
Cevi za daljinsko ogrevanje - Izolirani vezani cevni sistemi za podzemeljska toplovodna omrežja - Sestav fittingov jeklenih cevi, poliuretanske toplotne izolacije in zunanjega polietilenskega plašča

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

Fernwärmerohre - Werkmäßig gedämmte Verbundmantelrohrsysteme für direkt erdverlegte Fernwärmenetze - Verbundformstücke, bestehend aus Stahl-Mediumrohr, Polyurethan-Wärmedämmung und Außenmantel aus Polyethylen

Tuyaux de chauffage urbain - Systèmes bloqués de tuyaux préisolés pour les réseaux enterrés d'eau chaude - Raccords préisolés, tubes de service en acier, isolation thermique en polyuréthane et tube de protection en polyéthylène

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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

Tuyaux de chauffage urbain - Systèmes bloqués de tuyaux préisolés pour des réseaux d'eau chaude enterrés directement - Raccords préisolés pour tubes de service en acier, isolation thermique en polyuréthane et tube de protection en polyéthylène

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This European Standard was approved by CEN on 5 September 2015.

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CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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EN 448:2015 (E)**European foreword**

This document (EN 448:2015) 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of an identical text or by endorsement, at the latest by May 2016, and conflicting national standards shall be withdrawn at the latest by May 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 448:2009.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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Introduction

EN 448 has been aligned with EN 488 and other relevant European Standards.

Other standards from CEN/TC 107 are:

- EN 253, *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 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, *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 13941, *Design and installation of preinsulated bonded pipe systems for district heating;*
- EN 14419, *District heating pipes — Preinsulated bonded pipe systems for directly buried hot water networks — Surveillance systems;*
- EN 15632 (all parts), *District heating pipes — Pre-insulated flexible pipe systems;*
- EN 15698-1, *District heating pipes — Preinsulated bonded twin pipe systems for directly buried hot water networks — Part 1: Twin pipe assembly of steel service pipe, polyurethane thermal insulation and outer casing of polyethylene;*
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- EN 15698-2, *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 448:2015 (E)**1 Scope**

This European Standard specifies requirements and test methods for fittings of prefabricated thermally insulated pipe-in-pipe assemblies comprising a steel service fitting from DN 20 to DN 1200, rigid polyurethane foam insulation and an outer casing of polyethylene for use in directly buried hot water networks with preinsulated pipe assemblies in accordance with EN 253.

This European Standard covers the following fittings: bend, tee, reducer, single use compensator and anchor.

This European Standard applies only to factory made prefabricated fitting assemblies and single use compensators for continuous operation with hot water at various temperatures in accordance with EN 253.

This European Standard applies to fitting assemblies with a minimum design pressure of 16 bar (overpressure) complying with EN 13941.

This European Standard does not include calculation rules for loads and stresses. The design and installation rules, for the system, are given in EN 13941.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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+A2:2015, *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*

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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*

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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 10253-2, *Butt-welding pipe fittings — Part 2: Non alloy and ferritic alloy steels with specific inspection requirements*

EN 12814-1, *Testing of welded joints of thermoplastics semi-finished products — Part 1: Bend test*

EN 13018, *Non-destructive testing — Visual testing — General principles*

EN 13941, *Design and installation of preinsulated bonded pipe systems for district heating*

EN 14419:2009, *District heating pipes — Preinsulated bonded pipe systems for directly buried hot water networks — Surveillance systems*

EN 14870-1, *Petroleum and natural gas industries — Induction bends, fittings and flanges for pipeline transportation systems — Part 1: Induction bends (ISO 15590-1:2009 modified)*

- EN ISO 3452-1, *Non-destructive testing — Penetrant testing — Part 1: General principles (ISO 3452-1)*
- EN ISO 5579, *Non-destructive testing — Radiographic testing of metallic materials using film and X- or gamma rays — Basic rules (ISO 5579)*
- EN ISO 5817, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections (ISO 5817)*
- 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 9606-1, *Qualification testing of welders — Fusion welding — Part 1: Steels (ISO 9606-1)*
- EN ISO 9692-1:2013, *Welding and allied processes — Types of joint preparation — Part 1: Manual metal arc welding, gas-shielded metal arc welding, gas welding, TIG welding and beam welding of steels (ISO 9692-1:2013)*
- EN ISO 9934-1, *Non-destructive testing — Magnetic particle testing — Part 1: General principles (ISO 9934-1)*
- EN ISO 10675-1, *Non-destructive testing of welds — Acceptance levels for radiographic testing — Part 1: Steel, nickel, titanium and their alloys (ISO 10675-1)*
- EN ISO 11666, *Non-destructive testing of welds — Ultrasonic testing — Acceptance levels (ISO 11666)*
- EN ISO 14732, *Welding personnel — Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials (ISO 14732)*
- EN ISO 15607, *Specification and qualification of welding procedures for metallic materials — General rules (ISO 15607)*
- EN ISO 16810, *Non-destructive testing — Ultrasonic testing — General principles (ISO 16810)*
- EN ISO 17636-1, *Non-destructive testing of welds — Radiographic testing — Part 1: X- and gamma-ray techniques with film (ISO 17636-1)*
- EN ISO 17636-2, *Non-destructive testing of welds — Radiographic testing — Part 2: X- and gamma-ray techniques with digital detectors (ISO 17636-2)*
- EN ISO 17637, *Non-destructive testing of welds — Visual testing of fusion-welded joints (ISO 17637)*
- EN ISO 17638, *Non-destructive testing of welds — Magnetic particle testing (ISO 17638)*
- EN ISO 17640, *Non-destructive testing of welds — Ultrasonic testing — Techniques, testing levels, and assessment (ISO 17640)*
- EN ISO 23277, *Non-destructive testing of welds — Penetrant testing — Acceptance levels (ISO 23277)*
- EN ISO 23278, *Non-destructive testing of welds — Magnetic particle testing — Acceptance levels (ISO 23278)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 253:2009+A2:2015 and the following apply.

