SLOVENSKI STANDARD
SIST EN 448:2020

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Nadomešča:
SIST EN 448:2016

Cevi za daljinsko ogrevanje - Poviti enocevni sistemi za neposredno vkopana vročevodna omrežja - Tovarniško izdelana armatura iz jeklenih delovnih cevi, obdanih s poliuretansko toplotno izolacijo in zaščitnim plaščem iz polietilena

District heating pipes - Bonded single pipe systems for directly buried hot water networks - Factory made fitting assemblies of steel service pipes, polyurethane thermal insulation and a 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 monotubes pour des réseaux d'eau chaude enterrés directement - Assemblages de raccords manufacturés pour tubes de service en acier, isolation thermique en polyuréthane et tube de protection en polyéthylène

Ta slovenski standard je istoveten z: **EN 448:2019**

ICS:

23.040.07	Cevovodi za daljinsko ogrevanje in njihovi deli	Pipeline and its parts for district heat
23.040.40	Kovinski fitingi	Metal fittings
91.140.65	Oprema za ogrevanje vode	Water heating equipment

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EUROPEAN STANDARD

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EN 448

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English Version

District heating pipes - Bonded single pipe systems for directly buried hot water networks - Factory made fitting assemblies of steel service pipes, polyurethane thermal insulation and a casing of polyethylene

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

Fernwärmerohre - Verbund-Rohrsysteme mit einem Mediumrohr für direkt erdverlegte Fernwärmenetze - Werkmäßig hergestellte Formstücke bestehend aus Stahl-Mediumrohren, einer Wärmedämmung aus Polyurethan und einer Ummantelung aus Polyethylen

This European Standard was approved by CEN on 12 August 2019.

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

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European foreword

This document (EN 448:2019) 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 April 2020, and conflicting national standards shall be withdrawn at the latest by April 2020.

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

This document supersedes EN 448:2015.

In comparison with the previous edition, the main changes in EN 448:2019 are:

— editorial changes to the new structure of standards prepared by the Technical Committee CEN/TC 107.

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

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 — Bonded single pipe systems for directly buried hot water networks — Factory made pipe assembly of steel service pipe, polyurethane thermal insulation and a casing of polyethylene*;

— EN 488, *District heating pipes — Bonded single pipe systems for directly buried hot water networks — Factory made steel valve assembly for steel service pipes, polyurethane thermal insulation and a casing of polyethylene* ;

— 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 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 13941-2, *District heating pipes — Design and installation of thermal insulated bonded single and twin pipe systems for directly buried hot water networks — Part 2: Installation*;

— EN 14419, *District heating pipes — Bonded single and twin 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 — Bonded twin pipe systems for directly buried hot water networks — Part 1: Factory made twin pipe assembly of steel service pipes, polyurethane thermal insulation and one casing of polyethylene* ;

— EN 15698-2, *District heating pipes — Bonded twin pipe systems for directly buried hot water networks — Part 2: Factory made fitting and valve assemblies of steel service pipes, polyurethane thermal insulation and one casing of polyethylene*

— EN 17248, *District heating and district cooling pipe systems — Terms and definitions.*

1 Scope

This document specifies requirements and test methods for factory made thermally insulated bonded fitting assemblies for hot water networks in accordance with EN 13941-1, comprising a steel service fitting, rigid polyurethane foam thermal insulation and a casing of polyethylene.

The fitting assembly could also include the following additional elements: measuring wires, spacers and diffusion barriers.

This document covers the following fitting assemblies: bend, tee, reducer, single use compensator and anchor.

This document applies to fitting assemblies with a minimum design pressure of 1,6 MPa (overpressure).

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 253, *District heating pipes — Bonded single pipe systems for directly buried hot water networks — Factory made pipe assembly of steel service pipe, polyurethane thermal insulation and a casing of polyethylene*

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 10217-2, *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 13941-1, *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 13941-2, *District heating pipes — Design and installation of thermal insulated bonded single and twin pipe systems for directly buried hot water networks — Part 2: Installation*

EN 14419, *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)*

EN 17248, *District heating and district cooling pipe systems — Terms and definitions*

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)*

ISO 6761, *Steel tubes — Preparation of ends of tubes and fittings for welding*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in EN 17248 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

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 Specification

Steel grades are specified in EN 13941-1.

All steel pipes and components used for manufacturing of pipe assemblies under the scope of this document shall as a minimum be delivered to the manufacturer with an inspection certificate 3.1 according to EN 10204. The inspection certificate shall on request be passed on to the customer.

In case a material related inspection certificate 3.1 according to EN 10204 is required by the client who orders the fitting assemblies, this request shall be given whilst placing the order with the manufacturer of the fitting assemblies.

Any later request for provision of such documentation can be too late and can possibly not be met by the manufacturer, since the manufacturer shall organize the assignment of 3.1 certificates to pipes and part of pipes before starting the production.

4.1.3 Wall thickness and diameter

According to the scope of this document, all components shall be designed for a minimum of 1,6 MPa.

If the fitting assemblies shall be used in situations with pressures higher than 1,6 MPa, 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 service pipes regarding EN 253.

The nominal diameter, the outside diameter, the tolerances on the diameter of the pipe ends and the wall thickness shall be the same as for the service pipes in accordance with EN 253.

Subject to design considerations other wall thicknesses than those given in EN 253 may be used, but in no case shall these be less than the minima indicated in EN 253.

All components shall be designed in accordance with EN 13941-1, for the actions and stresses that normally occur during the service life of the fitting assembly (or of the component).

