BS EN ISO 11297-1:2013

BSI Standards Publication

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

Part 1: General

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN ISO 11297-1:2013.

The UK participation in its preparation was entrusted to Technical Committee PRI/88/3, Rehabilitation of pipeline systems using plastics piping materials and components.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 77821 6

ICS 23.040.20; 23.040.45; 91.140.80; 93.030

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 May 2013.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 11297-1

May 2013

ICS 23.040.45; 23.040.20; 91.140.80; 93.030

English Version

Plastics piping systems for renovation of underground drainage and sewerage networks under pressure - Part 1: General (ISO 11297-1:2013)

Systèmes de canalisations en plastique pour la rénovation des réseaux de branchements et de collecteurs d'assainissement enterrés sous pression - Partie 1: Généralités (ISO 11297-1:2013)

Kunststoff-Rohrleitungssysteme für die Renovierung von erdverlegten Abwasserdruckleitungen - Teil 1: Allgemeines (ISO 11297-1:2013)

This European Standard was approved by CEN on 18 April 2013.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

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.

CEN members are the national standards bodies of 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 United Kingdom.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN ISO 11297-1:2013: E

Foreword

This document (EN ISO 11297-1:2013) has been prepared by Technical Committee ISO/TC 138 "Plastics pipes, fittings and valves for the transport of fluids" in collaboration with Technical Committee CEN/TC 155 “Plastics piping systems and ducting systems” the secretariat of which is held by NEN.

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 November 2013, and conflicting national standards shall be withdrawn at the latest by November 2013.

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.

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.

Endorsement notice

The text of ISO 11297-1:2013 has been approved by CEN as EN ISO 11297-1:2013 without any modification.

Contents

Page

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 11297-1 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*.

ISO 11297 consists of the following parts, under the general title *Plastics piping systems for renovation of underground drainage and sewerage networks under pressure*:

— *Part 1: General*

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

Lining with continuous pipes is to form the subject of a future part 2; lining with cured-in-place pipes is to form the subject of a future part 4; lining with discrete pipes is to form the subject of a future part 5; and lining with adhesive-backed hoses is to form the subject of a future part 6.

Introduction

This part of ISO 11297 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:

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

— 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 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 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 6: Lining with adhesive-backed hoses

The requirements for any given renovation technique family are specified in part 1, applied in conjunction with the relevant other part. For example, this part of ISO 11297 and ISO 11297-3 specify the requirements relating to lining with close-fit 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 Standards.

A consistent structure of clause headings has been adopted for all parts of ISO 11297, in order to facilitate direct comparisons across renovation technique families.

Figure 1 shows the common part and clause structure and the relationship between ISO 11297 and the System Standards for other application areas.

