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Classification and characteristics of techniques for renovation, repair and replacement of drains and sewers

Klassifizierung und Eigenschaften von Techniken für die Renovierung, Reparatur und Erneuerung von Abwasserkanälen und -leitungen

Classification et caractéristiques des techniques de rénovation, de réparation et de remplacement des réseaux d’évacuation et d’assainissement

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91.140.80	Drenažni sistemi	Drainage systems
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Classification and characteristics of techniques for renovation, repair and replacement of drains and sewers

Classification et caractéristiques des techniques de rénovation, de réparation et de remplacement des réseaux d'évacuation et d'assainissement

Klassifizierung und Eigenschaften von Techniken für die Renovierung, Reparatur und Erneuerung von Abwasserkanälen und -leitungen

This European Standard was approved by CEN on 25 June 2018.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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

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European foreword

This document (EN 15885:2018) has been prepared by Technical Committee CEN/TC 165 “Waste water 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of an identical text or by endorsement, at the latest by May 2019, and conflicting national standards shall be withdrawn at the latest by May 2019.

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

This document supersedes EN 15885:2010.

The main changes with respect to EN 15885:2010 are:

a) new Clause 6 "Classification of trenchless replacement techniques for drains and sewers " added;

b) definitions adapted to EN ISO 11295:2017;

c) Table 1 to Table 9 supplemented by features "Installation equipment", "Surface area" and "Excavation";

d) images partly adapted to EN ISO 11295:2017;

e) sequence of sub-clauses 5.7 and 5.8 exchanged;

f) technique family “Repair with trowelled material” (previous sub-clause 6.4) renamed “Repair with trowelled or moulded material”, and distinction between these techniques and Repair by injection clarified by extended text in new 7.2 and 7.4;

g) editorial changes.

This document refers to existing EN product standards to the extent available for the techniques and materials covered.

It provides an overview of trenchless methods used for renovation and repair of drains and sewers, and for their replacement on the same line, regardless of the material used. In respect of sewer renovation and replacement techniques using plastics materials only, it reproduces definitions and other information (but no requirements) contained in EN ISO 11295. Due to their continuous development the most up-to-date information on these particular techniques may be contained in either this document or EN ISO 11295, whichever is the latest edition.

For management and control of rehabilitation activities in drains and sewers a European Standard EN 14654-2, *Management and control of operational activities in drain and sewer systems outside buildings — Part 2: Rehabilitation* is available.

According to the CEN-CENELEC Internal Regulations, the national standards organisations 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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies a system for the classification of trenchless techniques for renovation, repair and replacement on the same line of drains and sewers outside buildings, operated under gravity or pressure, including pipes, connections and manholes. It defines and describes families of techniques and their different generic methods and materials used.

This European Standard does not apply for replacement by open trenching according to EN 1610 and trenchless construction and testing of drains and sewers as new construction off-the-line of the existing drain or sewer according to EN 12889.

This European Standard does not apply for the specification of requirements for specific products.

For each technique family it lists relevant existing standards, materials and applications and outlines characteristics including installation aspects, structural and hydraulic capabilities and site impact.

This standard does not apply to any work required on the existing pipe prior to renovation, repair or replacement.

This European Standard provides information needed to determine viable options and for identification of the optimal technique with regard to a given set of renovation, repair or replacement objectives.

NOTE It is the responsibility of the designer to choose and design the renovation, replacement and repair systems.

It does not specify the calculation methods to determine, for each viable technique, the required amount of material needed to secure the desired performance of the pipeline to be rehabilitated.

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.

