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Plastics piping systems for renovation of underground water supply networks —

Part 2: Lining with continuous pipes

Systémes de canalisation en plastiques pour la rénovation des réseaux enterrés d'alimentation en eau —

Partie 2: Tubage par tuyau continu avec espace annulaire

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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 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 the following URL: 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*.

A list of all parts in the ISO 11298 series can be found on the ISO website.

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 deal with the following applications:

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

— ISO 11927, *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* (this application);

— ISO 11299, *Plastics piping systems for renovation of underground gas supply networks*.

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 system components "as manufactured".

Each of the system standards comprises a:

— *Part 1: General*,

and all applicable renovation technique family-related parts, which for water supply networks under pressure include or potentially include the following:

— *Part 2: Lining with continuous pipes (this document)*;

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

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

— *Part 5: Lining with discrete pipes*;

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

— *Part 10: Lining with sprayed polymeric materials*;

— *Part 11: 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, this document and ISO 11298-1 together specify the requirements relating to lining with continuous 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 ISO 11298 (all parts), in order to facilitate direct comparisons across renovation technique families.

Figure 1 shows the common part and clause structure and the relationship between ISO 11298 (all parts) and the system standards for other application areas.

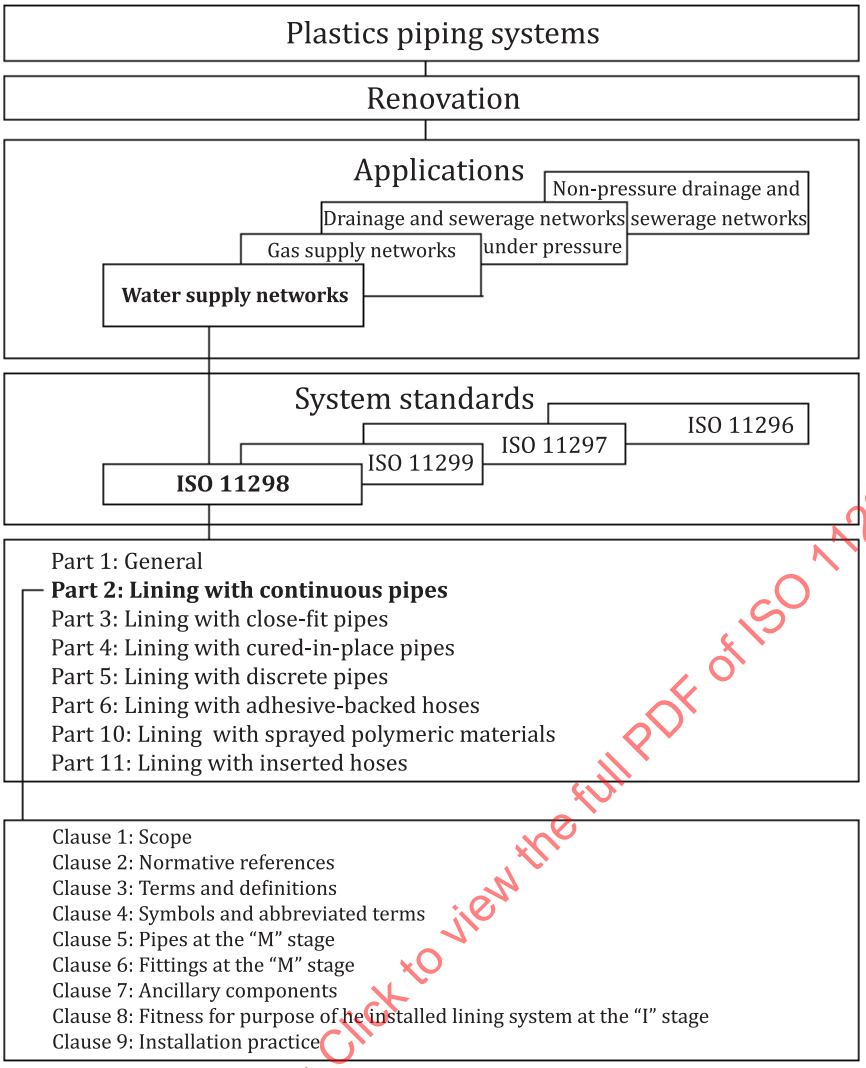

Figure 1 — Format of the renovation system standards

Plastics piping systems for renovation of underground water supply networks —

Part 2: Lining with continuous pipes

1 Scope

This document, read in conjunction with ISO 11298-1, specifies requirements and test methods for pipes and fittings which are part of plastics piping systems installed as continuous pipes in the renovation of underground water supply networks. It is applicable to PE pipes of three different types:

— PE solid wall single layered pipes (nominal outside diameter, d_n), including any identification stripes;

— PE pipes with co-extruded layers on either or both the outside and inside of the pipe (total outside diameter, d_n), as specified in Annex A, where all layers have the same MRS rating;

— PE coated pipes (outside diameter, d_n) having a peelable, contiguous, thermoplastics additional layer on the outside of the pipe ("coated pipe"); see Annex A.

