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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Submission of Comments

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 11300-2

Piping systems for rehabilitation of underground drains, sewers and water supply networks —

Part 2: Thermoset composite materials

ICS: 93.025; 91.140.80; 23.040.05; 93.030

ISO/TC 138/SC 8

Secretariat: JISC

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2025-03-31

This document is circulated as received from the committee secretariat.

ISO/CEN PARALLEL PROCESSING

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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 on 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 the following URL: 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*.

For piping systems made from thermoset composite materials, this document cancels and replaces the system standards: ISO 11296-1, -4, ISO 11297-1, -4 and ISO 11298-1, -4.

ISO 11300-1 similarly replaces for piping systems using PE material, the content of the standards:

ISO 11296-1, -2, -3, ISO 11297-1, -2, -3, ISO 11298-1, -2, -3 and ISO 21225-1, -2

ISO 11300-3 similarly replaces for piping systems using PVC-U material, the content of the standards:

ISO 11296-1, -3.

ISO 11300-4 similarly replaces for piping systems using thermoplastic composite materials, the content of the standards: ISO 11296-1, -7, -9.

A list of all parts in the ISO 11300 series can be found on the ISO website.

Once all four parts of ISO 11300 have been published, the above-mentioned replaced standards will be withdrawn.

In merging their respective contents, this document also adds or makes technical changes to the requirements of the last editions of ISO 11296-4, ISO 11297-4 and ISO 11298-4 as follows:

- Additional and amended definitions in [Clause 3](#).
- New material classification of thermoplastics membranes (amended [Table 1](#)).
- Extended material classification of resin systems (new [Table 2](#)).
- Additional requirements for declaration of short-term mechanical characteristics in [Table 5](#).
- Extended classification of lateral connections (new class D collar added in [Table 9](#) and [Figure 6](#)).

ISO/DIS 11300-2:2025(en)

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 System Standard for piping systems of various materials used for the rehabilitation of existing pipelines in a specified application area. System Standards for rehabilitation deal with the following applications:

- ISO 11300: *Piping systems for rehabilitation of underground drains, sewers and water supply networks*; (this standard)
- ISO 11301: *Piping systems for rehabilitation of underground gas supply networks*.

The System Standards ISO 11300 and ISO 11301 are subdivided into parts each covering a specific material or class of material of the piping system.

ISO 11300 is subdivided into four parts:

- *Part 1: Polyethylene (PE) material*;
- *Part 2: Thermoset composite materials* (this document);
- *Part 3: PVC-U material*;
- *Part 4: Thermoplastic composite materials*.

These System Standards cover various techniques for renovation and trenchless replacement. Furthermore, they 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 piping system components “as manufactured”.

A consistent structure of clause headings has been adopted for all parts of ISO 11300 and ISO 11301, in order to facilitate direct comparisons across rehabilitation technique families.

[Figure 1](#) shows the clause structure and the relationship between ISO 11300 and ISO 11301.

For complementary information, see ISO 11295. For assessment of conformity to the requirements of this document, see ISO/TS 23818-2.

System Standard ISO 11300 incorporates the relevant content of and replaces the following previous System Standards for the rehabilitation of existing drainage and sewerage and water supply networks:

- The ISO 11296 series: Plastics piping systems for renovation of underground non-pressure drainage and sewerage networks;
- 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 21225 series: Plastics piping systems for the trenchless replacement of underground pipeline networks.

