

Specification for

Preinsulated bonded pipe systems for underground hot water networks — Pipe assembly of steel service pipes, polyurethane thermal insulation and outer casing of high density polyethylene

This European Standard EN 253 : 1991 has the status of a
British Standard

Systèmes bloqués de tuyaux pré-isolés pour les
réseaux enterrés d'eau chaude — Tuyau
pré-isolé — Tube de service en acier —
Isolation thermique à base de polyuréthane et
protection externe à base de polyéthylène
haute densité

Werksmässig gedämmte
Verbundmantelrohrsystem für erdverlegte
Fernwärmenetze — Verbund-Rohrsystem
bestehend aus Stahl-Mediumrohr,
Polyurethan-Wämedämmung und
Aussenmantel aus Polyethylen hoher
Rohdichte

Cooperating organizations

The European Committee for Standardization, under whose supervision this European Standard was prepared, comprises the national standards organizations of the following Western European countries.

Austria	Oesterreichisches Normungsinstitut
Belgium	Institut belge de normalisation
Denmark	Dansk Standardiseringsraad
Finland	Suomen Standardisoimislaito, r.y.
France	Association française de normalisation
Germany	Deutsches Institut für Normung e.V.
Greece	Hellenic Organization for Standardization
Iceland	Technological Institute of Iceland
Ireland	National Standards Authority of Ireland
Italy	Ente Nazionale Italiano di Unificazione
Luxembourg	Inspection du Travail et des Mines
Netherlands	Nederlands Normalisatie-instituut
Norway	Norges Standardiseringsforbund
Portugal	Instituto Português da Qualidade
Spain	Asociación Española de Normalización y Certificación
Sweden	Standardiseringskommissionen i Sverige
Switzerland	Association suisse de normalisation
United Kingdom	British Standards Institution

This British Standard was published under the authority of the Standards Board and comes into effect on 30 September 1991

© BSI 1991

The following BSI references relate to the work on this standard:
Committee reference RHE/9
Draft for comment 87/70614 DC

ISBN 0 580 19849 9

Amendments issued since publication

Amd. No.	Date	Text affected

Contents

	Page
Cooperating organizations	Inside front cover
National foreword	i
Brief history	2
Text of EN 253	3
National appendix NA	Inside back cover
National appendix NB	Inside back cover

National foreword

This British Standard has been prepared under the direction of the Refrigeration, Heating and Air Conditioning Standards Policy Committee and is the English language version of EN 253 'Preinsulated bonded pipe systems for underground hot water networks — Pipe assembly of steel service pipes, polyurethane thermal insulation and outer casing of high density polyethylene' published by the European Committee for Standardization (CEN).

EN 253 was produced as a result of international discussion in which the UK took an active part.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

UDC 621.644.2-034.14 : 697.343 : 662.998-036 : 620.1

Descriptors: Water pipelines, buried pipelines, hot water, steel tubes, thermal insulation, polyurethane, polyethylene, specifications, tests, marking

English version

Preinsulated bonded pipe systems for underground hot water networks — Pipe assembly of steel service pipes, polyurethane thermal insulation and outer casing of high density polyethylene

Systèmes bloqués de tuyaux pré-isolés pour les réseaux enterrés d'eau chaude — Tuyau pré-isolé — Tube de service en acier — Isolation thermique à base de polyuréthane et protection externe à base de polyéthylène haute densité

Werksmässig gedämmte Verbundmantelrohrsysteme für erdverlegte Fernwärmenetze — Verbund-Rohrsystem bestehend aus Stahl-Mediumrohr, Polyurethan-Wärmedämmung und Aussenmantel aus Polyethylen hoher Rohdichte

This European Standard was approved by CEN on 15 November 1988. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

© CEN 1990 Copyright reserved to all CEN members

Ref. No. EN 253 : 1990 E



Documents

Document Sharing Hub

Brief history

This European Standard was drawn up by the Technical Committee CEN/TC 107 'Prefabricated district heating pipe systems' the secretariat of which is held by the Danish Standards Association.

This specification is part of the standards for bonded systems using polyurethane foam thermal insulation applied by injecting (pouring), to bond to a steel service pipe and a polyethylene casing pipe.

Specifications for other components for this system e.g. fittings and joints are in preparation by the TC.

TC 107 has agreed to write the specifications for the components mentioned above as individual standard documents which can be issued separately.

