INTERNATIONAL STANDARD

ISO 11296-3

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Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks —

Part 3: Lining with close-fit pipes

Systèmes de canalisations en matières plastiques pour la rénovation des réseaux d'assainissement gravitaires enterrés —
Partie 3: Tubage par tuyau continu sans espace annulaire

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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.

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 11296-3 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*.

ISO 11296 consists of the following parts, under the general title *Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks*:

— *Part 1: General*

— *Part 3: Lining with close-fit pipes*

— *Part 4: Lining with cured-in-place pipes*

Lining with continuous pipes is to form the subject of a part 2, lining with discrete pipes is to form the subject of a part 5 and lining with spirally-wound pipes is to form the subject of a part 7.

Introduction

The System Standard, of which this is part 3, specifies the requirements for plastics piping systems of various materials used for the renovation of existing pipelines in a specified application area. System Standards for renovation specify procedures for the following applications:

— plastics piping systems for renovation of underground non-pressure drainage and sewerage networks (this application);

— plastics piping systems for renovation of underground drainage and sewerage networks under pressure;

— plastics piping systems for renovation of underground water supply networks;

— plastics piping systems for renovation of underground gas supply networks.

These System Standards are distinguished from those for conventionally installed plastics piping systems because they set requirements for certain characteristics in the as-installed condition, after site processing. This is in addition to specifying requirements for plastics piping system components, as manufactured.

Each of the System Standards comprises a part 1 (general) and all applicable renovation technique family-related parts from the following:

— part 2: lining with continuous pipes;

— part 3: lining with close-fit pipes;

— part 4: lining with cured-in-place pipes;

— part 5: lining with discrete pipes;

— part 7: lining with spirally-wound pipes.

The requirements for any given renovation technique family are given in part 1, applied in conjunction with the other relevant part. For example, parts 1 and 2 specify the requirements relating to lining with continuous pipes. For complementary information, see ISO 11295. Not all technique families are applicable to every area of application and this is reflected in the part numbers included in each System Standard.

A consistent structure of clause headings has been adopted for all parts to facilitate direct comparisons across renovation technique families.

Figure 1 gives the common structure and the relationship between ISO 11296 and the System Standards for other application areas.

