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Plastics piping systems for renovation of underground gas supply networks

Part 3: Lining with close-fit pipes

Systèmes de canalisations en plastique pour la rénovation des réseaux de gaz 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 11299-3 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*.

ISO 11299 consists of the following parts, under the general title *Plastics piping systems for renovation of underground gas supply networks*:

— *Part 1: General*

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

Introduction

This part of ISO 11299 is part of a system standard for plastics piping systems of various materials used for the renovation of existing pipelines in a specified application area. System standards for renovation deal with the following applications:

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

— 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 (this application).

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 verification of characteristics of plastics piping systems as manufactured.

This system standard comprises a *Part 1: General* and all applicable parts relating to the renovation technique family, from the following:

— *Part 2: Lining with continuous pipes*

— *Part 3: Lining with close-fit pipes (this document)*

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

— *Part 6: Lining with adhesive-backed hoses*

The requirements for any given renovation technique family are specified in this part of ISO 11299 and are applied in conjunction with the relevant other part. For example, both ISO 11299-1 and this part of ISO 11299 specify the requirements relating to lining with close-fit pipes. For complementary information, see ISO 11295. Not all technique families are pertinent 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 of ISO 11299, in order to facilitate direct comparisons across renovation technique families.

Figure 1 illustrates the common part and clause structure and the relationship between ISO 11299 and the system standards for other application areas.