In compiling this document TC 107 has made use of results of research carried out by system manufacturers, raw material suppliers, users, universities and research institutes.

In accordance with the CEN/CENELEC Common Rules, the following CEN members are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

Contents

		Page			Page
1	Object and field of application	3	4.3.1	Composition	6
2	References	3	4.3.2	Cell structure	6
3	Definitions	4	4.3.3	Density	6
4	Requirements	4	4.3.4	Compressive strength	6
4.1	Steel service pipe	4	4.3.5	Water absorption at elevated temperature	6
4.1.1	Quality	4	4.4	Pipe assembly	6
4.1.2	Diameter	4	4.4.1	Pipe ends	6
4.1.3	Wall thickness	4	4.4.2	Increase in diameter of the casing pipe	6
4.1.4	Surface condition	5	4.4.3	Centre line deviation	6
4.2	Polyethylene casing	5	4.4.4	Expected life and longterm temperature resistance	7
4.2.1	Material	5	4.4.5	Thermal conductivity	7
4.2.2	Nominal outside diameter	5	4.4.6	Impact resistance	7
4.2.3	Wall thickness	5	5	Test methods	7
4.2.4	Tolerances on outside diameter and wall thickness	5	5.1	General	7
4.2.5	Appearance, surface finish, pipe ends	6	5.1.1	Test specimens	7
4.2.6	Weathering resistance of the casing pipe	6	5.2	Casing pipe	8
4.2.7	Yield stress and elongation at break	6	5.2.1	Material	8
4.2.8	Heat reversion	6	5.2.2	Dimensions	8
4.3	Polyurethane rigid foam insulation (PUR)	6	5.2.3	Appearance and surface finish	8
			5.2.4	Weathering resistance	8
			5.2.5	Elongation at break	8
			5.2.6	Heat reversion	8
			5.3	Polyurethane rigid foam (PUR)	8
			5.3.1	Composition	8
			5.3.2	Cell structure	8
			5.3.3	Density	8
			5.3.4	Compressive strength	10
			5.3.5	Water absorption	10
			5.4	Pipe assembly	10
			5.4.1	Increase in diameter of the casing pipe	10
			5.4.2	Axial shear strength	10
			5.4.3	Tangential shear strength	10
			5.4.4	Shear strength of the pipe assembly after ageing	10
			5.4.5	Thermal conductivity	12
			5.4.6	Impact resistance	12
			6	Marking	12
			6.1	Polyethylene pipe	12
			6.2	Pipe assembly	12
			Annex A	Relation between actual continuous operating conditions and accelerated ageing test conditions	13
			Annex B	Calculation of the minimum expected life with operation at various temperatures with respect to PUR foam performance	15
			Annex C	Guidelines for inspection	15

1 Object and field of application

This European standard specifies requirements and test methods for straight lengths of prefabricated thermally insulated pipe-in-pipe assemblies for underground hot water networks, comprising a steel service pipe from DN 20 to DN 600, rigid polyurethane foam insulation and an outer casing of high density polyethylene.

This standard applies only to injected (poured) insulated pipe assemblies, for continuous operation with hot water at various temperatures up to 120 °C and for short term operation with a peak temperature up to 140 °C.

The estimation of expected life with continuous operation at various temperatures is outlined in annex B.

2 References

ISO 844 : 1978	Cellular plastics – Compression test of rigid materials	ISO 4200 : 1985	Plain end steel tubes, welded and seamless – General tables of dimensions and masses per unit length
ISO 845 : 1988	Cellular plastics and rubbers – Determination of apparent (bulk) density	ISO 4590 : 1981	Cellular plastics – Determination of volume percentage of open and closed cells of rigid materials
ISO 1133 : 1981	Plastics – Determination of the melt flow rate of thermoplastics	ISO 4607 : 1978	Plastics – Methods of exposure to natural weathering
ISO 1183 : 1987	Plastics – Methods for determining the density and relative density of non-cellular plastics	ISO 6761 : 1981	Steel tubes – Preparation of ends of tubes and fittings for welding
ISO/DIS 1872/2	Plastics – Polyethylene (PE) thermoplastics Part 2: Preparation of test specimens and determination of properties	ISO 8501-1 : 1988	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 2506 : 1981	Polyethylene pipes (PE) – Longitudinal reversion – Test methods and specification	ISO/DIS 559 ¹⁾	Steel tubes for water and sewage
ISO 3126 : 1974	Plastics pipes – Measurement of dimensions	ISO/DIS 3607	Polyethylene (PE) pipes – Tolerances on outside diameters and wall thickness Revision of ISO 3607 : 1977
ISO 3127 : 1980	Unplasticized polyvinyl chloride (PVC) pipes for the transport of fluids. Determination and specification of resistance to external blows	ISO/DIS 8497 ²⁾	Thermal insulation – Determination of steady-state thermal transmission properties – Pipe insulation apparatus
		DIN 1626 : 1984 to be deleted when ISO 559 is published	Welded circular unalloyed steel tubes subject to special requirements – Technical delivery conditions
		DIN 1629 : 1984 to be deleted when ISO 559 is published	Seamless circular unalloyed steel tubes subject to special requirements – Technical delivery conditions
		DIN 52613 : 1977 to be deleted when ISO 8497 is published	Thermal insulation testings – Determination of thermal conductivity by the tube methods