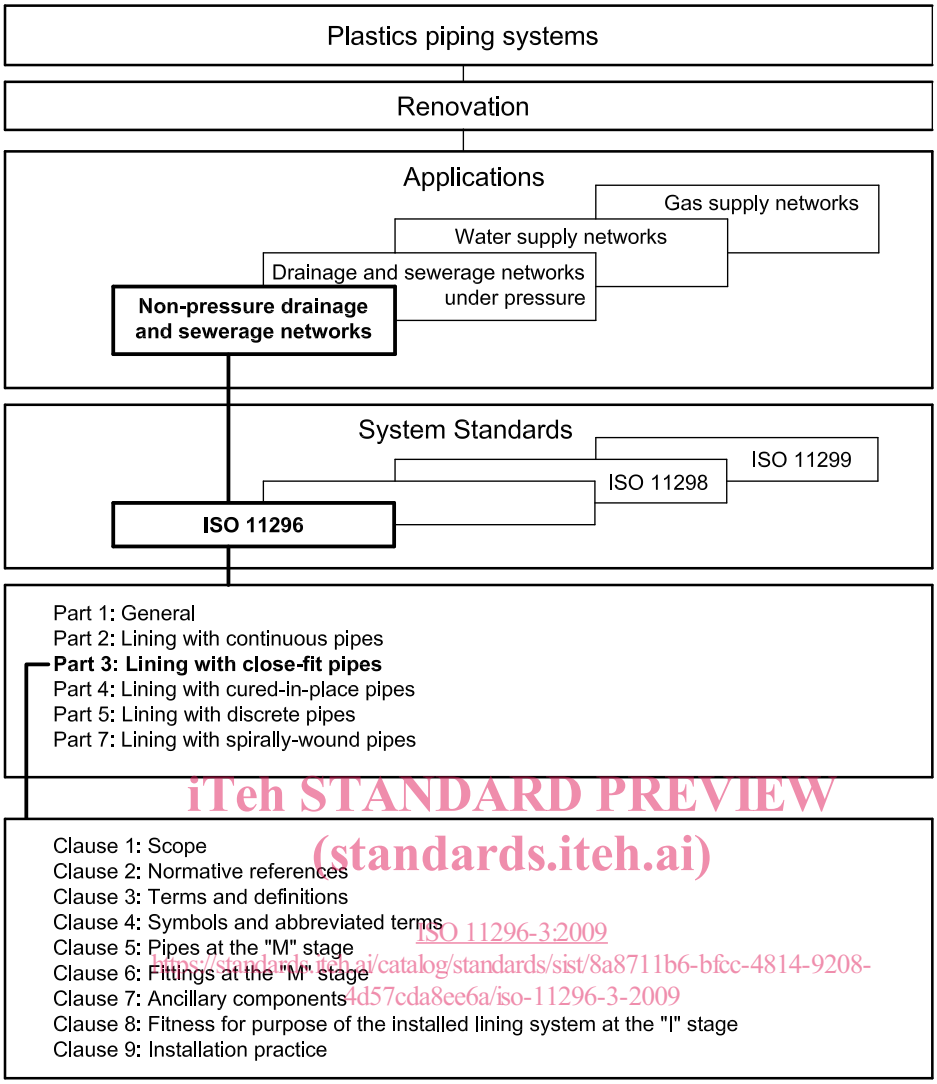

Figure 1 — Format of the renovation System Standards

Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks —

Part 3:
Lining with close-fit pipes

1 Scope

This part of ISO 11296, in conjunction with ISO 11296-1, specifies requirements and test methods for close-fit lining systems intended to be used for the renovation of non-pressure drainage and sewerage networks.

It applies to pipes and fittings made of polyethylene (PE) or unplasticized poly(vinyl chloride) (PVC-U). It is applicable to the plastic lining system only. It is not applicable to the requirements for the existing pipeline.

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 899-1:2003, *Plastics — Determination of creep behaviour — Part 1: Tensile creep*

ISO 2507-1, *Thermoplastics pipes and fittings – Vicat softening temperature — Part 1: General test method*

ISO 3126, *Plastics piping systems — Plastics components — Determination of dimensions*

ISO 4435, *Plastics piping systems for non-pressure underground drainage and sewerage — Unplasticized poly(vinyl chloride) (PVC-U)*

ISO 6259-1, *Thermoplastics pipes — Determination of tensile properties — Part 1: General test method*

ISO 8772:2006, *Plastics piping systems for non-pressure underground drainage and sewerage — Polyethylene (PE)*

ISO 9852, *Unplasticized poly(vinyl chloride) (PVC-U) pipes — Dichloromethane resistance at specified temperature (DCMT) — Test method*

ISO 9967:2007, *Thermoplastics pipes — Determination of creep ratio*

ISO 9969, *Thermoplastics pipes — Determination of ring stiffness*

ISO 11296-1:—[1)], *Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks — Part 1: General*

ISO 12176-1, *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems — Part 1: Butt fusion*

ISO 13953, *Polyethylene (PE) pipes and fittings — Determination of the tensile strength and failure mode of test pieces from a butt-fused joint*

ISO 18373-1:2007, *Rigid PVC pipes — Differential scanning calorimetry (DSC) method — Part 1: Measurement of the processing temperature*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11296-1 and the following apply.

3.1
close fit
location of the outside of the installed liner relative to the inside of the existing pipeline, which may either be an interference fit or include a small annular gap resulting from shrinkage and tolerances only

3.2
close-fit pipe
continuous lining pipe of thermoplastic material reshaped or otherwise expanded after insertion to achieve a close fit to the existing pipeline

3.3
melt mass-flow rate
value relating the viscosity of the molten material at a specified temperature and rate of shear

4 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviated terms given in ISO 11296-1 and the following apply.

d_{manuf} original circular outside diameter of the pipe (before processing for insertion)

$e_{m,\,max}$ maximum mean wall thickness

MFR melt mass-flow rate

OIT oxidation induction time

5 Pipes at the “M” stage

5.1 Materials

5.1.1 General

The material shall be either polyethylene (PE) or unplasticized poly(vinyl chloride) (PVC-U), to which are added those additives needed to facilitate the manufacture and/or installation of pipes conforming to this part of ISO 11296.

1) To be published.

5.1.2 Distinction between PVC-U types

PVC-U materials used for liner pipes may have PVC content less than the minimum of 80 %, and/or Vicat softening temperature less than the 79 °C specified by ISO 4435. For the purposes of this part of ISO 11296, distinction shall be made between PVC-U conforming to ISO 4435 (designated standard PVC-U) and PVC-U modified for lining applications.

NOTE This distinction is reflected in the requirements given in Table 4 and Table 11.

5.1.3 Virgin material

Virgin material, as defined in ISO 11296-1, may be used without limitations. Fusion compatibility of PE pipes shall conform to ISO 8772:2006, 4.6.

5.1.4 Reprocessable material and recyclable material

5.1.4.1 Reprocessable material

Own reprocessable material may be used, provided that it is derived from the same compound used for the relevant production. External reprocessable material shall not be used.

5.1.4.2 Recyclable material

Recyclable material shall not be used.

5.2 General characteristics

When viewed without magnification the internal and external surfaces of the pipe shall be smooth, clean and free from scoring, cavities and other defects, which would prevent conformity to this part of ISO 11296.

