INTERNATIONAL STANDARD

ISO 9349

Third edition
2017-03

Ductile iron pipes, fittings, accessories and their joints — Thermal preinsulated products

Tuyaux, raccords et accessoires en fonte ductile et leurs assemblages — Produits préisolés thermiques

Reference number
ISO 9349:2017(E)

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 5, *Ferrous metal pipes and metallic fittings*, Subcommittee SC 2, *Cast iron pipes, fittings and their joints*.

This third edition cancels and replaces the second edition (ISO 9349:2004), which has been technically revised with the following changes:

— 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.

Ductile iron pipes, fittings, accessories and their joints — Thermal preinsulated products

1 Scope

This document 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. These pipelines are mainly used to prevent the water to be conveyed from freezing by providing external insulation.

NOTE 1 In this document, all pressures are relative pressures expressed in bars[1)].

This document gives, in addition to the specifications of the existing International 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 document covers preinsulated ductile iron pipes, fittings and accessories of a size range extending from DN 60 to DN 600 inclusive, which are as follows:

— manufactured with socketed, flanged or spigot ends for jointing by means of various types of gaskets which are not within the scope of this document;

— 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 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.

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 density*

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

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

1) 100 kPa = 1 bar.

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO 7186, *Ductile iron products for sewerage applications*

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

ISO/TR 25901-3, *Welding and allied processes — Vocabulary — Part 3: Welding processes*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2531 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 http://www.iso.org/obp

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 ductile iron pipe comprising a conveying pipe, external thermal insulation and casing

3.4
preinsulated fitting
factory-produced ductile iron fitting comprising a conveying fitting, external thermal insulation and casing

3.5
casing
external protection of the thermal insulation layer made from PE or PVC or steel, in tubular or any suitable shape

3.6
thermal insulation
layer of porous and rigid polyurethane foam between the conveying pipe/fittings and casing, intended to reduce heat transfer between the fluid in the conveying pipe and the external environment

4 Technical requirements

4.1 General

A preinsulated pipe (or fitting) is generally manufactured by injection moulding 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 ductile iron pipes and fittings

The conveying pipes and fittings shall comply with the requirements of ISO 2531 for water applications and of ISO 7186 for sewage applications, or, by agreement between manufacturer and purchaser, 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 Casing of preinsulated pipes

Casings shall be made of polyethylene (HDPE), poly(vinyl chloride) (PVC) or steel. Their characteristics shall comply with the requirements of 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 with an international or national standard, or an agreed technical specification.

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 +2 %.

Table 1 — Casing materials and their characteristics

Casing[a]	Characteristic	Specified value	Test method
High density polyethylene (HDPE)	Density	≥940 kg/m^3	ISO 1183-3
	Yield stress	≥19 MPa	ISO 527-2
	Percentage elongation at fracture	≥350 %	ISO 527-2
Poly(vinyl chloride) (PVC)	Density	≥1 350 kg/m^3	ISO 1183-3
	Percentage elongation at fracture	50 % to 150 %	ISO 527-2
	Tensile strength	≥47 MPa	ISO 527-2
Steel (pipe or spirally wound)	Tensile strength	≥320 MPa	ISO 6892-1
	Percentage elongation at fracture	≥15 %	ISO 6892-1
[a] Other materials can be used by agreement between manufacturer and purchaser.			

4.4 Casing 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 HDPE casings

Before welding, the elements shall be cut with good 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 indexes of the added polyethylene and 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 Steel casings

Before welding, the elements shall be cut with good 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/TR 25901-3, and shall result in a watertight weld.

The steel casing should be externally coated, complying with an international or a national standard.

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.

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.

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.

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.

Table 2 — Thermal insulation characteristics

Characteristic	Specified value	Test method
Average density	≥80 kg/m^3	ISO 845
Local density	≥60 kg/m^3	ISO 845
Compressive strength	≥0,3 MPa	ISO 844
Thermal conductivity at 50 °C	≤0,023 W/(m·K)	ISO 8497

Table 3 — Maximum eccentricity of the insulation layer

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

4.6 Joints of conveying pipes and fittings

Joints of conveying pipes and fittings shall be flexible 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 and/or fittings.

Continuity of the casing 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 the following:

a) the identification of the casing manufacturer;

b) in addition, for plastic casings, an identification 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…);

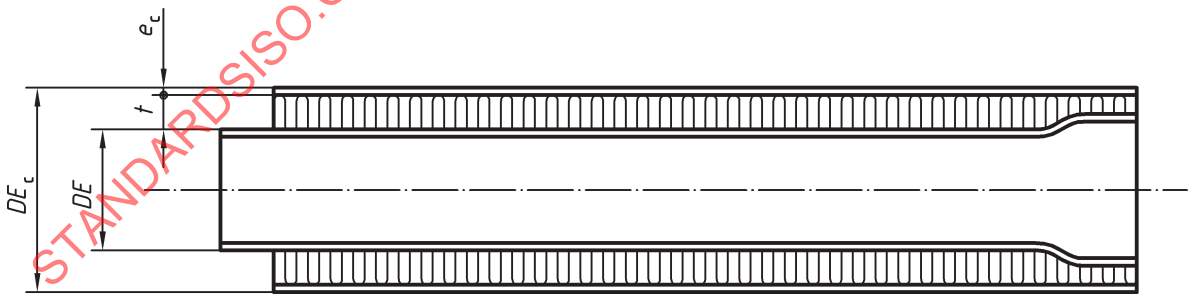
b) the identification of the preinsulated pipe or fitting manufacturer;

c) the year of manufacture;

d) a reference to this document, i.e. ISO 9349.

5 Tables of dimensions

The functional dimensions of preinsulated pipe with tubular casing are illustrated in Figure 1 and specified in Tables 4 to 7 as a function of the casing material. The larger DNs and other shapes of casing can be supplied by agreement between purchaser and supplier.



Key

DE external diameter of the conveying pipe

DE_c external diameter of the preinsulated pipe

t nominal thickness of the thermal insulation layer

e_c minimum thickness of the casing

Figure 1 — Functional dimensions of preinsulated pipe