¹⁾ ISO/DIS 559 has been submitted for combined voting (August 1988).

Until ISO 559 is published, DIN 1626 : 1984 and DIN 1629 : 1984 – or any equivalent national standard – shall be used.

²⁾ ISO/DIS 8497 has been submitted for voting (April 1988).

Until ISO 8497 is published, DIN 52613 : 1977 – or any equivalent national standard – shall be used.

3 Definitions

For the purpose of this standard the following definitions apply.

3.1 ageing

Carried out by keeping the service pipe at a certain, elevated temperature for a certain time while the casing pipe is exposed to room temperature.

3.2 bonded system

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

3.3 casing pipe

A pipe protecting the insulation and the service pipe from ground water, moisture and mechanical damage.

3.4 continuous temperature

The temperature at which the hot water network is designed to operate continuously.

3.5 conventional density of PE-raw material

Is determined at 23 °C on the extrudate from the melt flow rate measurement.

3.6 core density

The apparent density of the foam in the central part of the insulating layer.

3.7 density

The mass of a body of a material divided by the volume of the body.

3.8 centre line deviation

The deviation between the centre line of the service pipe and the centre line of the casing pipe.

3.9 high density polyethylene (HDPE)

Polyethylene with a conventional density from the upper end of the range of nominal densities available.

3.10 injected (poured) pipe assemblies

Those pipe assemblies in which the PUR foam has been injected or poured into the space between the service pipe and the casing pipe.

3.11 insulation material

A material which reduces the heat loss.

3.12 MDI-index (polymeric methyldiphenyl diisocyanate-index)

The quotient of the actual amount of isocyanate used and the stoichiometrically required amount, multiplied by 100.

3.13 melt flow rate – MFR 190/5

Is defined in ISO 1133 : 1981 (condition 18).

3.14 overall density

The mass of all PUR foam in the space between service and casing pipe divided by the volume of this annular space.

3.15 peak temperature

The highest temperature at which a system is designed to operate for short periods of time – see annex B.

3.16 pipe assembly

The assembled product, consisting of a service pipe, insulating material and a casing pipe.

3.17 polyurethane rigid foam (PUR)

Is produced by the chemical reaction of polyisocyanates with hydroxyl containing compounds in the presence of catalysts, the foaming being assisted by halogen hydrocarbons. These foams have a mainly closed cell structure.

3.18 room temperature

Defined as 23 ± 2 °C.

3.19 service pipe

The steel pipe that contains the water.

3.20 shear strength

The ability of the pipe assembly to withstand a shear force acting between the casing and the service pipe.

4 Requirements

4.1 Steel service pipe

A length of pipe shall not include a joint.

4.1.1 Quality

The steel service pipe shall comply with ISO 559¹⁾.

4.1.2 Diameter

The diameter shall be in accordance with table 1 which is derived from ISO 4200 : 1985.

4.1.3 Wall thickness

The nominal wall thickness shall be in accordance with ISO 4200 : 1985 with a minimum as indicated in table 1. Tolerances and weights shall be in accordance with ISO 4200 : 1985.

Subject to design considerations other wall thicknesses may be used, but in no case shall these be less than the minima indicated in table 1.

¹⁾ ISO/DIS 559 has been submitted for combined voting (August 1988).

Until ISO 559 is published, DIN 1626 : 1984 and DIN 1629 : 1984 – or any equivalent national standard – shall be used.