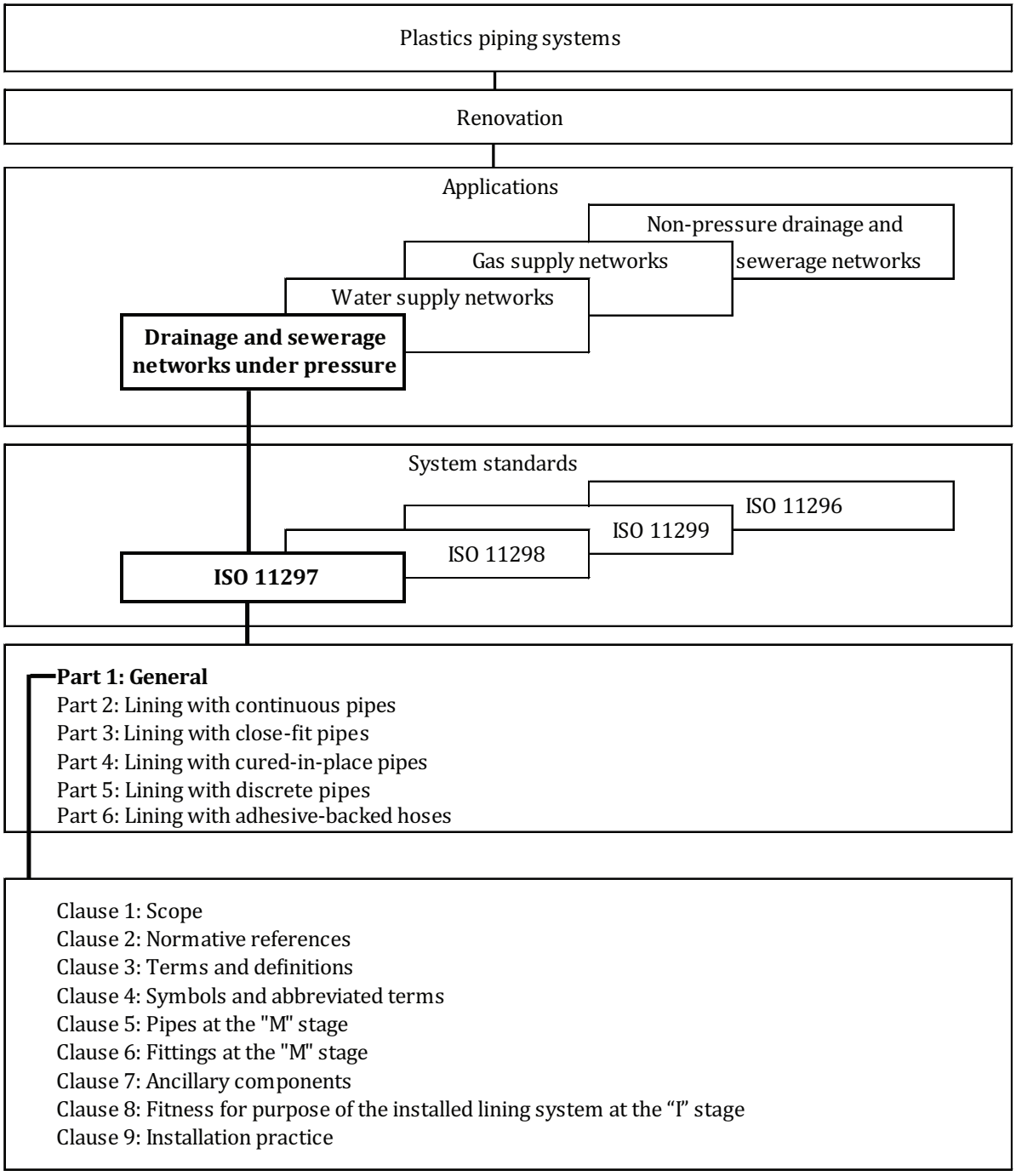


Figure 1 — Format of the renovation System Standards

INTERNATIONAL STANDARD **ISO 11297-1:2013(E)**

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

Part 1: General

1 Scope

This part of ISO 11297 specifies the requirements and test methods for plastics piping systems intended to be used for the renovation of underground drainage and sewerage networks under pressure. It is applicable to pipes and fittings, as manufactured, as well as to the installed lining system. It is not applicable to cover sprayed coatings, the existing pipeline or any annular filler.

This part of ISO 11297 gives the general requirements common to all relevant renovation techniques.

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 681-1, *Elastomeric seals — Material requirements for pipe joint seals used in water and drainage applications — Part 1: Vulcanized rubber*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 General

3.1.1
pipeline system
interconnecting pipe network for the conveyance of fluids

3.1.2
rehabilitation
all measures for restoring or upgrading the performance of an existing pipeline system

3.1.3
renovation
work incorporating all or part of the original fabric of the pipeline, by means of which its current performance is improved

3.1.4
replacement
rehabilitation of an existing pipeline system by the installation of a new pipeline system, without incorporating the original fabric

3.1.5
maintenance
keeping an existing pipeline system operational without the installation of additional fabric

3.1.6
repair
rectification of local damage

3.1.7
lining pipe
pipe inserted for renovation purposes

3.1.8
liner
lining pipe after installation

3.1.9
lining system
lining pipe and all relevant fittings for insertion into an existing pipeline for the purposes of renovation

3.1.10
renovated pipeline system
existing pipeline system plus the installed lining system used to renovate it, as well as any grout or other annular filling material used

3.1.11
characteristic
property, dimension or other feature of a material or component

3.1.12
declared value
limiting value of a characteristic declared in advance by the lining system supplier, which becomes the requirement for the purposes of assessment of conformity

3.1.13
annular filler
material for grouting annular space between existing pipeline and lining system

3.1.14
grouting
process of filling voids around the lining system

3.1.15
system test pressure
STP
hydrostatic pressure applied to the installed pipeline system in order to ensure its integrity and leaktightness

3.1.16
simulated installation
installation of a lining system into a simulated host pipeline, using representative equipment and processes, to provide samples for testing which are representative of an actual installation

