints – Acceptance levels*

EN 1714, *Non-destructive examination of welds – Ultrasonic examination of welded joints*

EN 10204, *Metallic products – Types of inspection documents*

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, *Welded steel tubes for pressure purposes – Technical delivery conditions – Part 1: 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 13018, *Non-destructive testing – Visual testing – General principles*

EN 13480-3:2002, *Metallic industrial piping – Part 3: Design and calculation*

EN 25817:1992, *Arc-welded joints in steel – Guidance on quality levels for imperfections (ISO 5817:1992)*

EN ISO 3834-1, *Quality requirements for fusion welding of metallic materials – Part 1: Criteria for the selection of the appropriate level of quality requirements (ISO 3834-1:2005)*

EN ISO 3834-2, *Quality requirements for fusion welding of metallic materials – Part 2: Comprehensive quality requirements (ISO 3834-2:2005)*

EN ISO 3834-3, *Quality requirements for fusion welding of metallic materials – Part 3: Standard quality requirements (ISO 3834-3:2005)*

EN ISO 3834-4, *Quality requirements for fusion welding of metallic materials – Part 4: Elementary quality requirements (ISO 3834-4:2005)*

EN ISO 9692-2, *Welding and allied processes – Joint preparation – Part 2: Submerged arc welding of steels (ISO 9692-2:1998)*

EN ISO 14731:2006, *Welding coordination – Tasks and responsibilities (ISO 14731:2006)*

EN ISO 15607:2003, *Specification and qualification of welding procedures for metallic materials – General rules (ISO 15607:2003)*

EN ISO 15609-1, *Specification and qualification of welding procedures for metallic materials – Welding procedure specification – Part 1: Arc welding (ISO 15609-1:2004)*

EN ISO 15614-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure test – Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1:2004)*

ISO 1000, *SI units and recommendations for the use of their multiples and of certain other units*

ISO 3419, *Non-alloy and alloy steel butt-welding fittings*

ISO/TR 15608:2000, *Welding – Guidelines for a metallic materials grouping system*

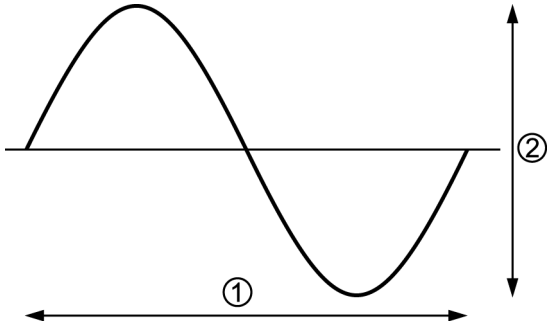
3 Terms and definitions, units and symbols

3.1 Terms and definitions

For the purpose of this European Standard, the terms and definitions given in EN 253:2009 and the following apply.

3.1.1
action
set of concentrated or distributed forces acting on the pipe system (force-controlled action), or cause of imposed or constrained deformations in the system (displacement-controlled action). Actions are often referred to as “loads”.

3.1.2
action cycle
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).



Key
1 One action cycle
2 Temperature or stress range

Figure 1 — Action cycle

3.1.3
bonded system
system consisting of a service pipe, insulating material and casing, which are bonded by the insulating material

3.1.4
cold installed preinsulated bonded pipes
district heating systems where the pipes are installed and taken into operation without prior pre-stressing by pre-heating

3.1.5
creep
slow progressive strain under the influence of stresses

3.1.6
design pressure
internal pressure equal to or greater than the maximum operating pressure at any point of the pipeline acting in a component or pipe section multiplied by a partial safety factor

3.1.7
design temperature
maximum temperature used for the design of a component or pipe section

3.1.8
displacement-controlled action
action called forth by enforced deformation or movement, e.g. thermal expansion or settling

3.1.9
distribution pipeline
pipeline leading from place of production or transmission line to heating installations. Distribution mains are primarily main pipelines or house service connections, see figure 2.

3.1.10
ductile materials
materials which with good approximation are linearly elastic up to the yield stress or to the 0,2% proof stress, and which have a minimum elongation at rupture of 14 %

