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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 enterrés de distribution de gaz -- Partie 3: Tubage par tuyau continu sans espace annulaire

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Foreword

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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).

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For an explanation of the voluntary nature of standards, 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids,* Subcommittee SC 8, *Rehabilitation of pipeline systems*

This second edition cancels and replaces the first edition (ISO 11299-3:2011), which has been technically revised.

The main changes compared to the previous edition are as follows:

Figure 1 and Clauses 1, 2, 3.3, 3.4, 3.6, 5.7, 5.8, 6, 8.4, 8.5, and 9.2 to 9.8 have been technically revised.

A list of all parts in the ISO 11299 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is a 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 dealing with the following applications are either available or in preparation:

— ISO 11296, *Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks*;

— ISO 11297, *Plastics piping systems for renovation of underground drainage and sewerage networks under pressure*;

— ISO 11298, *Plastics piping systems for renovation of underground water supply networks*;

— ISO 11299, *Plastics piping systems for renovation of underground gas supply networks* (this series of standards).

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

This System Standard comprises a:

— *Part 1: General*

and all applicable renovation technique family-related parts, which, for gas supply networks , include or potentially include 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*;

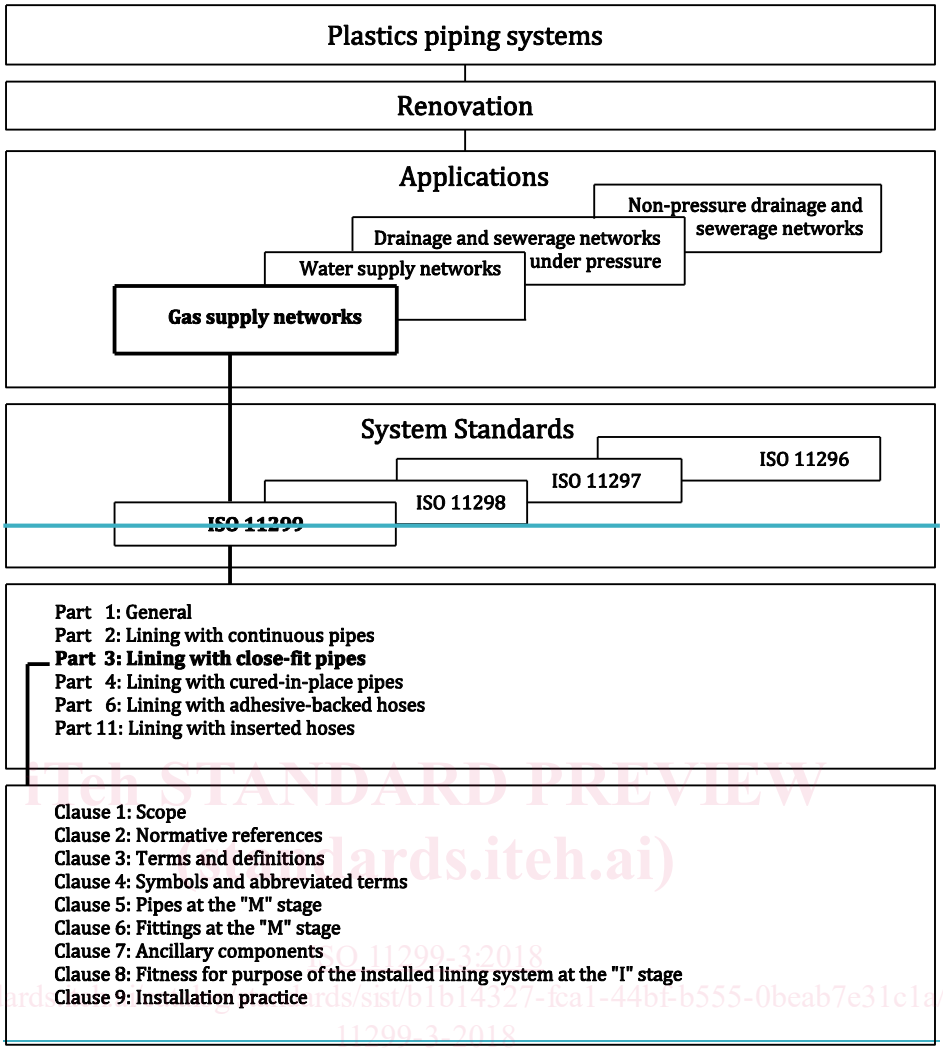
— *Part 6: Lining with adhesive-backed hoses*;

— *Part 11: Lining with inserted hoses*.