EN 752, *Drain and sewer systems outside buildings — Sewer system management*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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
rehabilitation
measures for restoring or upgrading the performance of existing pipeline systems, including *renovation* (3.2), *repair* (3.3) and *replacement* (3.4)

[SOURCE: EN ISO 11295:2017, 3.1.1, modified – term numbers adapted to numbering of EN 15885]

3.2
renovation
work incorporating all or part of the original fabric of the pipeline, by means of which its current performance is improved

[SOURCE: EN ISO 11295:2017, 3.1.2]

3.3
repair
rectification of local damage

[SOURCE: EN ISO 11295:2017, 3.1.3]

3.4
replacement
construction of a new pipeline, on or off the line of an existing pipeline, where the function of the new pipeline system incorporates that of the old

[SOURCE: EN ISO 11295:2017, 3.1.4]

3.5
technique family
grouping of *renovation* (3.2) or trenchless replacement techniques which are considered to have common characteristics for standardization purposes

[SOURCE: EN ISO 11295:2017, 3.2.1, modified – term numbers adapted to numbering of EN 15885]

3.6
lining
process of renovating an existing pipeline by introducing material on the inside

3.7
liner
lining pipe (3.8) after installation

[SOURCE: EN ISO 11295:2017, 3.2.3, modified – term numbers adapted to numbering of EN 15885]

3.8
lining pipe
pipe inserted for *renovation* (3.2) purposes

[SOURCE: EN ISO 11295:2017, 3.2.2, modified – term numbers adapted to numbering of EN 15885]

3.9
lining system
lining pipe (3.8) and all relevant fittings inserted into an existing pipeline for the purposes of *renovation* (3.2)

[SOURCE: EN ISO 11295:2017, 3.2.4, modified – term numbers adapted to numbering of EN 15885]

3.10
lining with continuous pipes
lining with pipe made continuous prior to insertion, where the diameter of the *lining pipe* (3.8) remains unchanged

[SOURCE: EN ISO 11295:2017, 3.2.5, modified – term numbers adapted to numbering of EN 15885]

3.11
lining with close-fit pipes
lining with a continuous pipe (3.10) for which the cross-section is reduced to facilitate installation and reverted after installation to provide a close fit to the existing pipe

[SOURCE: EN ISO 11295:2017, 3.2.6, modified – term numbers adapted to numbering of EN 15885]

3.12
lining with cured-in-place pipes
lining with a flexible tube impregnated with a thermosetting resin, which produces a pipe after resin cure

[SOURCE: EN ISO 11295:2017, 3.2.7]

3.13
lining with discrete pipes
lining with short lengths of pipe which are jointed to form a continuous pipe one by one during insertion

[SOURCE: EN ISO 11295:2017, 3.2.8]

3.14
lining with spirally-wound pipes
lining with a profiled strip, spirally wound to form a continuous pipe after installation

[SOURCE: EN ISO 11295:2017, 3.2.10]

3.15
lining with a rigidly anchored plastics inner layer
lining with a single rigid annulus of structural cementitious grout formed between a plastics inner layer and the host pipe, where the plastics layer is permanently anchored in the grout

[SOURCE: EN ISO 11295:2017, 3.2.13]

3.16
lining with pipe segments
lining with prefabricated segments bonded to the existing pipe, which either have longitudinal joints and cover the whole of the pipe circumference, or cover only part of circumference

[SOURCE: EN ISO 11295:2017, 3.2.14]

3.17
lining with sprayed or cast-in-place material
lining by applying mineral (cement or silicate) or polymeric material, with or without reinforcement, directly onto the inside surface of the host pipe and/or manhole, by manual or mechanical (including robotic) means

3.18
non-stabilizing repair
repair where the materials applied have a sealing effect but do not enhance structural stability

3.19
pipe bursting
on-the-line *replacement* (3.4) method in which an existing pipe is broken by longitudinal splitting or brittle fracture, using a mechanically applied force from within, where the pipe fragments are forced into the surrounding ground and a new pipe of the same, smaller or larger diameter, is simultaneously pulled in

[SOURCE: EN ISO 11295:2017, 3.2.15, modified – term numbers adapted to numbering of EN 15885]

3.20
pipe removal
on-the-line *replacement* (3.4) method, in which the existing pipe is removed by *pipe eating* (3.21) or pipe extraction and a new pipe is installed