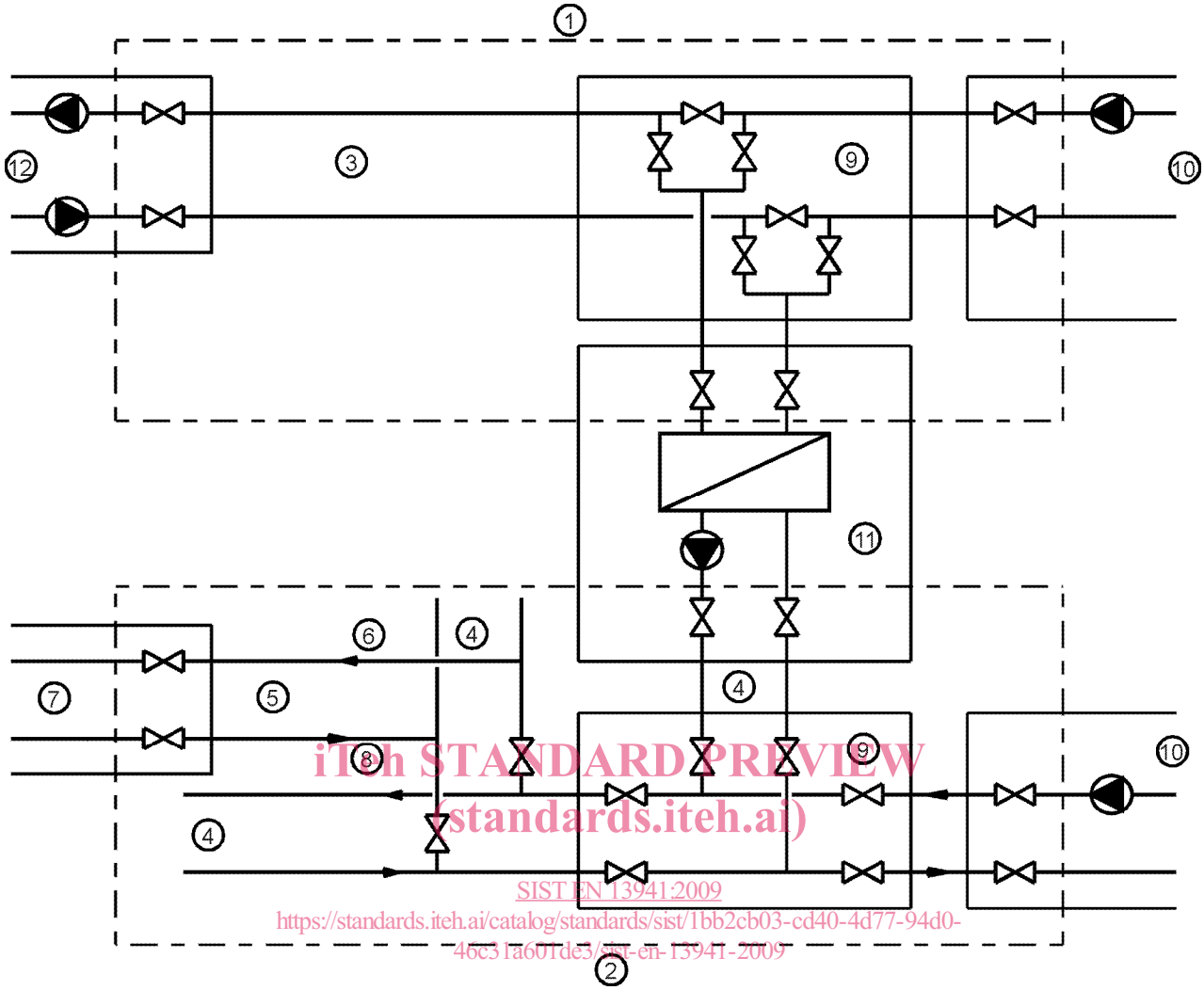
3.1.11
extruded tees
tees manufactured by drawing a collar on which the branch pipe is welded. The collar is welded onto a transitional piece with increased wall thickness, so that the local stress intensification for the tee is reduced before the straight pipe with normal wall thickness.

3.1.12
fabricated tees
tees manufactured by welding a branch pipe directly onto a run pipe

3.1.13
fatigue strength
stress range of constant magnitude which, under given circumstances, just causes fatigue failure

3.1.14
force-controlled action
action which maintains its size irrespectively of the deformation of the structure, e.g. pressure and weight

3.1.15
house service connection
pipeline leading from main pipeline to one consumer installation, see figure 2.



Key
1 Transmission system
2 Distribution system
3 Transmission pipe
4 Main pipe
5 House service connection
6 Supply pipe
7 Consumer
8 Return pipe
9 Valve chamber
10 Heat production
11 Heat exchanger station
12 Pump station

Figure 2 — Distribution and transmission systems

3.1.16
installation temperature
temperature arising from the ambient conditions during laying or installation, prevalent at the time when action is taken

3.1.17
main pipeline
pipeline supplying several heating installations. See figure 2.

3.1.18
number of equivalent full action cycles
number of action cycles with constant full action range calculated from a known or presupposed temperature history using Palmgren-Miner's formula and the respective SN-curve

3.1.19
operating pressure
maximum internal pressure acting against the pipe wall at any point or in any section of the pipeline at a given operating temperature

Application rule:

This is generally the internal pressure needed to take account of the static head, friction losses and required outlet pressure.

3.1.20
operating temperature
water temperature in a component or pipe section during specified operating conditions

3.1.21
pre-heated system
system which, after being assembled, but before backfilling, is heated to a pre-heating temperature allowing the system to expand without introducing additional stresses

3.1.22
preinsulated systems
systems assembled at site consisting of prefabricated pipe elements and components with integrated protective casing, insulation and service pipe

3.1.23
pressure
over-pressure or sub-pressure as compared to normal atmospheric pressure. Unless otherwise indicated, pressure refers to gauge pressure.

3.1.24
pre-stressing temperature
temperature applied during pre-stressing of a pre-heated system

Application rule:

The pre-heating temperature is chosen such as approximately average axial stress is obtained, compared to the axial stress levels at ambient temperature and maximum operating temperature.

3.1.25
reference stress
stress calculated (with sign) from the membrane or resulting stresses by Tresca or by von Mises' formula

Application rule:

The formulae are presented in 6.4.3.

3.1.26
resulting stresses
all stresses occurring in one point, i.e. membrane stresses plus stresses varying over the wall thickness

3.1.27
service life
span of time during which the network is expected to function without major replacements, given normal maintenance and operation conditions as described in the project