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 ≥ 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 wall thickness of the straight pipe (see EN 253).

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

The formula for the calculation of the ovality is:

$$0 = \frac{D_{s,\max} - D_{s,\min}}{D_s} \times 100 \qquad (1)$$

where

o is the ovality, in %;

$D_{s,\max}$ is the maximum outside diameter;

$D_{s,\min}$ is the minimum outside diameter in the same cross section in the bended area;

D_s is the specified outside diameter.

There shall be no folding in the bent area. Waves can be accepted, when the maximum height between trough and crest of the wave does not exceed 25 % of the nominal wall thickness of the bent pipe.

4.1.4.3 Hot-formed bends

For hot-formed bends manufactured from straight pipes by means of inductive heating (induction bends), no heat treatment is necessary as far as this method is applied with unalloyed or low-alloyed steel with [Mo] < 0,65 %. Hot-formed bends shall be supplied in conformity with EN 14870-1.

If for the bending other heating methods are applied, heat treatment following the bending of the pipes is required.

If a hot-formed bend shall be made from line pipe, this should be specified to the pipe manufacturer at the time of ordering so that they can take this into account when selecting the (chemical) composition of the pipe material and the welding filler material.

It is recommended to determine per batch, diameter, wall thickness and bend radius, through mechanical testing, that the bends comply with the applicable material specifications. It is customary that a representative bend or an (additional) section of a bend of adequate length be manufactured during the production process and that 10 % of the bends be tested.

4.1.4.4 Tolerances of bending angles

The deviation from the nominal bending angle shall not exceed the tolerances given in Table 1.

Table 1 — Deviations from nominal bending angle

Nominal diameter of service pipe	Deviation
≤ DN 200	±2,0°
> DN 200	±1,0°

4.1.5 T-pieces

4.1.5.1 Forged T-pieces

The wall thickness t and t_1, see EN 10253-2, shall be at least the same as those for the straight pipes, see EN 253. All other dimensions shall be in accordance with EN 10253-2.

4.1.5.2 Welded T-pieces

Welded T-pieces shall be manufactured by drawing a collar on which the branch pipe is welded or by welding the branch pipe directly to the main pipe. The wall thickness of the collar shall be at least the same as that for the branch pipe, see EN 253. The collar shall be drawn opposite the welding seam in the main pipe. When using branch pipe directly welded to the main pipe, compensating (reinforcement) plates can be used according to EN 13941-1 requirements.

4.1.5.3 Tolerances of angles between branch pipes and main pipes

The branch pipes shall be perpendicular to the main pipes within a tolerance of ± 2,0°.

4.1.6 Reducers

Reducers shall be in accordance with EN 10253-2, except for the wall thicknesses T and T_1, see EN 10253-2 which shall be at least the same as for the straight pipes (see EN 253) to be welded to the fittings.

4.1.7 Anchors

The anchors shall be marked with the information concerning maximum loads for which the construction was designed and calculated. The lifetime of the system shall not be influenced by the anchors construction.

4.1.8 Single use compensators

A single use compensator shall comply with the requirements of EN 13941-1.

4.1.9 Caps

Caps (dished ends) shall be in accordance with EN 10253-2 and comply with the requirements of EN 13941-1.

4.1.10 Fusion welding of steel fittings

4.1.10.1 Filler material

Filler material shall after welding have mechanical characteristics comparable with the parent metal.

4.1.10.2 Welding process

All types of fusion welding are acceptable but arc welding with covered electrodes and gas-shielded metal-arc welding are preferred. The welding process shall be specified and approved in accordance with EN ISO 15607.

The method of approval may be chosen by the manufacturer.

Fittings of wall thickness ≥ 5,6 mm shall be welded in more than one pass.

4.1.10.3 Preparation for welding

Pipe ends shall be prepared in accordance with the welding procedure used. When using covered electrodes or gas-shielded metal-arc welding, pipe ends and fittings with equal wall thickness shall be prepared in accordance with EN ISO 9692-1.

Table 2 of this document is derived from EN ISO 9692-1:2013, Table 1 and gives the relation between wall thickness and reference number.

Table 2 — Preparation of ends of pipes and fittings for weldings according to EN ISO 9692-1:2013

Symbol	Type of preparation	Wall thickness t of steel service pipe fittings or fitting end	Reference to EN ISO 9692-1:2013, Table 1
II	Square preparation	t < 3 mm	1.2.1
V	Single V preparation	3 mm ≤ t ≤ 10 mm	1.3
Y	Single Y preparation with broad root face	t > 10 mm	1.5
NOTE	Symbols are in accordance with EN ISO 2553.		

Pipe ends and fittings with different wall thicknesses shall be prepared and adapted for misalignment in accordance with Table 3 and Figure 1 of this document.

Table 3 — Adaptation of misalignment and difference in wall thickness

	Adaptation	Required action
Misalignment		
Misalignment $h \leq 0{,}3\ t$, max. 1 mm	Figure 1 detail A	
Misalignment 1 mm < $h \leq$ 10 mm		Adaptation of pipe ends
Misalignment h > 10 mm	Extra fitting	Extra prepared steel fitting minimum length. The seam spacing shall be such that the heat-affected zones do not overlap or interact. A spacing of 100 mm or more is recommended. The minimum spacing is 50 mm.
Difference in wall thickness		
Differences in wall thickness: $t' \leq 1{,}5\ t_n$	Figure 1 detail B	Adaptation of thicker wall t'
Differences in wall thickness: $t' > 1{,}5\ t_n$	Figure 1 detail C	Adaptation of both sides