[SOURCE: EN ISO 11295:2017, 3.2.16, modified – term numbers adapted to numbering of EN 15885]

3.21
pipe eating
type of *pipe removal* (3.20), where the existing pipe is progressively broken up and removed along with an annulus of the ground immediately surrounding the existing pipe

[SOURCE: EN ISO 11295:2017, 3.2.17, modified – term numbers adapted to numbering of EN 15885]

3.22
stabilizing repair
repair where the materials applied have a sealing effect and can enhance structural stability

3.23
repair by injection
filling of voids in existing pipe and/or surrounding ground, for structural repair or to seal leaks, by injection of grout or resin over all or part of the perimeter of the sewer

Note 1 to entry: Three different methods can be distinguished:

a) injection directly into a brickwork or masonry pipe structure;

b) injection of the soil around the pipe;

c) injection of a crack, joint or lateral connection, with or without the aid of a packer.

3.24
repair with trowelled or moulded material
filling of a damaged area which has been prepared by milling, by introducing a high-viscosity material without pressure and either smoothing it with a trowel or confining it within temporary formwork

3.25
repair with cured-in-place patch
repair by local lining with a flexible tube impregnated with a thermosetting resin which produces a short length of pipe after resin cure

3.26
repair with lateral connection collar
repair of a connection between lateral and main pipe by installing a cured-in-place collar

3.27
repair with internal mechanical devices
repair with internal mechanical seals or re-rounding clips

3.28
repair with internal mechanical seal
sealing of local pipe damage and/or joints by use of an internal elastomeric seal held in place by compression rings

3.29
repair with mechanical re-rounding clip
restoration of pipe roundness by insertion of an overlapping or hinged metal ring, which is expanded hydraulically and locks into place to permanently reverse local cross section deformation of circular pipe

3.30
flow diversion
temporary abatement of all flows into the section of pipeline to be renovated or repaired by bypassing or other means

3.31
maintenance
routine work undertaken to ensure the continuing performance of an asset

[SOURCE: EN 16323:2014, 2.1.6.2]

4 Symbols and abbreviations

SEL	structural integrity based on external loads capacity
G	gravity pipeline applications
P	pressurized pipeline applications
SIL	structural integrity based on internal loads capacity
EW	excavation works
NM	non man entry
ME	man entry
SOMP	silicate organic mineral polymer
CS	circular shape
NC	non circular and circular shapes possible
CCTV	closed circuit television
UP	unsaturated polyester
EP	epoxy
VE	vinylester
PE	polyethylene
PVC-U	unplasticized poly(vinyl chloride)
PP	polypropylene
EPDM	ethylene-propylene-diene monomer
GRP	glass reinforced plastics
GRC	glass reinforced cement
PUR	polyurethane
PRC	polyester resin concrete