3.1.17
simulated host pipeline
section of pipeline, which is not part of an operational network, but which replicates the environment of an operational network

3.1.18
technique family
group of renovation techniques which are considered to have common characteristics for standardization purposes

3.1.19
independent pressure pipe liner
liner which is capable on its own of resisting without failure all applicable internal loads throughout its design life

3.1.20
interactive pressure pipe liner
liner which relies on the host pipe for some measure of radial support in order to resist without failure all applicable internal loads throughout its design life

3.1.21
type testing
testing performed to prove that a material, component, joint or assembly is capable of conforming to the requirements given in the applicable standard

3.2 Techniques

The various techniques for renovation of underground drainage and sewerage networks under pressure, within the scope of pipeline rehabilitation techniques generally, are shown schematically in Figure 2. For definitions of standardized renovation techniques shown in Figure 2, but outside the scope of this part of ISO 11297, see ISO 11295.

The technique families within the scope of this part of ISO 11297 are defined as follows.

3.2.1
lining with continuous pipes
lining with pipe made continuous prior to insertion and which is not shaped to give it a cross-sectional diameter smaller than its final diameter after installation

3.2.2
lining with close-fit pipes
lining with a continuous pipe, of which the cross-section is reduced to facilitate installation and reverted after installation to provide a close fit to the existing pipe

Note 1 to entry: For the reduction in cross-section, the following are the two options:

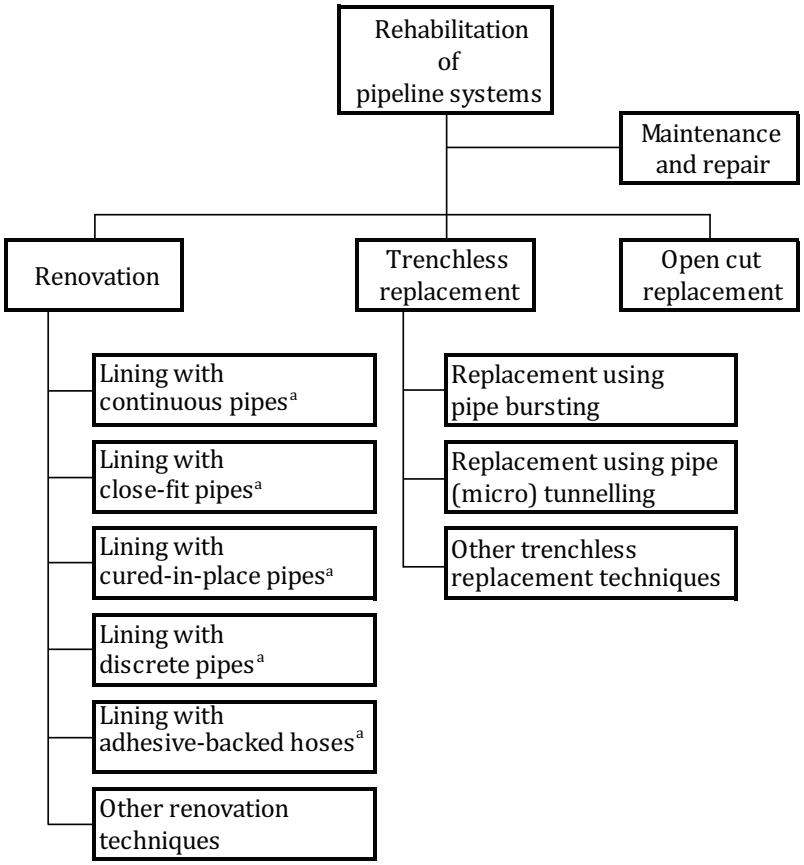
— reduction in the pipe manufacturing plant: the pipe is usually supplied coiled on a reel, from which it is directly inserted;

— reduction on site: the pipe is usually fed through the reduction equipment and simultaneously inserted in one continuous string.

3.2.3
lining with cured-in-place pipes
lining with a flexible tube impregnated with a thermosetting resin, which produces a pipe after resin cure

3.2.4
lining with discrete pipes
lining with pipes shorter than the section to be renovated, which are jointed to form a continuous pipe only during insertion, the cross-section of the lining pipe remaining unchanged

3.2.5
lining with adhesive-backed hoses
lining with a reinforced hose which relies on an adhesive bond to the host pipe to provide resistance to collapse



[a] This part of ISO 11297 is applicable.