5.3 Material characteristics

When tested in accordance with the methods given in Table 1 or Table 2, as applicable, the material from which the pipes are made shall conform to the requirements given in the relevant table.

Table 1 — Material characteristics of PE pipes

Characteristic	Requirement	Test parameter		Test method
		Parameter	Value	
Density	ISO 8772			
Longitudinal tensile stress at yield point	> 15 MPa	Speed of testing for $e \leqslant 12$ mm $e > 12$ mm	(100 ± 10) mm/min (25 ± 2,5) mm/min	ISO 6259-1
Elongation at break	> 350 %	Test piece shape and initial gauge length	Specimen type 1B in accordance with ISO 527-2	
Thermal stability (OIT)	ISO 8772			
Melt mass-flow rate				
Resistance to internal pressure (long-term behaviour)				
Resistance to circumferential tensile stress[a]	No failure during the test period	Annex B		

[a] Applies to folded pipes only, see Annex B.

Table 2 — Material characteristics of PVC-U pipes

Characteristic	Requirement	Test parameters		Test method
		Parameter	Value	
E-modulus (tensile)	Declared value[a] [b], but not less than 1 200 MPa	Speed of testing Test piece shape and initial gauge length	(5 ± 0,5) mm/min Specimen type 1B	ISO 527-2
Longitudinal tensile strength	Declared value[a], but not less than 20 MPa	Speed of testing	(5 ± 0,5) mm/min	ISO 6259-1
Elongation at break	Declared value[a], but not less than 70 %	Test piece shape and initial gauge length	Specimen type 1B in accordance with ISO 527-2	
Impact strength	ISO 4435			

[a] Some PVC-U close-fit pipe products have declared values considerably higher than the minima specified.

[b] The declared value of E-modulus determines the relationship between ring stiffness and SDR (see 8.4 and 8.5).

5.4 Geometric characteristics

The pipe diameter, wall thickness and shape in the “M” stage depend on the specific close-fit lining technique. “M” stage dimensions needed to obtain specified “I” stage dimensions (see 8.4) shall be declared, with their tolerances, by the manufacturer.

NOTE In the case of factory-folded pipes, variations in wall thickness in one cross-sectional area can be present at the “M” stage.

5.5 Mechanical characteristics

No mechanical requirements of pipes at the “M” stage apply.

5.6 Physical characteristics

When tested in accordance with the methods given in Table 3 or Table 4, as applicable, the pipe shall conform to the requirements given in the relevant table. In the case of factory-folded, heat-reverted PE pipes, the pipe shall additionally conform to the requirement for memory ability specified in Annex A.

Table 3 — Physical characteristics of PE pipes

Characteristic	Requirement	Test parameter	Test method
Longitudinal reversion	⩽ 3,5 % The pipe shall exhibit no bubbles or cracks	ISO 8772	

Table 4 — Physical characteristics of PVC-U pipes

Characteristic	Requirement	Test parameter		Test method
		Parameter	Value	
Vicat softening temperature	Declared value[a], but not less than 55 °C	Number of test pieces[b]	3	ISO 2507-1
Longitudinal reversion	ISO 4435			
Resistance to dichloro-methane at elevated temperatures (degree of gelation)	No attack at any part of the surface of the test piece	Temperature of bath Number of test pieces[b] Immersion time Min. wall thickness	(15 ± 1) °C 1 30 min 1,5 mm	ISO 9852
DSC (alternative test method to resistance to dichloromethane)[c]	B onset temperature ⩾ 185 °C	Number of test pieces[b]	4	ISO 18373-1:2007

[a] For standard PVC-U conforming to ISO 4435, the requirement for Vicat softening temperature is ⩾ 79 °C.

[b] The number of test pieces given indicates the number required to establish a value for the characteristic described in the table. The number of test pieces required for factory production control and process control should be listed in the manufacturer's quality plan.

[c] In case of dispute, the resistance to dichloromethane shall be used.

5.7 Jointing

When tested in accordance with the methods given in ISO 13953, the butt-fusion joints between PE pipes shall conform to the requirements given in Table 5.

Table 5 — Jointing characteristics of PE pipes

Characteristic	Requirement	Test parameter	Test method
Failure mode	Ductile failure	ISO 13953	

5.8 Marking

Pipes shall be marked in accordance with ISO 11296-1:—, 5.8.

The nominal size shall be marked as DN/OD.

NOTE In addition, PE pipes can be marked with the following optional information: MFR.

6 Fittings at the "M" stage

Fittings shall be either polyethylene (PE) conforming to ISO 8772 or unplasticized poly(vinyl chloride) (PVC-U) conforming to ISO 4435.

7 Ancillary components

This part of ISO 11296 is not applicable to any ancillary components.