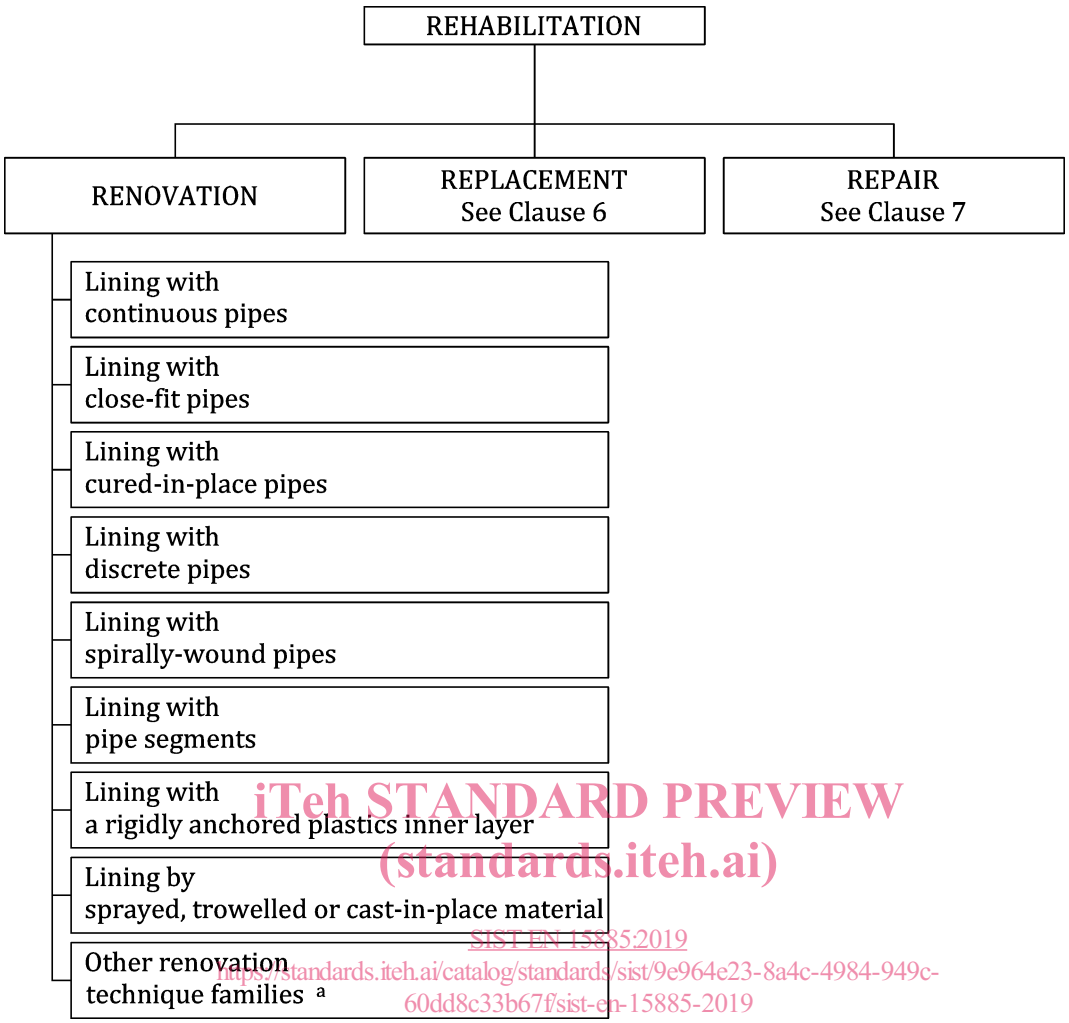
5 Classification of renovation techniques for drains and sewers

5.1 General

Renovation technique families within the scope of this European Standard are shown in Figure 1. This clause establishes a classification of renovation techniques into families, where renovation is applied to continuous lengths of drain or sewer usually between two or more access points.

Individual techniques shall be classified into families according to 5.2 to 5.9 where the different renovation technique families are defined and their respective features, including materials, applications, as well as geometric, performance and installation characteristics, are described.

NOTE Figures 2 to 16 provide schematic illustrations of each family but do not include all necessary equipment.



a Other renovation techniques, which do not fit into the above families, are outside the scope of this European Standard which covers only technique families commonly available at the time of drafting.