Figure 2 — Technique families for renovation of underground drainage and sewerage networks under pressure using plastics pipes, within the scope of pipeline rehabilitation techniques

3.3 Characteristics

3.3.1
nominal size
DN
numerical designation of the size of a component, which is a convenient round number approximately equal to the manufacturing dimension in millimetres

3.3.2
nominal size
DN/OD
nominal size, related to the outside diameter

3.3.3
nominal outside diameter
d_n
specified outside diameter, in millimetres, assigned to a nominal size DN/OD

Note 1 to entry: The nominal outside diameter, expressed in millimetres, is the minimum mean outside diameter, $d_{em,min}$, defined in 3.3.5.

3.3.4
mean outside diameter
d_{em}
value of the measurement of the outer circumference of a pipe or spigot end of a fitting in any cross-section, divided by π (≈ 3,142) and rounded to the next greater 0,1 mm

3.3.5
minimum mean outside diameter
$d_{em,min}$
minimum value of the mean outside diameter as specified for a given nominal size

3.3.6
wall thickness
e
value of the measurement of the wall thickness at any point around the circumference of a component

3.3.7
mean wall thickness
e_m
arithmetic mean of a number of measurements of the wall thickness regularly spaced around the circumference and in the same cross-section of a component

3.3.8
minimum wall thickness at any point
e_{min}
minimum value of the wall thickness at any point around the circumference of a component as specified

3.3.9
nominal wall thickness
e_n
numerical designation to the wall thickness, which is a convenient round number, approximately equal to the manufacturing dimension

Note 1 to entry: For thermoplastics solid-wall components, the value of nominal wall thickness, e_n, is identical to the specified minimum wall thickness at any point, e_{min}.

3.3.10
SDR
standard dimension ratio
ratio of the nominal outside diameter, d_n, to its nominal wall thickness, e_n

3.3.11
internal pressure resistance
capability to withstand internal hydrostatic pressurization

3.3.12
ring stiffness
resistance of a pipe to diametric deflection in response to external loading applied along one longitudinal diametric plane

Note 1 to entry: This definition applies to both long and short-term values.

3.4 Materials

3.4.1
virgin material
material in a form such as granules, powder or liquid, which has not been subjected to use or processing other than that required for its manufacture and to which no reprocessable or recyclable material has been added

3.4.2
own reprocessable material
material prepared from unused pipes and fittings, including trimmings from the production of pipes and fittings, which will be reprocessed in a manufacturer's plant after having previously been processed by the same manufacturer by a process such as moulding or extrusion and for which the complete formulation is known

3.4.3
external reprocessable material
material from unused products or trimmings which will be reprocessed and which were originally processed by another manufacturer

Note 1 to entry: If a manufacturer has a production of products other than pipes and fittings, reprocessable material from that production is considered as external reprocessable material when used for pipes or fittings production.

3.4.4
recyclable material
material prepared from used products which have been cleaned and crushed or ground

3.5 Product stages

3.5.1 General

The characteristics of components used for renovation and the materials from which they are made can be considered at two distinct stages as follows.

3.5.2
"M" stage
stage as manufactured, before any subsequent site processing of components associated with the particular renovation technique

Note 1 to entry: For pipes and fittings at the "M" stage, see Clauses 5 and 6, respectively.

3.5.3
"I" stage
stage as installed, i.e. in final configuration after any site processing of components associated with the particular renovation technique

Note 1 to entry: For pipes and fittings at the "I" stage, see Clause 8.

3.6 Service conditions

3.6.1
nominal pressure
PN
numerical designation used for reference purposes related to the mechanical characteristics of the component of a piping system

Note 1 to entry: Extended definitions of PN applicable to thermoplastics and thermosetting piping systems respectively are given in the relevant other parts of ISO 11297.

3.6.2
allowable operating pressure
PFA
maximum internal hydrostatic pressure that a component is capable of withstanding continuously in service

Note 1 to entry: It is expressed in bars[1)].

1) 1 bar =0,1 MPa = 0,1 N/mm^2 = $10^5 \cdot N/m^2$.

3.6.3
surge
rapid fluctuations of pressure, either positive or negative, caused by flow alterations over short periods of time e.g. due to the switching on or off of pumps or the opening or closing of valves

3.6.4
allowable maximum operating pressure
PMA
maximum internal hydrostatic pressure occurring from time to time, including surge, that a component is capable of withstanding in service

Note 1 to entry: It is expressed in bars.