3.1

anchor

construction used to transfer the loads from the steel service pipe through the insulation and the casing to a fixed point

3.2

bending angle

α

deviation in direction of the steel pipe centre lines

3.3

butt welded bend

bend manufactured either by hot bending of steel pipe or by hot forming of steel plates which are subsequently welded together

3.4

cold formed bend

bend manufactured by cold bending of steel pipe

3.5

cap

not pre-insulated butt welded fitting to be welded on the end of a pipe or fitting

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3.6

fitting

reducer, tee, factory-made elbow and bend, cap, welding stub, mechanical joint

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3.7

forged T-piece

T-piece manufactured by hot forming of either steel pipes or steel plates which are subsequently welded together

3.8

hot formed bend

bend manufactured by heating pipe during bending

3.9

induction bend

bend manufactured by induction bending

3.10

induction bending

continuous bending process which utilizes induction heating to create a narrow, circumferential, heated band around the material being bent

3.11

nominal size, DN

alphanumeric designation of size, common to components in piping systems which are used for reference purposes

[SOURCE: EN ISO 6708:1995, 2.1, modified]

3.12**pipe element**

reducer, tee, factory-made elbow and bend, flange, cap, welding stub, mechanical joint

3.13**reducer**

butt welding fitting to be welded between two steel pipes of different diameters

3.14**single use compensator****SUC**

compensator functioning during pre-heating, but being locked after pre-heating

NOTE Single use compensators are not preinsulated units.

3.15**surveillance system**

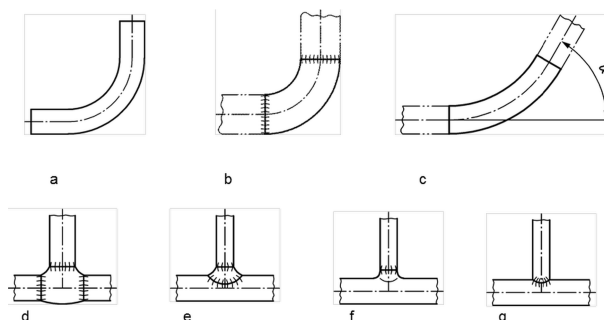
system that consists of measuring sections and measuring instruments for surveillance of pipe systems according to EN 14419:2009

3.16**welded tee**

butt welding fitting manufactured by welding together pieces of steel pipes with or without the use of a welding saddle or a drawn collar on the main pipe

3.17**welding saddle**

butt welding fitting to be welded into the main pipe for the welded connection between the main pipe and the branch pipe in a T-piece

**Key**

- | | | | |
|---|-----------------------------|---|-------------------------|
| a | cold or hot formed bends | e | tee with welding saddle |
| b | butt welding bend or elbows | f | tee with drawn collar |
| c | bending angle, α | g | directly welded tee |
| d | forged tee | | |

Figure 1 — Examples

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4 Requirements

4.1 Steel parts

4.1.1 General

The material of the fitting steel parts shall be certified in accordance with EN 10204. If traceability on material is required by the end user it shall be specified at the time of ordering. Corresponding material certificates shall be delivered to the end user if specified at the time of ordering.

4.1.2 Quality

The quality of pipe material used for the assembly of fittings shall be in accordance with EN 253:2009+A2:2015, Table 1. The quality of butt welding pipe fittings shall be in accordance with EN 10253-2.

NOTE For Sweden, a deviating situation is applicable for EN 253:2009+A2:2015, Table 1 (see the A-deviation in EN 253:2009+A2:2015, Annex G).

4.1.3 Wall thickness and diameter

According to the scope of this European Standard, all components shall be designed for a minimum of 16 bar.

NOTE If the fitting assemblies have to be used in situations with pressures higher than 16 bar, extra calculations will be necessary.

The minimum nominal wall thickness of all components shall prior to processing be at least the same as for the straight pipes.

The nominal diameter, the outside diameter and the minimum nominal wall thickness shall be the same as for the straight pipes in accordance with EN 253:2009+A2:2015, Table 2. The tolerances on the outside diameter of the pipe ends shall be in accordance with EN 253:2009+A2:2015, Table 3.

Subject to design considerations other wall thicknesses than those given in EN 253:2009+A2:2015, Table 2 may be used, but in no case shall these be less than the minima indicated in EN 253:2009+A2:2015, Table 2.

All components shall be designed in accordance with EN 13941, for the actions and stresses that normally occur during a system's entire service life.

4.1.4 Bends

4.1.4.1 Butt welding bends

The dimensions shall be in accordance with EN 10253-2 with the exception that the bend radius shall be $\geq 1,5$ times the outer diameter.

4.1.4.2 Cold formed bends

Cold formed bends shall be produced from seamless pipe or longitudinal welded pipes. At cold formed bends made of longitudinal welded pipes the weld bead shall be welded to factor $V = 1$ (calculation stress = 100 %).

After bending, the minimum wall thickness of the bent pipe shall be not less than 85 % of the nominal wall thickness of the straight pipe (see EN 253:2009+A2:2015, Table 2).

The maximum ovality in the bent area shall not exceed 6 %.

The formula for the calculation of the ovality is:

$$o = \frac{(D_{s\max} - D_{s\min})}{D_s} \times 100 \quad (1)$$

where