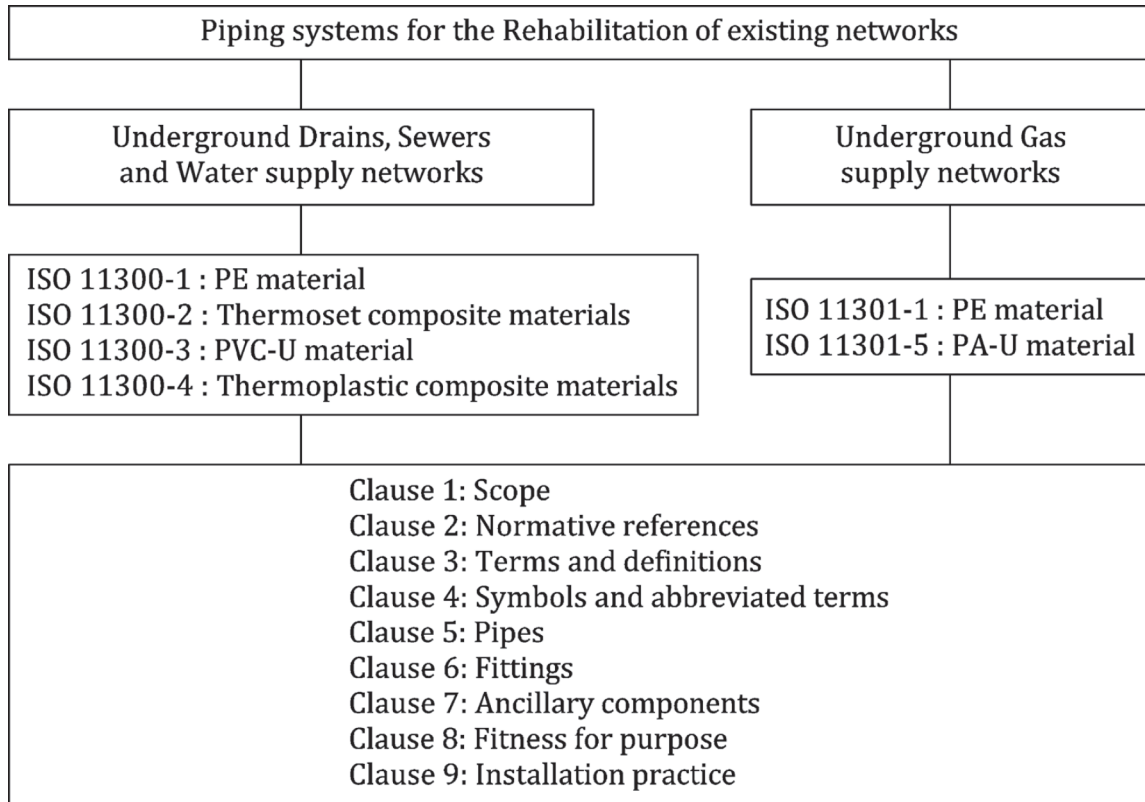


Figure 1 — Format of the rehabilitation system standards

Piping systems for rehabilitation of underground drains, sewers and water supply networks —

Part 2: Thermoset composite materials

1 Scope

This document specifies requirements and test methods for pipes and fittings which are part of piping systems for the rehabilitation of underground non-pressure and pressure drains and sewers, and of water supply networks which transport water intended for human consumption, including raw water intake pipelines.

It is applicable to the renovation technique family:

— lining with cured-in-place pipes (CIPP).

It applies to the use of thermoset composite materials with various thermosetting resin systems, in combination with compatible fibrous carrier materials, reinforcement, and both permanent and process-related thermoplastics membranes (see [5.1](#)).

It is applicable to pipes and fittings, as manufactured, as well as to the installed system, with service temperatures up to 50 °C for drains and sewers and up to 25 °C for water supply networks.

For pressurised networks, this document applies to independent (fully structural, class A) and interactive (semi structural, class B) pressure pipe liners, as defined in ISO 11295, which do not rely on adhesion to the existing pipeline.

It does not include requirements or test methods for resistance to abrasion, cyclic loading or impact, which are outside the scope of 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 75-2:2013, *Plastics — Determination of temperature of deflection under load — Part 2: Plastics and ebonite*

ISO 178:2019, *Plastics — Determination of flexural properties*

ISO 899-2:2024, *Plastics — Determination of creep behaviour — Part 2: Flexural creep by three-point loading*

ISO 3126, *Plastics piping systems — Plastics components — Determination of dimensions*

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

ISO 4633, *Rubber seals — Joint rings for water supply, drainage and sewerage pipelines — Specification for materials*

ISO 7432, *Glass-reinforced thermosetting plastics (GRP) pipes and fittings — Test methods to prove the design of locked socket-and-spigot joints, including double-socket joints, with elastomeric seals*

ISO 7509, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes — Determination of time to failure under sustained internal pressure*

ISO 7685:2019, *Glass-reinforced thermosetting plastics (GRP) pipes — Determination of initial ring stiffness*

ISO 8513:2023, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes — Test methods for the determination of the initial longitudinal tensile strength*

