



SLOVENSKI STANDARD

SIST EN 16506:2015

01-januar-2015

Sistemi za obnovo odvodov odpadne vode in kanalizacije - Oblaganje s togo pritrjeno polimerno notranjo oblogo (RAPL)

Systems for renovation of drains and sewers - Lining with a rigidly anchored plastics inner layer (RAPL)

Systeme für die Renovierung von Abwasserkanälen und -leitungen - Lining mit fest verankerter Kunststoffauskleidung

Systèmes de rénovation des réseaux d'assainissement - Chemisage par revêtement de plastique interne rigidement ancré

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ICS:

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93.030	Zunanji sistemi za odpadno vodo	External sewage systems

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EUROPEAN STANDARD

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Systems for renovation of drains and sewers - Lining with a rigidly anchored plastics inner layer (RAPL)

Systèmes de rénovation des réseaux d'assainissement -
Chemisage par revêtement de plastique interne rigidement
ancré

Systeme für die Renovierung von Abwasserkanälen und -
leitungen - Lining mit fest verankerter Kunststoffauskleidung

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

	Page
Foreword.....	4
1 Scope	5
2 Normative references	5
3 Terms and definitions	6
4 Symbols and abbreviations	8
4.1 Symbols	8
4.2 Abbreviations	8
5 Pipes at the “M” stage.....	8
5.1 General.....	8
5.2 Appearance	9
5.3 Materials	9
5.3.1 Components of RAPL.....	9
5.3.2 Material characteristics of inner layers	10
5.3.3 Material characteristics of the grout system	11
5.4 Geometric characteristics.....	12
5.4.1 General.....	12
5.4.2 Profiled plastics strips.....	13
5.4.3 PE sheet material with integral anchors	14
5.5 Jointing of components of internal layers.....	14
5.5.1 General.....	14
5.5.2 Welding of PE-sheet material with studs to form it into tube	14
5.5.3 Mechanical jointing of spirally wound PVC-U plastics profiled strips.....	14
6 Marking	15
6.1 Marking of plastics inner layers	15
6.2 Marking of packaged grout.....	15
7 Fittings at the “M” stage	15
7.1 General.....	15
7.2 Lateral connections	15
7.2.1 Materials	15
7.2.2 Geometric characteristics.....	16
8 Lining system at the “I” stage.....	16
8.1 General.....	16
8.2 Wall thickness	17
8.3 Performance requirements	17
8.4 Preparation and conditioning of simulated “I” stage samples.....	17
9 Installation	18
9.1 Preparatory work	18
9.2 Storage, handling and transport of pipe components.....	18
9.3 Equipment	18
9.4 Installation procedures	18
9.5 Lining termination in manholes	18
9.6 Reconnecting to existing laterals	19
9.7 Final inspection.....	19
10 Documentation.....	19
Annex A (normative) Test method for anchoring strength of plastics inner layer by pull-off.....	20
A.1 General.....	20

A.2	Principle	20
A.3	Equipment	20
A.4	Preparation	21
A.5	Carrying out test	22
Annex B	(normative) “I” stage crushing strength test	26
B.1	Scope	26
B.2	Principle	26
B.3	Equipment	26
B.4	Preparation	26
B.5	Carrying out test	27
B.6	Calculation and expression of results	27
B.7	Test report	28
	Bibliography	29

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[SIST EN 16506:2015](https://standards.iteh.ai/catalog/standards/sist/59d43bb4-2dc7-4f48-9a24-fe430fd9690/sist-en-16506-2015)

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EN 16506:2014 (E)**Foreword**

This document (EN 16506:2014) has been prepared by Technical Committee CEN/TC 165 "Wastewater engineering", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2015 and conflicting national standards shall be withdrawn at the latest by April 2015.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

Products conforming to this standard do not belong to the product family "Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks", because the structural behaviour depends mainly on the cementitious grout and the plastics inner layer serves primarily as permanent formwork for corrosion protection.

For the technique of spirally wound pipes in particular the scope of EN ISO 11296-7 is distinguished from that of this standard in requiring the plastics pipe component to have adequate ring stiffness to resist all external loads on its own without any structural contribution from grout used as annular filler as given in EN 15885:2010, 5.7. Plastic piping systems used for renovation are specified in the standards series EN ISO 11296, comprising a "Part 1: General" and various technique related parts.