3.6.5
surge factor
F_{surge}
value of the ratio PMA/PFA, which is generally a function of pipe material and rate of pressure rise

Note 1 to entry: The value assigned for design can also vary depending upon the anticipated frequency of the surge conditions.

3.7 Joints

No general definitions apply.

4 Symbols and abbreviated terms

4.1 Symbols

d_{em}	mean outside diameter
$d_{em,min}$	minimum mean outside diameter
d_n	nominal outside diameter
e	wall thickness
e_m	mean wall thickness
e_{min}	minimum wall thickness at any point
e_n	nominal wall thickness
F_{surge}	value of the ratio PMA/PFA

4.2 Abbreviated terms

DN nominal size

DN/OD nominal size, related to the outside diameter

"I" as installed

"M" as manufactured

PFA allowable operating pressure

PMA allowable maximum operating pressure

PN nominal pressure rating

SDR standard dimension ratio

STP system test pressure

5 Pipes at the "M" stage

5.1 Materials

No general requirements apply.

5.2 General characteristics

The choice of colour shall follow national identification requirements.

Colours used nationally for water supply and/or gas supply pipes should not be used for pressure sewer supply pipes within that nation and vice versa.

5.3 Material characteristics

No general material requirements apply.

5.4 Geometric characteristics

No general geometric requirements apply.

5.5 Mechanical characteristics

No general mechanical requirements apply.

5.6 Physical characteristics

No general physical requirements apply.

5.7 Jointing

For the requirements for jointing techniques used to attach and/or assemble components, the applicable part of ISO 11297 for each technique family applies.

NOTE Integral joints are considered to be part of the pipe.

5.8 Marking

Pipes specified in detail in other parts of ISO 11297 shall be permanently and legibly marked in such a way that the marking does not initiate cracks or other types of premature failure and that storage, weathering, handling and installation (see Clause 9) do not affect the legibility of the marking.

The pipes shall be marked with at least the following information:

a) reference to the relevant part of ISO 11297;

b) manufacturer's name and/or trademark;

c) nominal size or other dimension (e.g. *d*n);

d) SDR or wall thickness or ring stiffness as applicable;

e) pressure rating as PN or bar;

f) material;

g) manufacturer's information in clear figures or in code, providing traceability to the production period (specified by at least year and month) and production site, if manufacturer is producing at several sites;

h) approval mark (if applicable).

6 Fittings at the "M" stage

6.1 Materials

No general requirements regarding choice of material apply.

6.2 General characteristics

No general requirements apply.

The choice of colour should follow national identification requirements.

Colours used nationally for gas and/or water supply pipes should not be used for sewers within that nation, and vice versa.

6.3 Material characteristics

No general material requirements apply.

6.4 Geometric characteristics

No general geometric requirements apply.

6.5 Mechanical characteristics

No general mechanical requirements apply.

6.6 Physical characteristics

No general physical requirements apply.

6.7 Jointing

For the requirements for jointing techniques used to attach and/or assemble components the applicable Part of ISO 11297 for the relevant technique family applies.

NOTE Integral joints are considered to be part of the fitting.

6.8 Marking

Where fittings are specified by normative reference to another plastics piping System Standard, no marking additional to that specified in the referenced standard shall be required.

Fittings specified in detail in other parts of ISO 11297 shall be marked with at least the following information:

a) reference to the relevant part of ISO 11297;

b) manufacturer's name and/or trademark;

c) nominal size or other dimension (e.g. d_n);

d) SDR or wall thickness or ring stiffness as applicable;

e) pressure rating as PN or bar;

f) material;

g) manufacturer's information in clear figures or in code, providing traceability to production period (specified by at least year and month), and production site if manufacturer is producing at several sites;

h) approval mark (if applicable).

7 Ancillary components

For valves the relevant pressure capability shall be specified in the open position and in the closed position so that the valve function and its tightness are ensured under this pressure.

Certain liner pipe systems require mechanical, end-load-bearing fittings for liner terminations. Full details of these shall be included in the installation manual, if applicable.

8 Fitness for purpose of the installed lining system at the "I" stage

8.1 Materials

The pipe and any fittings may be made of different materials, provided these conform to 5.1 and 6.1, respectively of the relevant part of ISO 11297.

NOTE For pipes and fittings at the "M" stage, see Clauses 5 and 6, respectively.

