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

**Part 7:
Lining with spirally-wound pipes**

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Systèmes de canalisations en plastique pour la rénovation des réseaux
de branchements et de collecteurs d'assainissement enterrés sans
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Partie 7: Tubage par enroulement hélicoïdal 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.

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 11296-7 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
- Part 7: Lining with spirally-wound pipes

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Lining with continuous pipes is to form the subject of a Part 2 and lining with discrete pipes is to form the subject of a Part 5.

Introduction

The System Standard, of which this is Part 7, specifies the requirements for plastics piping systems of various materials used for 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 relevant other 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 shows the common structure and the relationship between ISO 11296 and the System Standards for other application areas.

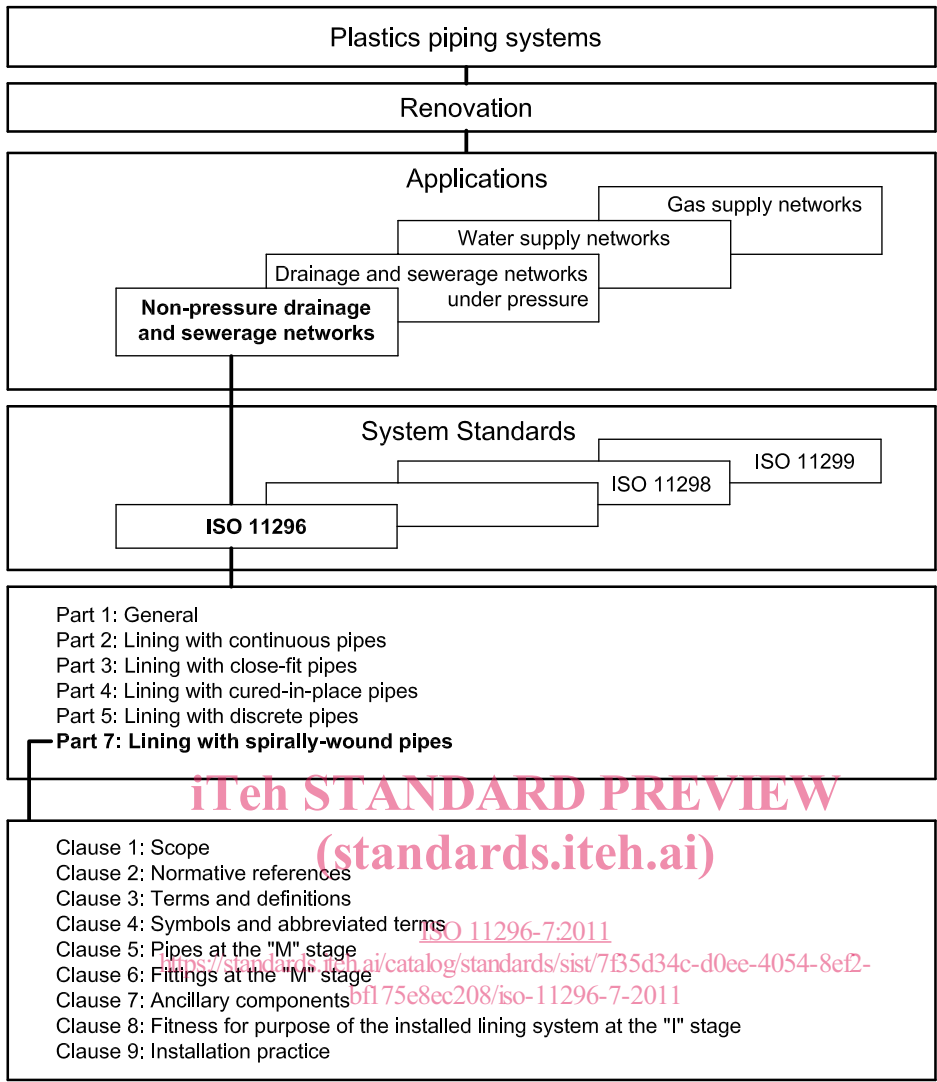


Figure 1 — Format of the renovation System Standards

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

Part 7: Lining with spirally-wound pipes

1 Scope

This part of ISO 11296, in conjunction with Part 1, specifies requirements and test methods for pipes which are formed on site by spirally winding and jointing a pre-manufactured profiled plastics strip, or a profiled plastics strip and integral locking joiner strip, and used for the renovation of underground non-pressure drainage and sewerage networks.