In addition, it covers

— jointing of pipe lengths by means of butt fusion, and

— fabricated and injection-moulded fittings made of PE.

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 applications operating at constant temperatures greater than 20 °C and up to 40 °C, see ISO 4427-1:2007, Annex A.

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 4427-1:2007, *Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply — Part 1: General*

ISO 4427-2, *Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply — Part 2: Pipes*

ISO 4427-3, *Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply — Part 3: Fittings*

ISO 4427-5, *Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply — Part 5: Fitness for purpose of the system*

ISO 11298-1:2018, *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*

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

EN 12201-1, *Plastics piping systems for water supply, and for drainage and sewerage under pressure — Polyethylene (PE) — Part 1: General*

EN 12201-2, *Plastics piping systems for water supply, and for drainage and sewerage under pressure — Polyethylene (PE) — Part 2: Pipes*

EN 12201-3, *Plastics piping systems for water supply, and for drainage and sewerage under pressure — Polyethylene (PE) — Part 3: Fittings*

EN 12201-5, *Plastics piping systems for water supply, and for drainage and sewerage under pressure — 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 11298-1 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 http://www.iso.org/obp

3.1
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

3.2
coated pipe
pipe with a peelable, contiguous thermoplastic additional layer on the outside of the pipe

3.3
solid wall single layered pipe
pipe with smooth internal and external surface, extruded from the same *compound formulation* (3.1) throughout the wall

3.4
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

3.5
out-of-roundness
difference between the measured maximum and the measured minimum outside diameter in the same cross-sectional plane of the pipe

4 Symbols and abbreviated terms

4.1 Symbols

d_n nominal outside diameter

$e_{coating}$ nominal thickness of the coating

4.2 Abbreviated terms

MFR melt mass-flow rate

CCTV closed-circuit television

MRS minimum required strength

OIT oxidation induction time

PE polyethylene

5 Pipes at the "M" stage

5.1 Material

Pipes shall be of PE conforming to the requirements of ISO 4427-1.

5.2 General characteristics

General characteristics of pipes shall conform to the requirements of ISO 4427-2.

5.3 Material characteristics

Material characteristics shall conform to the requirements of ISO 4427-2.

5.4 Geometrical characteristics

Geometrical characteristics of pipes shall conform to the requirements of ISO 4427-2. In addition, any combination of nominal diameter and wall thickness shall be permitted, provided this is validated by design calculations that take account of both installation and operational loadings on the pipe for a specific application.

5.5 Mechanical characteristics

The mechanical characteristics of pipes shall conform to the requirements of ISO 4427-2.

5.6 Physical characteristics

The physical characteristics of pipes shall conform to the requirements of ISO 4427-2.

5.7 Jointing

When pipes are assembled to each other or to components, the joints shall conform to ISO 4427-2, ISO 4427-3 and ISO 4427-5. All butt fusions shall be externally debeaded and if required by the client, internally debeaded.

5.8 Marking

All pipes shall be marked either in accordance with ISO 11298-1 or in accordance with ISO 4427-2. Where the pipe is coated (see A.3), the coating shall be marked so as to clearly distinguish the pipe from non-coated pipe in service (e.g. by broad colour bands).

5.9 Regional requirements for pipes

In countries of the Single European Market, ISO 4427-1, ISO 4427-2, ISO 4427-3 and ISO 4427-5 are replaced by EN 12201-1, EN 12201-2, EN 12201-3 and EN 12201-5.

6 Fittings at the "M" stage

6.1 Requirements

Fittings shall fulfil the requirements in ISO 4427-3.

NOTE Wide tolerance fittings can be required for compatibility with pipe dimensions as specified in 5.4.

6.2 Marking

Each fitting shall be marked either in accordance with ISO 11298-1 or in accordance with ISO 4427-3.

6.3 Regional requirements for fittings

In countries of the Single European Market, ISO 4427-3 specified as normative reference in 6.1 to 6.2 is replaced by EN 12201-3.

7 Ancillary components

This document does not cover any ancillary components.

8 Fitness for purpose of the system for pipes and fittings at the "I" stage

Pipes and fittings shall conform to the requirements of ISO 11298-1.

Out-of-roundness of the lining system after installation (including any caused by grouting of the annular space) shall not exceed any maximum value agreed between the client and installer.

9 Installation practice

9.1 Preparatory work

The preparatory work shall conform to ISO 11298-1.

NOTE Depending on the condition of the existing pipeline, cleaning can be necessary to remove encrustation.

9.2 Storage, handling and transport

Precautions shall be taken to ensure that no excessive damage is caused to the lining pipe during unloading, site handling and storage. In this context, excessive damage shall mean any scratch which is more than 10 % of the wall thickness in depth or the imposition of any severe bending operation, which results in a permanent kink, crease or fold.