The requirements for any given renovation technique family are given in Part 1, applied in conjunction with the relevant other part. For example, ISO 11299-1 and this document together 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 shows the common part and clause structure and the relationship between ISO 11299 and the System Standards for other application areas.



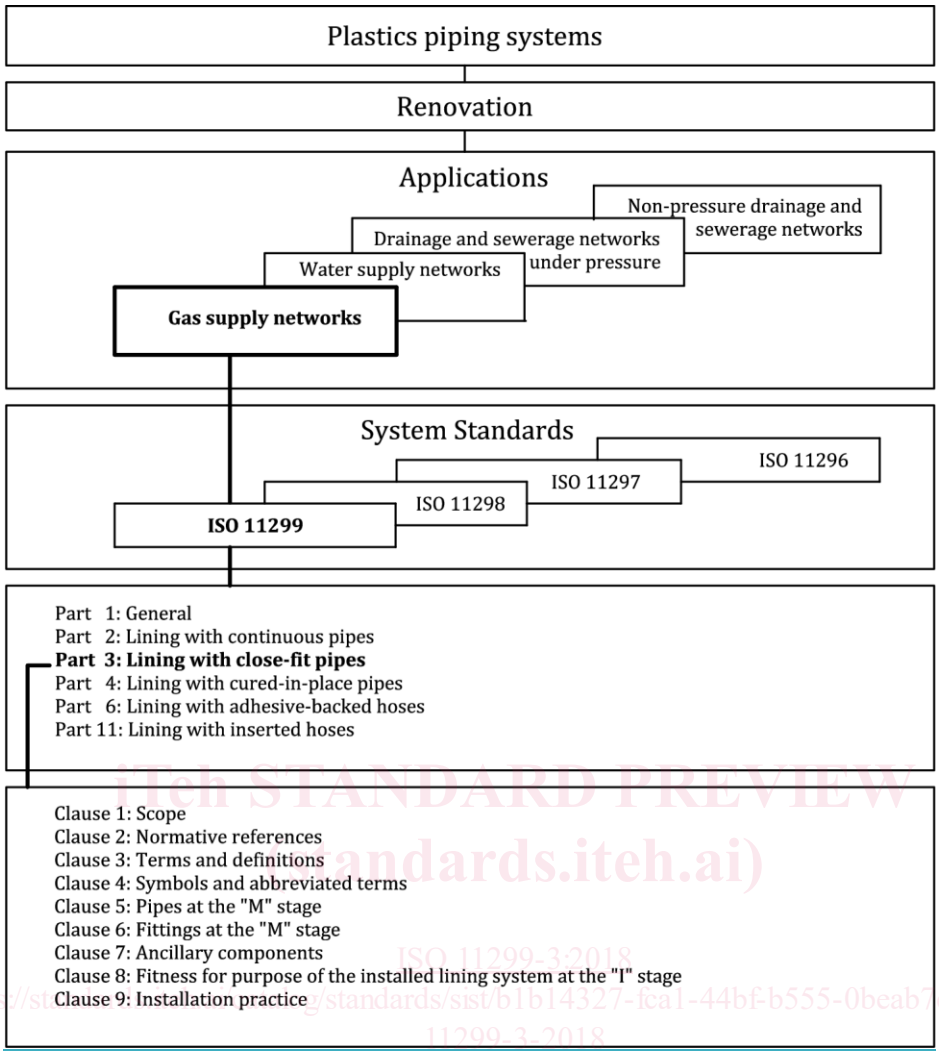


Figure 1 — Format of the renovation system standards

Plastics piping systems for renovation of underground gas supply networks — Part 3: Lining with close-fit pipes

1 Scope

This document, 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 applies to pipes and fittings, as manufactured, as well as to the installed lining system. It is applicable to polyethylene (PE) pipe of either solid wall single layer or ~~coextruded~~co-extruded layer construction, which is reduced in the factory or on site to provide a close-fitting independent or interactive pressure pipe liner, as well as associated fittings and joints for the construction of the lining system. This document is not applicable for PE coated pipes having a peelable, contiguous, thermoplastics additional layer on the outside of the pipes.

It is applicable to PE pipes, fittings and assemblies intended to be used at an operating temperature of 20 °C as the reference temperature.

NOTE For other operating temperatures, guidance is given in ISO 4437-5:2014.

