
Preinsulated ductile iron pipeline systems

Systèmes de canalisations préisolées en fonte ductile

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 9349 was prepared by Technical Committee ISO/TC 5, *Ferrous metal pipes and metallic fittings*, Subcommittee SC 2, *Cast iron pipes, fittings and their joints*.

This second edition cancels and replaces the first edition (ISO 9349:1991), of which it constitutes a technical revision. Its scope has been limited to the conveyance of fluids at temperature not exceeding 50 °C; its style and presentation have been reviewed and improved.

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Preinsulated ductile iron pipeline systems

1 Scope

This International Standard specifies the requirements and test methods applicable to preinsulated ductile iron pipes, fittings, accessories and their joints for the construction of pipelines (or parts thereof)

- to convey water (e.g. potable water), wastewater and other liquids;
- to be operated with or without pressure;
- to be installed below or above ground;
- to limit temperature variations of the conveyed fluids.

NOTE 1 In this International Standard, all pressures are relative pressures expressed in bars (100 kPa = 1 bar).

This International Standard gives, in addition to the specifications of the existing ISO standards for the conveying ductile iron pipes and fittings, specifications for materials, dimensions and tolerances, mechanical and thermal properties of the thermal insulation layer and external casing of preinsulated ductile iron pipes, fittings and accessories.

This International Standard covers preinsulated ductile iron pipes, fittings and accessories of a size range extending from DN 60 to DN 600 inclusive, which are

- manufactured with socketed, flanged or spigot ends for jointing by means of various types of gaskets which are not within the scope of this International Standard;
- preinsulated in the works (excluding on-site application of the insulation layer and/or the casing);
- normally delivered internally and externally coated;
- intended for fluid temperatures from 0 °C to 50 °C, excluding frost.

NOTE 2 Other applications are possible by agreement between manufacturer and purchaser.

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.

ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

ISO 844, *Rigid cellular plastics — Determination of compression properties*

ISO 845, *Cellular plastics and rubbers — Determination of apparent (bulk) density*

ISO 857-1, *Welding and allied processes — Vocabulary — Part 1: Metal welding processes*

ISO 1183-3, *Plastics — Methods for determining the density of non-cellular plastics — Part 3: Gas pycnometer method*

ISO 2531, *Ductile iron pipes, fittings, accessories and their joints for water or gas applications*

ISO 6892, *Metallic materials — Tensile testing at ambient temperature*

ISO 7186, *Ductile iron products for sewage applications*

ISO 8497, *Thermal insulation — Determination of steady-state thermal transmission properties of thermal insulation for circular pipes*

3 Terms and definitions

For the purposes of this document, the terms and definitions of ISO 2531 and the following apply.

- 3.1**
conveying pipe
pipe conveying the fluid
- 3.2**
conveying fitting
pipeline component conveying the fluid and corresponding to a change in direction, to a diversion, or to a blanking off of the pipeline
- 3.3**
preinsulated pipe
factory-produced pipe comprising a conveying pipe, thermal insulation and external protection
- 3.4**
preinsulated fitting
factory-produced fitting comprising a conveying fitting, thermal insulation and external protection
- 3.5**
casing
external protection of the thermal insulation layer made from PE, PVC or steel

4 Technical requirements

4.1 General

A preinsulating pipe (or fitting) is generally manufactured by injection moulding of the polyurethane foam thermal insulation layer between the ductile iron conveying pipe (or fitting) and a casing which provides the external protection against mechanical damage and moisture ingress.

The external diameter, DR, of a preinsulated pipe or fitting is the external diameter of the casing.

4.2 Conveying pipes and fittings

The conveying pipes and fittings shall comply with the requirements of ISO 2531 for water applications and those of ISO 7186 for sewage applications or, by agreement between manufacturer and customer, with the requirements of relevant national standards.

Prior to thermal insulation application, the external surface of the conveying pipes and fittings shall be dry and clean.

4.3 External protection of preinsulated pipes

Casings shall be made of existing pipes of polyethylene (HDPE), poly(vinyl chloride) (PVC) or steel. Their characteristics shall comply with the requirements given in Table 1. For above ground applications, HDPE and PVC casings shall be resistant to ultraviolet radiation. All steel casings shall be externally coated (e.g.

galvanized); the external coating shall be adapted to the application (above or below ground) and shall comply to an international or to a national standard, or to an agreed technical specification.

Table 1

Casing	Characteristic	Specified value	Test method
High density polyethylene (HDPE)	Volume mass	$\geq 940 \text{ kg/m}^3$	ISO 1183-3
	Apparent yield stress	$\geq 19 \text{ MPa}$	ISO 527-2
	Percentage elongation after fracture	$\geq 350 \%$	ISO 527-2
Poly(vinyl chloride) (PVC)	Volume mass	$\geq 1\,350 \text{ kg/m}^3$	ISO 1183
	Percentage elongation after fracture	50 % to 150 %	ISO 527-2
	Tensile strength	$\geq 47 \text{ MPa}$	ISO 527-2
Steel (pipe or spirally wound)	Tensile strength	$\geq 320 \text{ MPa}$	ISO 6892
	Percentage elongation after fracture	$\geq 15 \%$	ISO 6892

Prior to thermal insulation application, the internal surface of the casings shall be dry and clean.