8.2 General characteristics

The installed lining system shall meet a water pressure test to ensure the integrity of pipes, joints, fittings and other components, such as anchor blocks and the fitness for purpose requirements in the technique-related parts of ISO 11297, as applicable.

The pressure test methodology and the pass/fail criteria shall be agreed on between the client and the system installer and documented in the installation manual.

NOTE 1 Because of the interaction between the liner and the host pipe upon pressurization when some techniques are utilized, it is possible for conventional plastics pipe testing methodologies to not apply in these instances.

The system test pressure, STP, shall be calculated from the nominal pressure rating, PN, as follows:

$$\left.\begin{array}{l} STP = PN \times 1{,}5 \\ \text{or} \\ STP = PN + 5\,\text{bar} \end{array}\right\} \text{whichever is the least}$$

Under normal circumstances, the installation point for the testing equipment shall be the lowest point of the test section.

Care shall be taken to ensure that the installed lining system is compatible with any chemical treatments used for sewer maintenance and cleaning specified by the network operator.

NOTE 2 Due to the potential transport of large solids at high velocities near to the pumps, abrasion and impact damage can be a major factor in liner design.

NOTE 3 Requirements for chemical, impact, abrasion and jetting resistance are outside the scope of this part of the standard.

8.3 Material characteristics

Elastomeric sealing rings shall conform to the performance requirements of EN 681-1.

8.4 Geometric characteristics

The installed lining system shall have a minimum free bore in accordance with the design requirements (e.g. flow capacity, maximum size of solids capable of passing the pumps, structural stability and routine maintenance).

NOTE 1 Free bore has two aspects. The first (cross-sectional) free bore is to ensure that adequate cross-section is retained for flow capacity. The second (dimensional) free bore is to ensure that adequate clearance is retained for routine maintenance equipment to be used or for access to be maintained in the installed pipeline system.

NOTE 2 The maximum free bore of a renovated pipeline system is limited by the internal dimensions of the existing pipeline at the time of lining and also by the wall thickness and closeness of fit of the installed lining system, which generally varies according to the renovation technique used. For design aspects, see ISO 11295.

8.5 Mechanical characteristics

All elements of the installed lining system shall be able to withstand without leakage, and for the full design life, all stresses arising from operation within the system parameters and any residual stresses caused by the installation or thermal effects.

The installed system shall have sufficient stiffness and strength to resist:

a) the external loading throughout the specified design life;

b) the internal loading throughout the specified design life, including the effects of surge;

c) any residual stresses caused by the installation or thermal effects.

NOTE 1 ISO 11295 provides guidance on structural design aspects of renovation.

NOTE 2 Minimum short-term ring stiffnesses of pipes are specified as a function of pipe material in the technique-related parts of ISO 11297, to provide comparable minimum levels of long-term external load-bearing capacity for all renovation technique families.

NOTE 3 The internal loading of sewers under pressure generally includes surge and cyclic pressures associated with frequent starting and stopping of pumps. Note that negative surge pressures can be an important component of net short-term external loading applicable to the lining system.

NOTE 4 This part of ISO 11297 is not applicable to the design issues of the calculation of any residual stresses.

For interactive liners, the lining system shall be capable of spanning holes and gaps in the wall of the existing pipeline at the rated pressure and for the design life of the system.

NOTE 5 This part of ISO 11297 is not applicable to the design issues of hole and gap spanning. For additional information, including assessment of the effects of interactive liners on the host pipe, see ISO 11295.

The system supplier shall document compliance with all relevant mechanical requirements, and also the source of any material-related surge factor proposed for design calculation purposes.

8.6 Physical characteristics

No general requirements for physical characteristics apply to the installed lining system.

8.7 Additional characteristics

No general requirements for additional characteristics apply to the installed lining system.

8.8 Sampling

For the purposes of type testing, samples shall be taken either from actual installations or from simulated installations.

NOTE It is possible that a single installation operation could include some parts which constitute actual installations, and some which constitute simulated installations.

9 Installation practice

9.1 Preparatory work

No general requirements apply.

NOTE Information is provided in Annex A, Clause A.1 of ISO 11295:2010.

9.2 Storage, handling and transport of pipes and fittings

The manufacturer's prescribed procedures for storage, handling and transport of all lining system components shall be adhered to.

9.3 Equipment

9.3.1 General

Installation, inspection and lifting equipment shall be as specified by the system designer and/or installer. It shall conform to the relevant construction and safety standards.