Figure 1 — Renovation technique families

5.2 Lining with continuous pipes

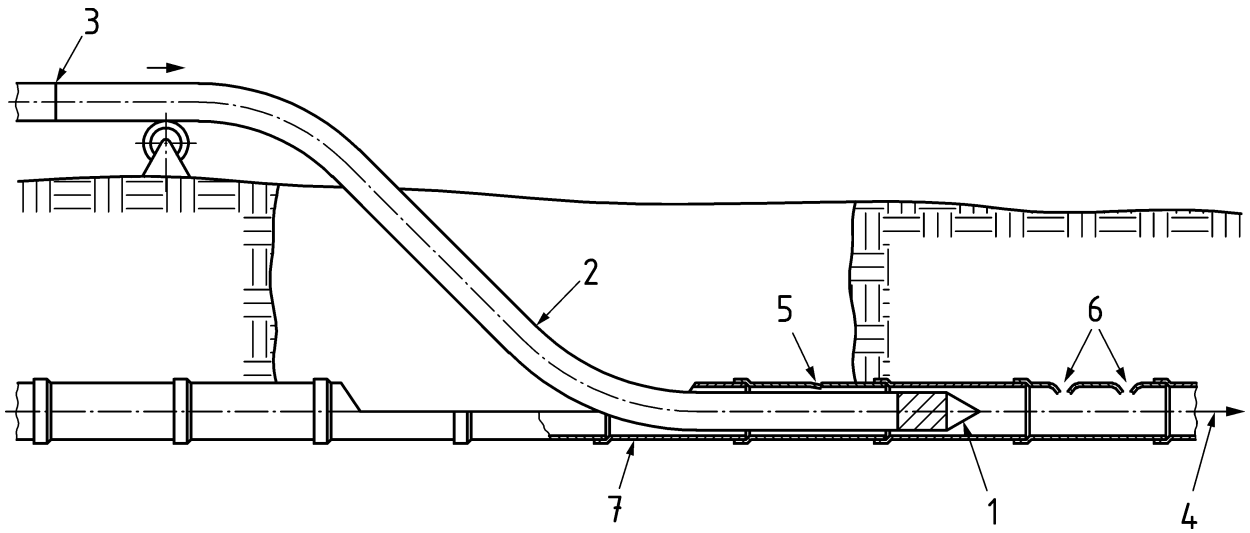
Lining is carried out with a continuous pipe or a pipe made continuous, typically by butt-fusion, prior to insertion, where the cross section of the pipe used for lining remains unchanged. This technique is often referred to as slip-lining.

Two methods of lining with continuous pipes are identified:

— Method A: The lining pipe is smaller in diameter than the internal diameter of the host pipe to facilitate installation, and the host pipe itself is nominally round and without geometric defects.

— Method B: The lining pipe is smaller in diameter than the internal diameter of the host pipe to facilitate installation, but the host pipe may have geometric defects that are corrected by using a ‘re-rounding pulling head’.

A schematic representation of lining with continuous pipes, with re-rounding of existing pipeline, is shown in Figure 2. Features common to both methods are described in Table 1.



Key

1	pulling and re-rounding head (only for Method B)	5	re-rounded defect
2	lining pipe	6	defects
3	prior jointing of lining pipe	7	existing pipe
4	pulling force		

Figure 2 — Schematic representation of lining with continuous pipes with re-rounding of existing pipeline

Table 1 — Features of lining with continuous pipes

Feature	Description
Relevant documents:	EN ISO 11296-2, EN ISO 11297-2
Materials:	PE
Applications:	— non-pressure pipes; — pressure pipes.
Geometric characteristics:	— minimum size: 100 mm; — maximum size: 1 200 mm; — maximum length: 750 m; — capable of accommodating slightly curved alignments of the existing pipe.
Performance:	— significant reduction in hydraulic (volumetric and flow) capacity; — invert grade of liner can deviate from that of existing pipeline; — structural rehabilitation is possible; — abrasion resistance depends on liner material; — chemical resistance depends on liner material.
Installation characteristics:	a) pipes manufactured or prior assembled into the continuous length required; b) insertion possible by pushing and/or pulling; c) surface working space: storage of the whole insertion length required on surface: 1) small diameters (typically ≤180 mm) can be supplied on coils, small space; 2) larger diameters: supplied in straight lengths; d) access to the existing pipeline: generally requires local excavation; e) technique does not rely on adhesion to host pipe; f) flow diversion is typically required for installation; g) the annular space can be grouted, e.g. in non-pressure applications, to fix line and level and/or prevent subsequent movement; h) live insertion is possible (but excl. drinking water applications for hygiene reasons); i) reconnection of laterals: generally requires excavation.
Installation equipment:	— rollers to support the entire length of the lining pipe string (except where pipe is inserted directly from a coil); — pushing unit, if applicable; — rollers to guide the lining pipe into the existing pipeline; — winch or rod puller to pull the lining pipe through the existing pipeline; — jointing equipment appropriate to the material; — grouting equipment, if applicable.
Surface area:	— for the lining pipe string (or coil trailer for smaller diameters) at the insertion end; — for a winch or a rod puller at the receiving end.
Excavation:	— at the insertion end: — long enough to allow the lining pipe to enter the existing pipeline, taking account of the permissible minimum bending radius; — wide enough for the guidance equipment and pushing equipment if applicable; — at the receiving end: — large enough to accommodate the lining pipe nose cone and the winch mast or rod puller, where applicable.