When assessing damage to the pipe wall caused by scratches, the installer should be aware that further scratch damage can occur during installation.

The lining pipe shall be stored on reasonably level ground, free of large sharp stones, debris or litter, to avoid potentially damaging point-loading.

In general, and in the absence of any specific handling requirements, these precautions shall include the use of webbing slings in place of wire rope or chains and the use of spreader beams for pipe lengths in excess of 12 m. Where the system designer specifies handling requirements, these shall prevail.

The lining pipe shall be transported on a flat-bed vehicle, free of nails or other projections, or on a purpose-built trailer designed to carry the lining pipe as a free-standing coil or wound on to a drum. Before being loaded, the lining pipe shall be visually checked for any damage.

Pipe ends shall be securely sealed to prevent contamination of the pipe by moisture and/or dirt under storage, handling and transport.

For pipes of 600 mm diameter or larger, a suitable plug or other closure, which also prevents ovalization or other deformation, is recommended.

9.3 Equipment

9.3.1 Butt fusion equipment and debeading equipment

Butt fusion equipment shall be capable of producing joints between PE pipes or PE pipes and fittings under site conditions and shall comply with ISO 12176-1.

In addition to the heater plate, the equipment shall include such clamping, re-rounding and trimming systems as ensure alignment and matching of the pipe ends, and an external debeader capable of removing the bead cleanly in one continuous strip without damage to the pipe surface. If an internal debeader is used, this shall not cause damage to the internal pipe surface.

A shelter shall be provided to avoid fusion joint contamination from water and dust and to generally maintain a clean and warm working environment. The ends of the lining pipe string shall be plugged to prevent cold air blowing through, which could otherwise adversely affect the fusion joint.

9.3.2 Pipe rollers

Pipe rollers shall be used for all pipe handling operations except by means of a crane. The rollers shall minimize frictional loads and prevent damage to the pipe as it is moved during the butt fusion and installation processes.

9.3.3 Winching and rod pulling equipment

Winching equipment usually consists of a powered winch connected to the lining pipe by a winch cable and appropriate nose cone connection.

Rod pulling equipment usually consists of a hydraulic ram-driven carriage, connected to the lining pipe by a string of rods which screw or hook together, and an appropriate nose cone connection.

All pulling equipment shall have a means of displaying in real time, and recording graphically or numerically, the force applied to the pipe during installation. In the case of a winch, this shall be by directly measuring the load on the winch wire. In the case of a rod puller, this shall be by directly measuring either the load applied to the rods or the load applied to the nose cone.

WARNING — All pulling operations are potentially dangerous and any exposed winch cable or puller rods should be guarded.

NOTE Attention is drawn to any national health and safety regulations applicable to pulling equipment and operations.

9.3.4 Pipe entry guides

Pipe entry guides shall be designed to prevent damage to the lining pipe during insertion.

9.3.5 Electrofusion equipment

Electrofusion equipment shall conform to ISO 12176-2. The power supply/controller and associated alignment and fixing clamps shall be such as to ensure fusion when following the manufacturer's guidelines for surface preparation and fusion.

9.3.6 Inspection equipment

Closed-circuit television (CCTV) shall provide a full colour picture and recording/replay facilities complete with slow motion and frame by frame replay and shall provide a clear picture of all parts of the installed pipe. The recording shall be labelled on screen with full location, metreage, liner type, nominal size and date information.

Laser profiling equipment shall additionally report mean internal diameter and pipe ovality, with graphical images of pipe cross-section, at metreage intervals of one diameter or less.

All equipment to be introduced into the installed pipe, including proving pigs, shall be constructed and maintained so as to prevent any damage or contamination to the installed pipe.

9.3.7 Lifting equipment

All lifting equipment shall be covered by current test certification and shall be operated only by trained personnel.

NOTE Attention is drawn to any legislation applicable to lifting equipment.

9.4 Installation

Installation shall follow the procedures detailed in the installation manual.

The installation manual shall specify the method of installation, including the use of pipe entry guides, liner termination and reconnection to existing network and customer service pipes, inspection and testing, and all necessary parameters according to the requirements of the method described.

The manual shall also include:

a) maximum allowable pulling force as declared by the pipe manufacturer as a function of temperature;

NOTE The maximum pulling force is usually calculated to limit the maximum stress to not more than 50 % of the tensile yield stress of the material.

b) minimum allowable longitudinal bending radius during installation, as declared by the pipe manufacturer as a function of SDR and temperature, and the associated minimum length of access pit as a function of excavation depth;

c) details of the types of fittings to be used.

Where pipes are jointed to form one pipe string on site using butt-fusion, a method statement for internal debeading, where required, and for external debeading shall be provided and shall specify at least:

— how the bead is removed;

— how the bead and related joint are identified;

— how the bead is to be examined for quality control purposes and stored for future reference.

Where there is a peelable layer, this shall be removed prior to jointing.