It applies to spirally-wound pipes of fixed or variable diameter installed by one of two methods.

The first method employs a dedicated winding machine in front of the open end of an existing pipeline, e.g. in a manhole. The pipes thus formed are simultaneously inserted into the existing pipeline by the winding forces, and by certain techniques can also be expanded in diameter after or during insertion.

The second method employs a dedicated winding machine which forms the pipe as it traverses the existing pipeline from one manhole to the next.

It covers spirally-wound pipes of fixed or variable diameter made of profiled plastics strips, with or without steel stiffening elements, of unplasticized poly(vinyl chloride) (PVC-U) with integral locking mechanism or high density polyethylene (HDPE) with integrally welded joints.

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

ISO 179-1, *Plastics — Determination of Charpy impact properties — Part 1: Non-instrumented impact test*

ISO 306, *Plastics — Thermoplastics 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 4427 (all parts), *Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply*

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

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

ISO 7619-1, *Rubber, vulcanized or thermoplastic — Determination of indentation hardness — Part 1: Durometer method (Shore hardness)*

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

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

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

ISO 11296-4:2009, *Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks — Part 4: Lining with cured-in-place pipes*

EN 1979, *Plastics piping and ducting systems — Thermoplastics spirally-formed structured-wall pipes — Determination of the tensile strength of a seam*

EN 14364:2006, *Plastics piping systems for drainage and sewerage with or without pressure — Glass-reinforced thermosetting (GRP) plastics based on unsaturated polyester resin (UP) — Specifications for pipes, fittings and joints*

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 spirally-wound pipe
pipe formed by continuously winding and joining a profiled plastics strip, or a profiled plastics strip and integral locking joiner strip

3.2 seam
joint between adjacent profiled plastics strips formed by an integral locking mechanism and/or seam sealant

3.3 integral locking mechanism
mechanical interlock achieved by suitable design of the edges of the extruded profile

3.4 seam sealant
thermoplastic or adhesive material added to the integral locking mechanism or profiled plastics strip surface to make the seam leaktight

3.5 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

NOTE Tolerances in the above definition refers to offsets and deformities in the existing pipeline. Spirally-wound liners are not subject to shrinkage.

3.6 close-fit spirally-wound pipe
continuous lining pipe wound from a profiled plastics strip, with or without steel reinforcement, expanded or wound in place to achieve a close fit to the existing pipeline

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.

4.1 Symbols

A_w	cross-sectional area of the profiled plastics strip	mm ² /mm
d_e	outside diameter	mm
e_a	height of neutral axis of the strip above its base	mm
e_o	overall profile height	mm
$e_{w,min}$	minimal waterway wall thickness	mm
e_w	waterway wall thickness at any point	mm
e_1	encapsulation thickness at any point	mm
e_2	encapsulation thickness at any point	mm
I_w	second moment of area of the strip	mm ⁴ /mm
l_s	length of the specimen for short-term tensile force resistance test of the locked seam	mm
S	ring stiffness of the pipe	kN/m ²
w	effective width of the strip	mm
w_s	width of the specimen for short-term tensile force resistance test of the locked seam	mm

4.2 Abbreviated terms

EPDM	ethylene-propylene-diene monomer
GRP	glass-reinforced thermosetting plastic
HDPE	high density polyethylene
PE	polyethylene
PVC-U	unplasticized poly(vinyl chloride)
SWO	spirally-wound

5 Pipes at the “M” stage

This clause specifies requirements for profiled plastics strips, and the material classification of any steel stiffening elements incorporated, prior to winding into a pipe. For requirements for the wound pipe, see Clause 8.

5.1 Materials

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

Depending on the design of the profiled plastics strip, the seam sealant shall comprise one or more of the following materials:

- thermoplastics elastomers (e.g. HDPE, EPDM, silicone);
- adhesives (e.g. amorphous poly-alpha-olefin).