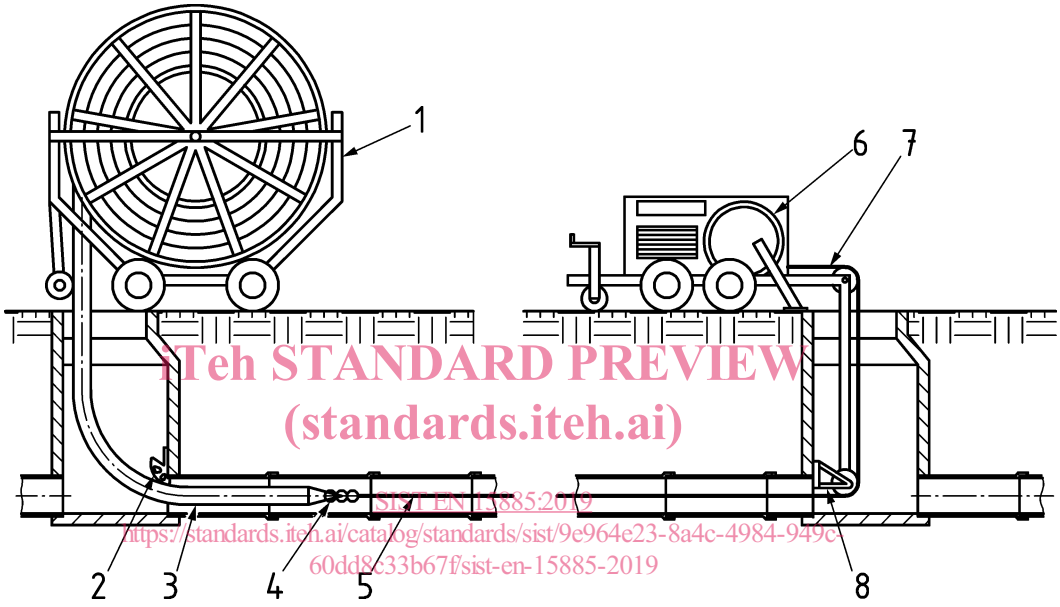
5.3 Lining with close-fit pipes

Lining is carried out with a continuous pipe for which the effective maximum external diameter is reduced to facilitate installation and reverted after installation to provide a close fit to the existing pipe.

Schematic representations of the following two possible methods of linings with close-fit pipes are shown in Figures 3 and 4. Features are described in Table 2.

— Method A: reduction in the pipe manufacturing plant; the pipe is usually supplied coiled on a reel from which it is directly inserted;

— Method B: reduction on site (typically applied to pressure pipelines only); the pipe is fed through diameter reduction or folding equipment and simultaneously inserted.



Key

1	drum trailer	5	winch cable
2	pipe guide	6	winch
3	lining pipe (folded)	7	guide pulley
4	pulling head	8	bracing

NOTE Pipe reverted (unfolded) after insertion by application of heat and/or pressure.

Figure 3 — Schematic representation of installation of a pipe reduced in cross section in the pipe manufacturing plant (Method A)