The variation in the casing external diameter, DR, during injection moulding of the thermal insulation shall not exceed $\pm 2 \%$.

4.4 External protection of preinsulated fittings

4.4.1 General

The external protection of fittings shall consist of preformed casings which shall be fabricated by welding several elements cut from the same HDPE or steel casings as those used for preinsulated pipes (see 4.3).

After welding and before moulding the polyurethane foam, the preformed casing shall be centred with respect to the conveying fitting. The internal surface of the preformed casing shall be dry and clean. After the moulding operation, there shall be no leakage of foam through the welds.

4.4.2 Welding preformed HDPE casings

Before welding, the elements shall be cut, with high precision, to the required angle and both ends shall be ground.

The welding operation shall be carried out by qualified personnel, either by the hot plate method (butt welding) or by deposition of polyethylene. The difference in fluidity index of the added polyethylene and that of the polyethylene of the casing shall not exceed 0,5.

The mismatch between welded elements shall not exceed half the thickness of the casing in the direction perpendicular to the casing wall, and 3 mm in the direction parallel to the axis of the casing.

The welds shall have a maximum width of 20 mm and a maximum height of 5 mm; they shall not be ground.

4.4.3 Welding preformed steel casings

Before welding, the elements shall be cut, with high precision, to the required angle and both ends shall be ground.

The welding operation shall be carried out by qualified personnel, in accordance with ISO 857-1, and shall result in a watertight weld.

4.5 Thermal insulation

The rigid polyurethane foam thermal insulation layer shall have a regular structure of fine pores. Specifications concerning the foam shall be as given in Table 2.

Table 2

Characteristic	Specified value	Test method
Average volume mass	$\geq 80 \text{ kg/m}^3$	ISO 845
Local volume mass	$\geq 60 \text{ kg/m}^3$	ISO 845
Compressive strength	$\geq 0,3 \text{ MPa}$	ISO 844
Thermal conductivity at 50 °C	$\leq 0,023 \text{ W/(m} \cdot \text{K)}$	ISO 8497

The mean thickness of the thermal insulation layer shall be as given in Tables 4 to 7, excluding the socket end of the pipe or fitting; this will give a maximum thermal conductivity of 0,027 W/(m · K) for the preinsulated pipe.

NOTE Thicker thermal insulation layers may be supplied by agreement between manufacturer and purchaser.

The eccentricity of the insulation layer, defined as the distance between the ductile iron conveying pipe axis and the casing axis, shall not exceed the values given in Table 3.

Table 3

Casing external diameter DR mm	Maximum value of the eccentricity mm
DR ≤ 170	3
170 < DR ≤ 410	4,5
410 < DR ≤ 630	6
630 < DR	8

At both ends of pipes and fittings, the end faces of the insulation layer shall be covered by a polymeric sheath or a rubber ring.

4.6 Joints of conveying pipes and fittings

Joints of conveying pipes and fittings shall be flexible push-in joints complying with the requirements of ISO 2531 or ISO 7186, as applicable.

4.7 Junctions between preinsulated pipes and fittings (on-site assembly)

Continuity of the thermal insulation shall be ensured by inserting a ring of flexible foam between the end faces of the polyurethane foam layer of two consecutive pipes or fittings.

Continuity of the external protection shall be provided by means of a rubber sleeve or a heat shrink polyethylene sleeve.

4.8 Marking

4.8.1 Ductile iron conveying pipes and fittings shall be marked in conformity with ISO 2531 or ISO 7186, as applicable.

4.8.2 Casings shall be marked with

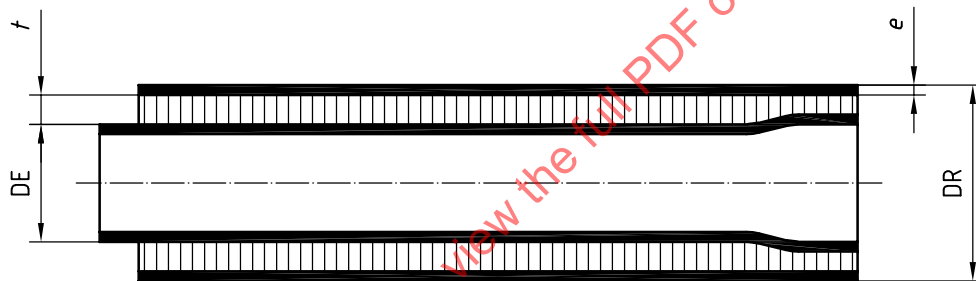
- a) the identity of the casing manufacturer;
- b) in addition, for plastic casings, identity of the material, the nominal dimensions (diameter and thickness), and the year and month of manufacture.

4.8.3 Preinsulated pipes and fittings shall bear the following information on their external cylindrical surface:

- a) the nominal diameter and, for fittings, the type (e.g. for bends: B 1/8 DN...);
- b) the identity of the preinsulated pipe or fitting manufacturer;
- c) the year of manufacture;
- d) reference to this International Standard.

5 Tables of dimensions

The functional dimensions are illustrated in Figure 1 and specified in Tables 4 to 7 as a function of the casing material.



Key

- DE nominal external diameter of the conveying pipe
- DR nominal external diameter of the preinsulated pipe
- t nominal thickness of the thermal insulation layer
- e minimum thickness of the casing

Figure 1