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

Part 9: Lining with a rigidly anchored plastics inner layer

Systèmes de canalisations en plastique pour la rénovation des réseaux de branchements et de collecteurs d'assainissement enterrés sans pression —

Partie 9: Tubage par coffrage plastique interne rigidement ancré

Reference number
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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 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,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 165, *Waste water engineering,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 11296 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 family of system standards 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:

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

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

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

— the ISO 11299 series, *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 series comprises a:

— *Part 1: General*

and all applicable renovation technique family-related parts, which for non-pressure drainage and sewerage networks includes or potentially includes 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;*

— *Part 8: Lining with pipe segments;*

— *Part 9: Lining with rigidly anchored plastics inner layer (this document);*

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

The requirements for any given renovation technique family are specified in Part 1, applied in conjunction with the relevant other part. For example, both ISO 11296-1 and this document together specify the requirements relating to lining with a rigidly anchored plastics inner layer. For complementary information, see ISO 11296-1. Not all technique families are pertinent to every area of application and this is reflected in the part numbers included in each system standard series.

A consistent structure of clause headings has been adopted for all parts of the ISO 11296 series in order to facilitate direct comparisons across renovation technique families.

Figure 1 shows the common part and clause structure and the relationship between ISO 11296-1 and the system standards for other application areas.