This document follows the approach in considering products used for renovation at the "M" stage and the "I" stage as specified in EN 13380 and the series EN ISO 11296.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies performance requirements and test methods for pipes and fittings for the renovation of underground drain and sewer systems 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. It is applicable to plastics inner layers and grout systems with or without steel reinforcement.

This European Standard 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 European Standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

EN 206:2013, *Concrete - Specification, performance, production and conformity*

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

EN 728, *Plastics piping and ducting systems - Polyolefin pipes and fittings - Determination of oxidation induction time*

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

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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 1610:1997, *Construction and testing of drains and sewers*

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

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

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 10048, *Hot rolled narrow steel strip - Tolerances on dimensions and shape*

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 16506:2014 (E)

EN 13100-4, *Non destructive testing of welded joints of thermoplastics semifinished 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*

EN 14654-1, *Management and control of operational activities in drain and sewer systems outside buildings - Part 1: Cleaning*

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

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

EN ISO 527-2:2012, *Plastics - Determination of tensile properties - Part 2: Test conditions for moulding and extrusion plastics (ISO 527-2:2012)*

EN ISO 527-3, *Plastics - Determination of tensile properties - Part 3: Test conditions for films and sheets (ISO 527-3)*

EN ISO 1133-1:2011, *Plastics - Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics - Part 1: Standard method (ISO 1133-1:2011)*

EN ISO 1133-2:2011, *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 1133-2:2011)*

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

EN ISO 2039-1, *Plastics - Determination of hardness - Part 1: Ball indentation method (ISO 2039-1)*

EN ISO 4624:2003, *Paints and varnishes - Pull-off test for adhesion (ISO 4624:2002)*

EN ISO 6259-1, *Thermoplastics pipes - Determination of tensile properties - Part 1: General test method (ISO 6259-1)*

EN ISO 11296-1:2011, *Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks - Part 1: General (ISO 11296-1:2009)*

EN ISO 11296-7:2013, *Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks - Part 7: Lining with spirally-wound pipes (ISO 11296-7:2011)*

3 Terms and definitions

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

3.1

lining with a rigidly anchored plastics inner layer

RAPL

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**lateral connection collar**

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

[SOURCE: EN ISO 11296-4:2011, 3.1.11]

3.4**design thickness**

thickness of grout required by structural design

3.5**annulus**

gap between the internal layers and host pipe or external layers

3.6**reinforcement**

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

3.7**grout system**

cement based grout including any fillers, reinforcement or other additives or admixtures, in specified proportions

3.8**declared value**

limiting value of a characteristic declared in advance by lining system supplier which becomes the requirement for the purposes of assessment of conformity

[SOURCE: EN ISO 11296-1:2011, 3.1.12]

3.9**virgin material**

material in a form such as granules or powder that has not been subjected to use or processing other than that required for its manufacture and to which no reprocessible or recyclable material has been added

[SOURCE: EN ISO 11296-1:2011, 3.4.1]

3.10**own reprocessible material**

material prepared from rejected unused plastics strips or sheets, including trimmings from the production of other products of the same material, that will be reprocessed in a manufacturer's plant after having been previously processed by the same manufacturer by a process such as moulding or extrusion, and for which the complete formulation is known

EN 16506:2014 (E)

4 Symbols and abbreviations

4.1 Symbols

A_w	cross-sectional area of the profiled plastics strip
$d_{e,min}$	minimum outside diameter of inner plastics layer in circular pipes
e_o	overall profile height
e_w	waterway wall thickness
e_a	height of neutral axis of the strip above its base
e_1	thickness of plastic at any point over the top (short side) of an encapsulated steel strip
e_2	thickness of plastic at any point over the height (long side) of an encapsulated steel strip
f_{bt}	bending tensile stress from crushing strength
f_h	anchoring strength of plastics inner layer
I_w	second moment of area of the strip
$R_{c,28}$	compressive strength after 28 days
$R_{f,28}$	flexural strength after 28 days
$r_{e,min}$	minimum local radius of curvature of inner plastics layer in non-circular pipe
w	effective width of the strip

4.2 Abbreviations

RAPL	Rigidly anchored plastics inner layer
PE	Polyethylene
PVC-U	Unplasticized poly(vinyl chloride)

SIST EN 16506:2015

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5 Pipes at the “M” stage

5.1 General

Since by definition RAPL is partly manufactured on site, requirements of the finished product can only be verified at the “I” stage. “I” stage requirements are specified in Clause 8.