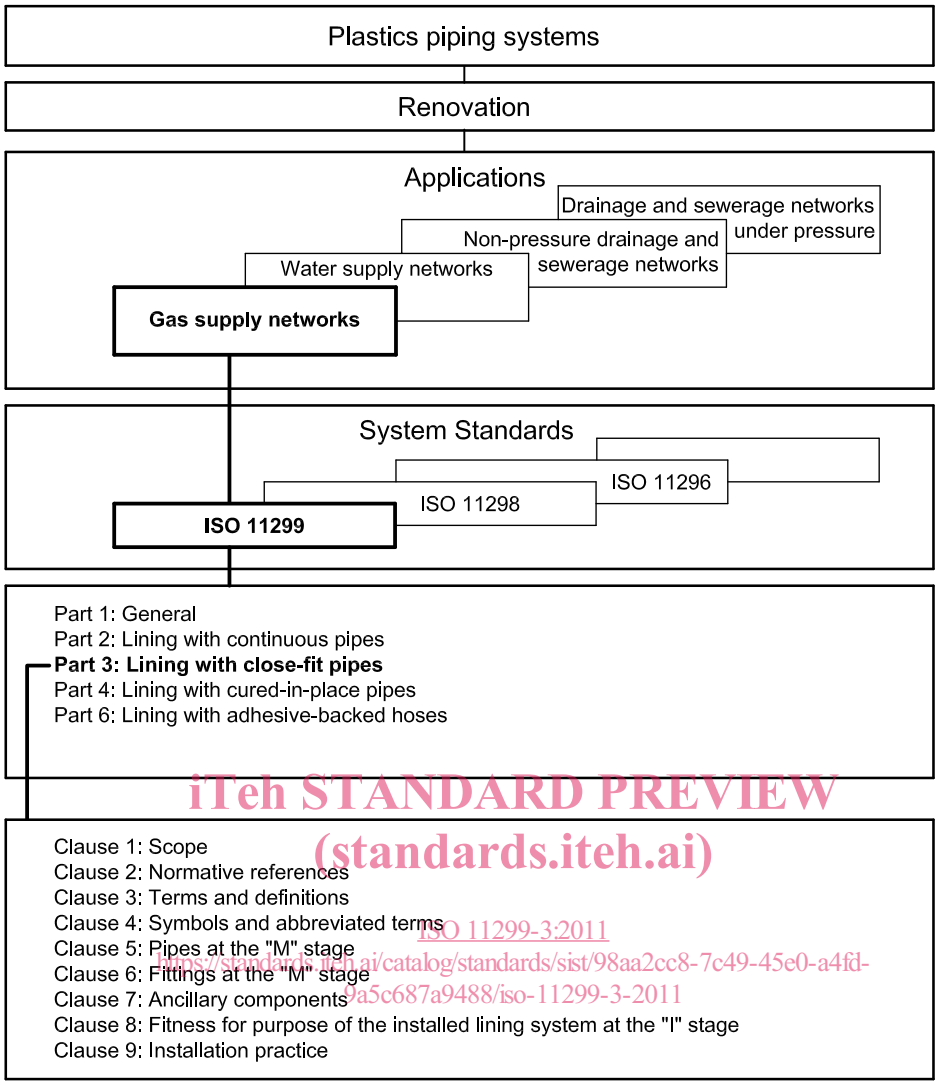

Figure 1 — Format of the renovation system standards

Plastics piping systems for renovation of underground gas supply networks

Part 3: Lining with close-fit pipes

1 Scope

This part of ISO 11299, in conjunction with ISO 11299-1, specifies requirements and test methods for close-fit lining systems intended to be used for the renovation of gas supply networks.

It is applicable to polyethylene (PE) pipes for both independent and interactive pressure pipe liners as well as associated fittings and joints for the construction of the lining system.

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

ISO 4437:2007, *Buried polyethylene (PE) pipes for the supply of gaseous fuels — Metric series — Specifications*

ISO 8085-3, *Polyethylene fittings for use with polyethylene pipes for the supply of gaseous fuels — Metric series — Specifications — Part 3: Electrofusion fittings*

ISO 11299-1:2011, *Plastics piping systems for renovation of underground gas supply networks — Part 1: General*

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

ISO 12176-2, *Plastics pipes and fittings — Equipment for fusion jointing polyethylene systems — Part 2: Electrofusion*

3 Terms and definitions

For the purposes of this document, the terms, definitions, symbols and abbreviations given in ISO 11299-1 and the following apply.

3.1 General

3.1.1
close fit
situation 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

3.1.2
close-fit pipe
continuous lining pipe of thermoplastic material reshaped or otherwise expanded after insertion to achieve a close fit to the existing pipeline

3.2 Techniques

No additional definitions apply.

3.3 Characteristics

3.3.1
maximum mean outside diameter
$d_{em,max}$
maximum value of the mean outside diameter as specified for a given nominal size

3.4 Materials

No additional definitions apply.

3.5 Product stages

No additional definitions apply.

3.6 Service conditions

3.6.1
maximum operating pressure
MOP
maximum effective pressure of the fluid in the piping system which is allowed in continuous use

NOTE 1 MOP is expressed in bar, where 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.

NOTE 2 It takes into account the physical and the mechanical characteristics of the components of a piping system.

NOTE 3 It is calculated using the following equation:

$$MOP = \frac{20 \times (MRS)}{C \times (SDR - 1)}$$

3.7 Joints

3.7.1
electrofusion joint
joint between a PE socket or saddle electrofusion fitting and a pipe or fitting with spigotted ends, made by heating the electrofusion fittings by the Joule effect of the heating element incorporated at their jointing surfaces, causing the material adjacent to them to melt and pipe and fitting surfaces to fuse

3.7.2
butt fusion joint
joint made by heating the planed ends of matching surfaces by holding them against a flat heating plate until the PE material reaches fusion temperature, quickly removing the heating plate and pushing the two softened ends against one another

3.7.3
mechanical joint
joint made by assembling a PE pipe to another PE pipe, or any other element of the piping system that generally includes a compression part, to provide for pressure integrity, leaktightness and resistance to end loads

NOTE A support sleeve inserted into the pipe bore can be used to provide a permanent support for the PE pipe to prevent creep in the pipe wall under radial compressive forces.