ISO 8521:2020, *Glass-reinforced thermosetting plastic (GRP) pipes — Test methods for the determination of the initial circumferential tensile wall strength*

ISO 8533, *Glass-reinforced thermosetting plastics (GRP) pipes and fittings — Test methods to prove the design of cemented or wrapped joints*

ISO 8773, *Plastics piping systems for non-pressure underground drainage and sewerage — Polypropylene (PP)*

ISO 10468:2023, *Glass-reinforced thermosetting plastics (GRP) pipes — Determination of the ring creep properties under wet or dry conditions*

ISO 10928:2024, *Plastics piping systems — Glass-reinforced thermosetting plastics (GRP) pipes and fittings — Methods for regression analysis and their use*

ISO 10952, *Glass-reinforced thermosetting plastics (GRP) pipes and fittings — Determination of the resistance to chemical attack for the inside of a section in a deflected condition*

ISO/DIS 11295:2024, *Plastics piping systems used for the rehabilitation of pipelines — Classification and overview of strategic, tactical and operational activities*

ISO/DIS 11300-1, *Piping systems for rehabilitation of underground drains, sewers and water supply networks — Part 1: Polyethylene (PE) material*

ISO 13002, *Carbon fibre — Designation system for filament yarns*

ISO 14125:1998, *Fibre-reinforced plastic composites — Determination of flexural properties*

ISO 23856:2021, *Plastics piping systems for pressure and non-pressure water supply, drainage or sewerage — Glass-reinforced thermosetting plastics (GRP) systems based on unsaturated polyester (UP) resin*

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

EN 681-2, *Elastomeric seals — Material requirements for pipe joint seals used in water and drainage applications — Part 2: Thermoplastic elastomers*

EN 681-3, *Elastomeric seals — Material requirements for pipe joint seals used in water and drainage applications — Part 3: Cellular materials of vulcanized rubber*

EN 681-4, *Elastomeric seals — Material requirements for pipe joint seals used in water and drainage applications — Part 4: Cast polyurethane sealing elements*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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 General terms

3.1.1

pipeline system

interconnecting pipe network for the conveyance of fluids

3.1.2

drain

conduit which conveys wastewater, surface water or other unwanted liquids, including its connections to lateral pipes, manhole, gullies and other network components

[SOURCE: ISO 6701-1:2020, 3.3.4.38, modified to include connections as stated]

3.1.3

sewer

pipeline which conveys unwanted liquids, including its connections to lateral pipes, manholes, access chambers and other network components

[SOURCE: ISO 6701-1:2020, 3.3.4.41, modified to include connections as stated]

3.1.4

rehabilitation

measures for restoring or upgrading the performance of existing *pipeline systems* ([3.1.1](#)), including *renovation* ([3.1.5](#)), *repair* ([3.1.6](#)) and *replacement* ([3.1.7](#))

3.1.5

renovation

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

3.1.6

repair

rectification of local damage

3.1.7

replacement

construction of a new pipeline, on or off the line of an existing pipeline, where the function of the new *pipeline system* ([3.1.1](#)) incorporates that of the old

3.1.8

trenchless replacement

replacement ([3.1.7](#)) without opening trenches other than small excavations to provide access for the particular technique

3.1.9

maintenance

routine work undertaken to ensure the existing performance of an asset

3.1.10

lining pipe

pipe inserted for *renovation* ([3.1.5](#)) purposes

3.1.11

liner

lining pipe ([3.1.10](#)) after installation

3.1.12

lining system

lining pipe ([3.1.10](#)) and all relevant fittings for insertion into an existing pipeline for the purposes of *renovation* ([3.1.5](#))

3.1.13

characteristic

property, dimension or other feature of a material or component

3.1.14

declared value

limiting value of a *characteristic* (3.1.13) declared in advance by the *lining system* (3.1.12) supplier, which becomes the requirement for the purposes of assessment of conformity

3.1.15

system test pressure

STP

either hydrostatic or air pressure, or both applied to the installed pipeline system in order to ensure its integrity and leaktightness

3.1.16

simulated installation

installation of a *lining system* (3.1.12) into a *simulated host pipeline* (3.1.17), 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* (3.1.13) for standardization purposes

3.1.19

independent pressure pipe liner

liner 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 existing pipeline 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

3.1.22

CCTV

system comprised of cameras, recorders, interconnections and displays that are used to inspect pipelines

3.2 Terms related to techniques

The various techniques for rehabilitation of underground drains and sewers and water supply networks, within the scope of pipeline rehabilitation techniques generally, are shown schematically in [Figure 2](#). For definitions of standardized renovation and replacement techniques shown in [Figure 2](#), but outside the scope of this document, see ISO 11295.