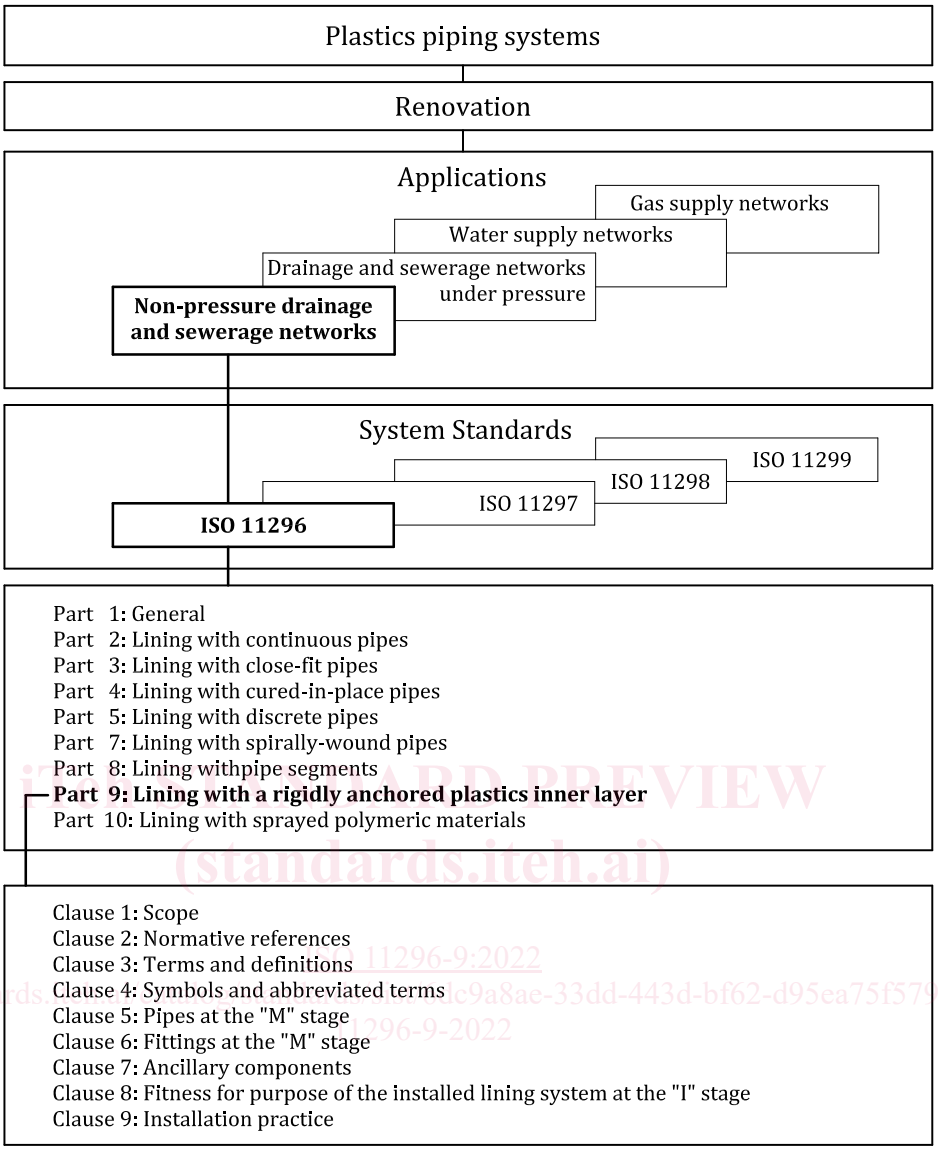

Figure 1 — Format of the renovation system standards

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

Part 9:
Lining with a rigidly anchored plastics inner layer

1 Scope

This document, in conjunction with ISO 11296-1, specifies the requirements and test methods for pipes and fittings for the renovation of underground non-pressure drainage and sewerage networks by lining with a single rigid annulus of structural cementitious grout formed behind a plastics inner layer. This plastics layer serves as permanent formwork anchored to the grout.

This document is applicable to plastics inner layers and grout systems with or without steel reinforcement. It does not apply to the structural design of the lining system.

NOTE Systems with multiple annuli are available, but these are controlled by patent rights and not covered by this document.

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 37, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties*

ISO 48-4, *Rubber, vulcanized or thermoplastic — Determination of hardness — Part 4: Indentation hardness by durometer method (Shore hardness)*

ISO 75-2:2013, *Plastics — Determination of temperature of deflection under load — Part 2: Plastics and ebonite*

ISO 306, *Plastics — Thermoplastic materials — Determination of Vicat softening temperature (VST)*

ISO 527-1, *Plastics — Determination of tensile properties — Part 1: General principles*

ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

ISO 630-1, *Structural steels — Part 1: General technical delivery conditions for hot-rolled products*

ISO 630-2, *Structural steels — Part 2: Technical delivery conditions for structural steels for general purposes*

ISO 1133-1, *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics — Part 1: Standard method*

ISO 1133-2, *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics — Part 2: Method for materials sensitive to time-temperature history and/or moisture*

ISO 1183-1, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pycnometer method and titration method*

ISO 4624:2016, *Paints and varnishes — Pull-off test for adhesion*

ISO 4948-2, *Steels — Classification — Part 2: Classification of unalloyed and alloy steels according to main quality classes and main property or application characteristics*

ISO 6935 (all parts), *Steel for the reinforcement of concrete*

ISO 11296-1:2018, *Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks — Part 1: General*

ISO 11296-4:2018, *Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks — Part 4: Lining with cured-in-place pipes*

ISO 11296-4:2018/Amd 1:2021, *Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks — Part 4: Lining with cured-in-place pipes — Amendment 1: Updated definitions, marking requirements and procedure for alternative expression of flexural test results*

ISO 11296-7, *Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks — Part 7: Lining with spirally-wound pipes*

ISO 11357-6, *Plastics — Differential scanning calorimetry (DSC) — Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT)*

ISO 12162, *Thermoplastics materials for pipes and fittings for pressure applications — Classification, designation and design coefficient*

ISO 13262, *Thermoplastics piping systems for non-pressure underground drainage and sewerage — Thermoplastics spirally-formed structured-wall pipes — Determination of the tensile strength of a seam*

EN 196-1, *Methods of testing cement — Part 1: Determination of strength*

EN 445:2007, *Grout for prestressing tendons — Test methods*

EN 1015-3, *Methods of test for mortar for masonry — Part 3: Determination of consistence of fresh mortar (by flow table)*

EN 1015-6, *Methods of test for mortar for masonry — Part 6: Determination of bulk density of fresh mortar*

EN 1107-2, *Flexible sheets for waterproofing — Determination of dimensional stability — Part 2: Plastic and rubber sheets for roof waterproofing*