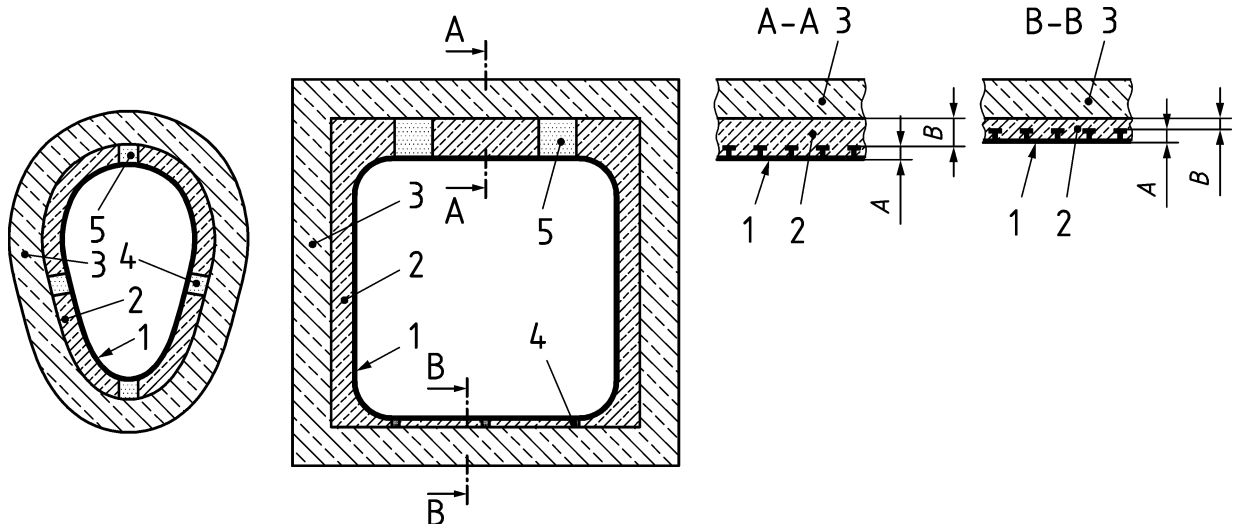
The lining pipes shall consist of at least the following components:

- anchored plastics inner layer;
- grout system;

and optionally:

- reinforcement;
- spacers to ensure grout thickness and prevent flotation;
- external layer.

An example of a lining system with RAPL is shown in Figure 1.



Key

- 1 anchored plastics inner layer
- 2 grout system
- 3 existing pipe
- 4 spacer (technique dependent)
- 5 anti-flotation spacers
- A height of anchors (equivalent to e_0)
- B minimum thickness of grout above height of anchors

Figure 1 — Example of wall construction of a lining system with RAPL

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The anchored plastics inner layer shall consist of one of the following:

- a) PE sheet material with integral anchors;
- b) PVC-U profiled strips with integral or separate seam locking mechanisms.

NOTE The anchored plastics inner layer can incorporate steel stiffening elements.

5.2 Appearance

When viewed without magnification the surfaces of the anchored plastics inner layer shall be smooth, clean and free from scoring, cavities and other defects which can affect their performance.

5.3 Materials

5.3.1 Components of RAPL

The detailed structure of the lining system shall be declared in the manufacturer's product specification. RAPL components shall comprise the materials specified in Table 1.

Table 1 — Materials for RAPL components

Component	Material
Anchored plastics inner layer	PE in accordance with 5.3.2.1
	Profiled plastics strips in accordance with 5.3.2.2
Grout system	Cementitious grout in accordance with 5.3.3
Steel bars incorporated in the grout (optional)	Steel in accordance with EN 10025-1 and EN 10025-2
Steel stiffening elements (optional)	Steel in accordance with EN 10048
External layer (optional)	PE in accordance with 5.3.2.1 or Profiled plastics strips in accordance with 5.3.2.2

For the anchored plastics inner layer either virgin material or the manufacturer's own reprocessible material shall be used.

5.3.2 Material characteristics of inner layers

5.3.2.1 Material characteristics of PE sheet material

The internal layers made from PE sheet material shall conform to the requirements given in Table 2.

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