3.2.1

lining with cured-in-place pipes

lining with a flexible tube impregnated with a thermosetting resin, which produces a pipe after resin cure

3.2.2**inversion**

process of turning a flexible tube or hose inside out by the use of fluid (water or air) pressure

3.2.3**inverted-in-place insertion**

method whereby the *lining tube* (3.2.15) is introduced by *inversion* (3.2.2) to achieve simultaneous insertion and inflation

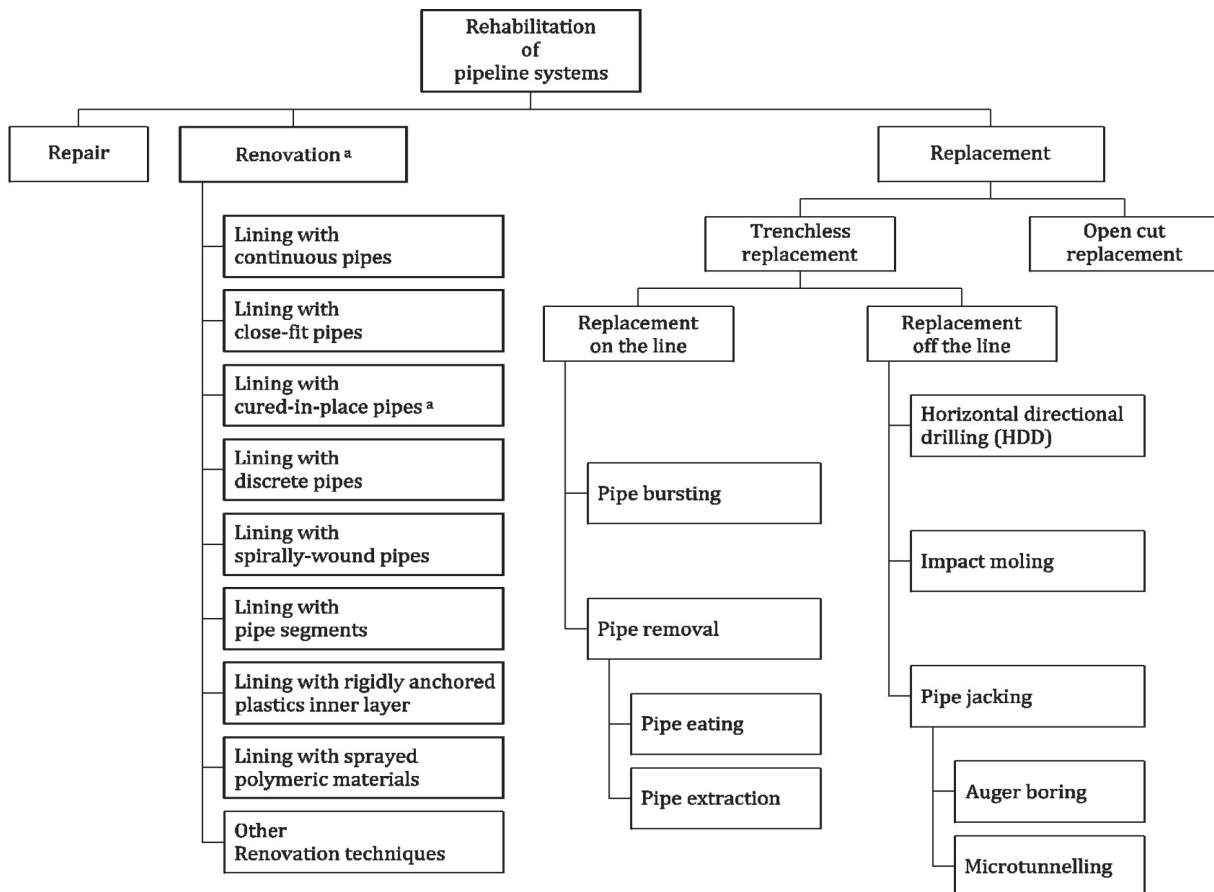
3.2.4**inflation**

the process of expanding a *lining tube* (3.2.15) to achieve a *close fit* (3.2.6) to the existing pipeline by the use of externally supplied fluid (water or air) pressure