3.7.4
fusion compatibility
ability of two similar or dissimilar PE materials to be fused together to form a joint which conforms to the performance requirements of this part of ISO 11299

4 Symbols and abbreviated terms

4.1 Symbols

C	overall service (design) coefficient
d_e	outside diameter (at any point)
$d_{em,max}$	maximum mean outside diameter
$d_{em,min}$	minimum mean outside diameter
d_{manuf}	original circular outside diameter of the pipe (before processing for insertion)
$e_{m,max}$	maximum mean wall thickness
T	temperature at which stress rupture data have been determined
t	time to occurrence of a leak in the pipe
t_y	wall thickness tolerance
σ_s	design stress

4.2 Abbreviated terms

LPL	lower confidence limit of the predicted hydrostatic strength
MFR	melt mass-flow rate
MOP	maximum operating pressure
MRS	minimum required strength
PE	polyethylene
R	series of preferred numbers, conforming to the Renard series
SDR	standard dimension ratio

5 Pipes at the “M” stage

5.1 Materials

5.1.1 Virgin material

The virgin material used shall be in accordance with one of the PE compound designations given in Table 1.

Table 1 — PE compound designations

Designation	Classification by MRS MPa
PE 80	8
PE 100	10

The compound shall conform to ISO 4437.

5.1.2 Reprocessable and recyclable material

In accordance with ISO 4437, the manufacturer's own reprocessable material may be used, provided that it is derived from the same compound as used for the relevant production.

Reprocessable material obtained from external sources and recyclable material shall not be used.

5.2 General characteristics

5.2.1 Appearance

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 11299.

5.2.2 Colour

The pipes shall be yellow or orange, or black with yellow or orange identification stripes.

5.3 Material characteristics

The material from which the pipes are made shall conform to the requirements specified in Table 1 of ISO 4437:2007.

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 "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-section can be present. This is acceptable as long as the folded pipe has properties such that it can obtain a wall thickness in accordance with 8.4 when installation is complete.

5.5 Mechanical characteristics

When tested in accordance with the method given in Table 2, the pipe shall conform to the requirements in the table.

Table 2 — Mechanical characteristics of pipes

Characteristic	Requirement	Test parameters		Test method
		Parameters	Value	
Elongation at break	ISO 4437[a]			
Hydrostatic strength (80 °C, 165 h)				

[a] The pipe shall be reverted in the case of factory-folded pipes.

5.6 Physical characteristics

Physical characteristics shall conform to those specified in ISO 4437. In the case of factory-folded heat-reverted pipes, the pipe shall additionally conform to the requirement for memory ability specified in Annex A.

5.7 Jointing

Butt-fusion joints shall conform to ISO 4437. Butt fusion joints shall not be made between folded pipes prior to reversion.

NOTE The joining of circular pipes to form a string prior to site processing is considered part of the “M” stage.

5.8 Marking

Pipes shall be marked in accordance with ISO 11299-1:2011, 5.8.

Under item c) specified in ISO 11299-1:2011, 5.8, the nominal size marked shall be DN/OD.

Under item d) specified in ISO 11299-1:2011, 5.8, the dimension marked shall be SDR.

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

6 Fittings at the “M” stage

Fittings shall conform to the requirements of ISO 8085-3.

NOTE It is possible for some fittings conforming to ISO 8085-3 to not be compatible with the dimensional tolerances given in Table 3.

7 Ancillary components

Ancillary components shall conform to ISO 4437.

NOTE Interactive pressure pipe liners can rely on the use of technique-dependent, mechanical fittings for end connections and service connections. The mechanical fittings provide the connection between the liner, which is generally thin walled, and the rest of the pipeline system, by clamping the liner wall inside/outside. By means of a movable compression part, the fitting provides pressure integrity, leaktightness and resistance to end loads. The fitting generally includes a support sleeve, either inserted into or assembled around the liner, and can also include a grip ring. The mechanical fitting can be supplied for field assembly.

8 Fitness for purpose of the installed lining system at the “I” stage

8.1 Materials

Any combination of pipes, fittings and valves for heat fusion conforming to Clauses 5, 6 and 7 respectively may be used, provided that, where applicable, fusion compatibility has been demonstrated in accordance with ISO 4437:2007, 4.6.

8.2 General characteristics

The internal surface of the pipe shall be smooth and free from scoring and other defects which could impair the functionality.

NOTE A feature of close-fit pipe is that the lining can conform to the surface characteristics of the existing pipe.

8.3 Material characteristics

There are no additional requirements for material characteristics.