EN 1542:1999, *Products and systems for the protection and repair of concrete structures — Test methods — Measurement of bond strength by pull-off*

EN 1610:2015, *Construction and testing of drains and sewers*

EN 1916:2002, *Concrete pipes and fittings, unreinforced, steel fibre and reinforced*

EN 10025-1, *Hot rolled products of structural steels — Part 1: General technical delivery conditions*

EN 10025-2, *Hot rolled products of structural steels — Part 2: Technical delivery conditions for non-alloy structural steels*

EN 12814-2, *Testing of welded joints of thermoplastics semi-finished products — Part 2: Tensile test*

EN 12814-8, *Testing of welded joints of thermoplastics semi-finished products — Part 8: Requirements*

EN 13067, *Plastics welding personnel - Qualification testing of welders — Thermoplastics welded assemblies*

EN 13100-4, *Non-destructive testing of welded joints of thermoplastics semi-finished products — Part 4: High voltage testing*

EN 13412:2006, *Products and systems for the protection and repair of concrete structures — Test methods — Determination of modulus of elasticity in compression*

EN 14117, *Products systems for the protection and repair of concrete structures — Test methods — Determination of time of efflux of cementitious injection products*

CEN/TR 14920, *Jetting resistance of drain and sewer pipes — Moving jet test method*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
lining with a rigidly anchored plastics inner layer
lining with pipe comprising a single rigid annulus of structural cementitious grout and a plastics inner layer anchored to the grout

3.2
anchored plastics inner layer
layer with integral anchors which forms the inside surface of the pipe after installation

3.3
profiled plastics strip
extruded profile of unplasticized poly(vinyl chloride) (PVC-U) or polyethylene (PE), with integral or separate *seam* (3.5) locking mechanism, used to form the waterway wall of a pipe liner

3.4
joiner strip
extruded profile of PVC-U or PE used to connect adjacent profiled plastic strips

3.5
seam
joint between adjacent *profiled plastics strips* (3.3) formed by an *integral locking mechanism* (3.6), use of a separate *joiner strip* (3.4) and/or *seam sealant* (3.7)

3.6
integral locking mechanism
mechanical interlock achieved by suitable design of the edges of the extruded profile, without use of a separate *joiner strip* (3.4)

3.7
seam sealant
thermoplastic or adhesive material added to the *integral locking mechanism* (3.6), *joiner strip* (3.4) or *profiled plastics strip* (3.3) surface to make the *seam* (3.5) leaktight

3.8
studded PE sheet
polyethylene sheet with integral anchoring studs

3.9
lateral connection collar
fitting for reconnecting a lined main pipe to an existing or renovated lateral pipe

3.10
annular space
gap between the plastics inner layer and either the host pipe or the external layer where present

3.11
reinforcement
steel bars incorporated in the grout or steel stiffening elements placed alongside or encapsulated within the plastics inner layer

3.12
grout system
cement-based grout including any fillers, *reinforcement* (3.11) or other additives or admixtures, in specified proportions

3.13
design thickness
combined thickness of plastics inner layer and grouted annulus required by structural design

3.14
spacer
block of material compatible with *grout system* (3.12) used to maintain minimum thickness of *annular space* (3.10) and prevent flotation of inner plastics layer during filling with grout

4 Symbols and abbreviated terms

4.1 General

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

4.2 Symbols

A_w	cross-sectional area of the profiled plastics strip per unit width
b_c	width of air test channel
D	mean diameter of the dolly
d_e	outside diameter of inner plastics layer in circular pipes
$d_{e,min}$	minimum outside diameter of inner plastics layer in circular pipes
e_o	overall height of anchored plastics inner layer
e_w	waterway wall thickness
e_a	height of neutral axis of the strip above its base
e_g	thickness of grout above height of anchors
$e_{g,min}$	minimum thickness of grout above height of anchors
F_a	effective crushing test result
F_h	failure load
F_u	ultimate (collapse) load
f_{bt}	bending tensile stress from crushing strength
f_h	anchoring strength of plastics inner layer
f_s	short-term tensile welding factor