Only virgin and own reprocessable materials, as defined in ISO 11296-1, are permitted for the profiled plastics strips and seam sealant. The material(s) used for the seam sealant shall be declared by the manufacturer of the profiled plastics strips.

Any steel stiffening elements, including material grade classified in accordance with ISO 4948-2 or other equivalent international or national standard, shall be declared by the supplier. The material of any stiffening element, whether or not encapsulated, shall in all cases be approved by the client for the environment of its specific application.

NOTE 1 Detailed specification of non-plastics materials is outside the scope of this part of ISO 11296.

NOTE 2 Some sewage effluents and groundwater contaminants potentially corrosive to steel can penetrate a thin protective layer of PVC-U or HDPE. Depending on the profile design and installation technique, such protective layers can also be exposed to risk of damage.

5.2 General characteristics

When viewed without magnification, the surfaces of the profiled plastics strips 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

The material of the profiled plastics strip when extruded to a flat plate of thickness 3 mm to 6 mm shall conform to the requirements given in Tables 1 and 2.

Thermoplastics used as seam sealants shall conform to the material requirements of Tables 1 and 2 for PVC and HDPE respectively. Thermoplastic elastomers (e.g. EPDM) used as seam sealants shall conform to the material requirements of Table 3.

Table 1 — Material characteristics of PVC-U profiled plastics strips

Characteristics	Requirements	Test parameters		Test method
		Parameter	Value	
Modulus of elasticity, <i>E</i> (tensile)	≥ 2 000 MPa	Speed of testing Specimen	(1 ± 0,2) mm/min Type 1B	ISO 527-2
Tensile strength longitudinal	≥ 35 MPa	Speed of testing Specimen	(5 ± 0,5) mm/min Type 1B	ISO 527-1
Elongation at break	≥ 40 %			
Charpy Impact Strength	≥ 10 kJ/m ²	Specimen Direction of blow Notch	Type 1 Flatwise Double V, Type A	ISO 179-1

Table 2 — Material characteristics of HDPE profiled plastics strips

Characteristics	Requirements	Test parameters		Test method
		Parameter	Value	
Modulus of elasticity, E (tensile)	≥ 800 MPa	Speed of testing Specimen	$(1 \pm 0,2)$ mm/min Type 1B	ISO 527-2
Tensile strength longitudinal	≥ 15 MPa	Speed of testing Specimen	(100 ± 10) mm/min Type 1B	ISO 6259-1
Elongation at break	≥ 300 %			

Table 3 — Material characteristics of thermoplastic elastomer sealants

Characteristics	Requirements	Test parameters		Test method
		Parameters	Value	
Tensile strength longitudinal	≥ 1 MPa	Speed of testing Specimen	500 mm/min Type 1	ISO 37
Elongation at break	≥ 200 %			
Shore hardness A	30 ± 5	—		ISO 7619-1

5.4 Geometric characteristics

The dimensions and section properties including tolerances of the profiled plastics strips shall be declared by the profile plastics strips supplier. (standards.iteh.ai)

The declared values shall conform to the requirements given in Table 4, where applicable.

Table 4 — Profiled plastics strip dimensions and section properties

Characteristics	Symbol	Units	Requirements
Profiled strip dimensions	e_o	mm	declared value but not less than 4,5 mm
	e_w	mm	declared value but not less than 1,4 mm
	e_a	mm	declared value
	e_1	mm	declared value but not less than 1,4 mm
	e_2	mm	declared value but not less than 1,4 mm
	w	mm	declared value
	A_w	mm ² /mm	declared value
	I_w	mm ⁴ /mm	declared value
Minimum outside diameter of wound pipe	$d_{e,min}$	mm	declared value ^a
Maximum outside diameter of wound pipe	$d_{e,max}$	mm	declared value ^b
^a $d_{e,min}$ shall be limited by the maximum allowable winding strain in the profile strip. ^b $d_{e,max}$ shall be limited by the minimum pipe ring stiffness requirement (see 8.5).			

The profiled plastics strip supplier shall assign to each profile strip a unique product code (see 5.8) for which the dimensions and section properties listed in Table 4 shall be declared.

An example of a profiled plastics strip excluding the seam is illustrated in Figure 2 a). An example of a profiled plastics strip with encapsulated steel is illustrated in Figure 2 b).