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

ISO 4437-1, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 1: General*

ISO 4437-2, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 2: Pipes*

ISO 4437-3, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 3: Fittings*

ISO 4437-4, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 4: Valves*

ISO 4437-5:2014, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 5: Fitness for purpose of the system*

ISO 11299-1~~: —~~[1]:2018, *Plastics piping systems for renovation of underground water supply networks — Part 1: General*

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

[1] ~~2nd edition, to be published.~~

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

EN 1555-1, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 1: General*

EN 1555-2, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 2: Pipes*

EN 1555-3, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 3: Fittings*

EN 1555-4, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 4: Valves*

EN 1555-5:2010, *Plastics piping systems for the supply of gaseous fuels — Polyethylene (PE) — Part 5: Fitness for purpose of the system*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11299-1 and the following 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 https://www.iso.org/obp

3.1 General

3.1.1
compound formulation
clearly defined homogenous mixture of base polymer with additives, e.g. antioxidants, pigments, stabilizers and others, at a dosage level necessary for the processing and intended use of the final product

3.1.2
solid wall single layered pipe
pipe with smooth internal and external surface, extruded from the same compound/formulation throughout the wall

3.1.~~2~~3
pipe with co-extruded layers
pipe with smooth internal and external surface, having co-extruded layers on either or both the outside and inside of the pipe, where all layers have the same MRS rating

3.1.~~3~~4
close fit
situation of the outside of the installed liner relative to the inside of the existing pipeline, which can either be an interference fit or include a small annular gap resulting from shrinkage and tolerances only

3.1.~~4~~5
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
~~**MRS**~~
minimum required strength
MRS
value of σ_{LPL} rounded down to the next smaller value of the R10 series or R20 series, depending on the value of σ_{LPL}

Note 1 to entry: R10 and R20 series are the Renard number series according to ISO 3 and ISO 497.

3.3.2
~~**MFR**~~
melt mass-flow rate
MFR
rate of extrusion of a molten resin through a die of specified length and diameter under prescribed conditions of temperature, load and piston position in the cylinder of an extrusion plastometer, the rate being determined as the mass extruded over a specified time

Note 1 to entry: MFR is expressed in units of grams per 10 min.

[SOURCE: ISO 1133-1:2011, 3.1]

3.4 Materials

3.4.1
crazing
microstructural phenomenon associated with the short-term application of tensile bending strain exceeding the material-related critical yield strain

3.5 Product stages

No additional definitions apply.

3.6 Service conditions

3.6.1
maximum operating pressure
MOP
maximum effective pressure of gas in a piping system, expressed in bar[2], which is allowed in continuous use

Note 1 to entry: It takes into account the physical and mechanical characteristics of the components of the piping system (and the influence of the gas on these characteristics) and it is calculated using the following formula:

[2] 1 bar =0,1 MPa = 0,1 N/mm^2 = 10^5·N/m^2.

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

[SOURCE: ISO 17885:2015, 3.1.11]

3.6.2
design coefficient
C
coefficient with a value greater than 2, which takes into consideration service conditions as well as properties of the components of a piping system other than those represented in the lower confidence limit

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, using a fitting that generally includes a compression part, to provide for pressure integrity, leaktightness and a gripping part to provide resistance to end loads

Note 1 to entry: 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 document.

4 Symbols and abbreviated terms

4.1 Symbols

For the ~~purpose~~purposes of this document, the symbols given in ISO 11299-1 and the following apply.

C	design coefficient
d_e	outside diameter (at any point)
d_{manuf}	original circular outside diameter of the pipe (before processing for insertion)
$e_{m,\,max}$	maximum mean wall thickness

σ_{LPL} quantity with the dimensions of stress, which represents the 97,5 % lower confidence limit of the predicted hydrostatic strength at temperature T, and time t

T temperature at which stress rupture data have been determined

t time to occurrence of a leak in the pipe

4.2 Abbreviated terms

For the purposes of this document the following abbreviated terms apply:

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

5 Pipes at the "M" stage

5.1 Materials

The compound(s) from which the pipes are made shall conform to ISO 4437-1 and ISO 4437-2.

5.2 General characteristics

General characteristics of solid wall single layered pipes and pipes with co-extruded layers shall conform to the requirements of ISO 4437-2.

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 document.

5.2.2 Colour

Pipes shall be black (PE 80 or PE 100), yellow (PE 80), or orange (PE 100). In addition, black PE 80 pipes can be identified by yellow stripes and black PE 100 pipes can be identified by yellow or orange stripes, according to national preference.

5.3 Material characteristics

The material from which the pipes are made shall conform to the requirements specified in ISO 4437-2. The requirements for OIT and MFR shall apply to each individual layer.

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.

In the case of factory-folded pipes, variations in wall thickness in one cross-section can be present at the "M" stage. This is acceptable, as long as the folded pipe has the property to obtain a wall thickness in accordance with 8.4 when installation is complete.