NOTE Further details of equipment specific to individual renovation techniques or technique families are given in Parts 2 to 6 of ISO 11297 as applicable.

9.3.2 Inspection equipment

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, lining type and size and date information.

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

The equipment shall conform to all relevant safety standards.

9.3.3 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

9.4.1 General

The installer shall follow an installation manual which details all of the procedures required to carry out the installation. The manual shall specify all key process parameters, declaring relevant values and tolerances.

The installation shall be carried out by staff trained in the relevant technique and fully conversant with the procedures documented in the installation manual.

NOTE The installation manual is the responsibility of the installer, but can be written by the technique owner, designer or manufacturer.

IMPORTANT — Attention is drawn to the need for care in respect of the potential for any residues of materials, lubricants or other chemical agents from the installation process to damage the surrounding environment.

9.4.2 Safety precautions

All applicable national health and safety regulations shall be taken into account. Safety requirements shall be identified for all stages of the installation procedure, from preparation of the access to the completion of the work.

9.4.3 Simulated installations

Simulated installations shall be conducted under representative environmental and processing conditions for the installation site and technique. Figure 3 shows the relationship between samples taken from simulated and actual installations.

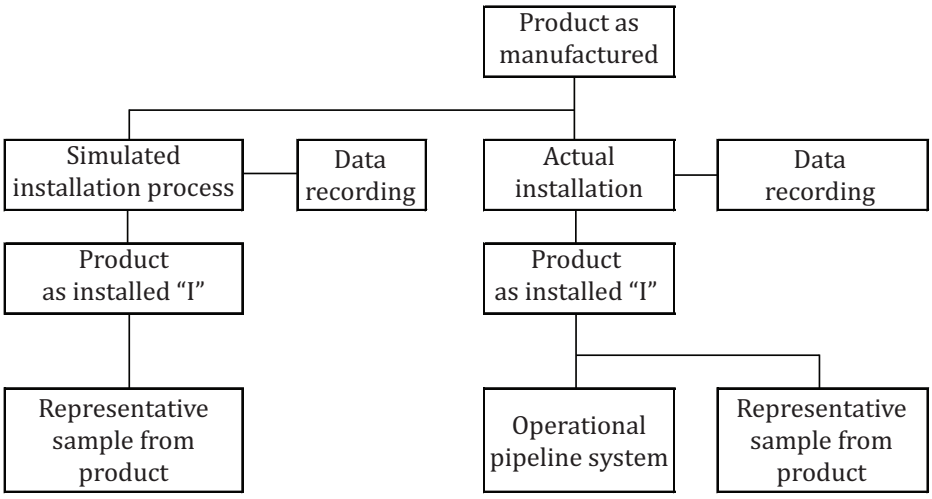


Figure 3 — Relationship between samples taken from simulated and actual installations

9.5 Process-related inspection and testing

The required measurements and other tests relating to the installation process and the methods by which the measurements shall be taken or the tests conducted, shall be documented in the installation manual.

9.6 Lining termination

Lining termination shall include operations, such as dismantling of the installation system, making good any corrosion protection equipment on the host pipe and preparing the ends of the installed lining system for subsequent reconnection.

9.7 Reconnection to the existing pipeline system

The methods of connecting the installed lining system to existing connections and the recommended method of making subsequent connections, including fittings to be used and any special equipment required shall be documented in the installation manual.

9.8 Final inspection and testing

If specified by the client, the installed lining system shall be subjected to a recorded internal visual examination, either by walk-through or CCTV and/or profiling, throughout its length on completion.

NOTE 1 Where specified, testing to verify leaktightness of the installed lining system in accordance with 8.2, can take place in stages. For example in order to verify leaktightness of the installed pipe including any integral joints only, leaktightness can be carried out before the re-opening of any service connections.

If site conditions do not allow the required final inspection, the client may specify another equivalent method to document the installed liner.

NOTE 2 Attention is drawn to any national requirements which can be applicable.

9.9 Documentation

The values of the installation parameters achieved shall be documented, together with all written, photographic and/or electronic records of the renovation required by the installation manual (see 9.5).

Bibliography

[1] ISO 11295:2010, *Classification and information on design of plastics piping systems used for renovation*

[2] ISO 11297-3, *Plastics piping systems for renovation of underground drainage and sewerage networks under pressure — Part 3: Lining with close-fit pipes*

This page deliberately left blank

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™