3.2.5**winched-in-place insertion**

method whereby the flat *lining tube* (3.2.15) is first pulled into the pipe to be lined and then inflated to bring it up to size

Note 1 to entry: With some techniques, *inflation* (3.2.4) is achieved by *inversion* (3.2.2) through the pulled-in *lining tube* (3.2.15) of a separate impregnated tube or dry hose, which is either withdrawn after resin cure or left in place as a permanent internal membrane.



^a Within scope of this document covering piping systems of thermoset composite materials.

Figure 2 — Technique families for renovation of underground drains, sewers and water supply networks using plastics pipes, within the scope of pipeline rehabilitation techniques

3.2.6**close fit**

situation 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

3.2.7**abrasion layer**

inner layer of *composite* (3.2.11) of declared thickness provided as a sacrificial layer for abrasion of the *CIPP liner* (3.2.9) in service

Note 1 to entry: The abrasion layer thickness is expressed using the symbol $e_{c,a}$ (see 4.1).

3.2.8**carrier material**

porous component of the *lining tube* (3.2.15), which carries the liquid *resin system* (3.2.21) during insertion into the pipe being renovated and forms part of the installed *lining system* (3.1.12) once the resin has been cured

3.2.9**CIPP liner**

lining tube (3.2.15) after installation and resin cure

3.2.10**CIPP product****cured-in-place pipe product**

CIPP liner (3.2.9) of a particular design, produced from a *lining tube* (3.2.15) of specified materials, with a wall structure which is uniquely defined for each diameter/wall thickness combination, and which is impregnated with a specific *resin system* (3.2.21) and installed by a specific process

3.2.11**composite**

combination of cured *resin system* (3.2.21), either *carrier material* (3.2.8) or *reinforcement* (3.2.20), or both, excluding any internal or external membranes

Note 1 to entry: Pure resin not wholly contained within the carrier material is nevertheless part of the composite.

3.2.12**curing**

process of resin polymerization, which may be initiated or accelerated by the use of heat or exposure to light

3.2.13**design thickness**

$e_{c,d}$
required wall thickness of the *composite* (3.2.11), excluding any *abrasion layer* (3.2.7), as determined by structural design

3.2.14**lateral connection collar**

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

3.2.15**lining tube**

flexible tube, consisting of *resin system* (3.2.21), *carrier material* (3.2.8) and either *reinforcement* (3.2.20) or membranes or both, as combined prior to insertion in the pipe to be lined

3.2.16**permanent membrane**

internal or external membrane designed to retain its integrity through the processes of *lining tube* (3.2.15) insertion and *resin system* (3.2.21) cure, and to provide functions for the operational life of the *CIPP liner* (3.2.9)

3.2.17**semi-permanent membrane**

internal or external membrane designed to retain its integrity through the processes of *lining tube* (3.2.15) insertion and *resin system* (3.2.21) cure, but not relied on to retain its integrity at the “I” stage

3.2.18**temporary membrane**

membrane forming the internal or external surface of the *lining tube* (3.2.15) for the purposes of protection during transportation and storage and with process-related functions only during installation

Note 1 to entry: Internal temporary membranes are removed during or after the installation.

3.2.19**preliner**

permanent or semi-permanent external membrane which is installed separately before the insertion of the *lining tube* (3.2.15)

3.2.20**reinforcement**

fibres incorporated in the *lining tube* (3.2.15) which enhance the dimensional stability of either the *lining tube* (3.2.15) or the structural properties, or both of the *CIPP liner* (3.2.9)

Note 1 to entry: The reinforcement can be incorporated in the *carrier material* (3.2.8), constitute the carrier material, or can be a separate layer.

3.2.21**resin system**

thermosetting resin including either the *curing* (3.2.12) agent(s) or initiators, or both and any fillers or other additives in specified proportions

3.2.22**nominal CIPP “M” stage wall thickness**

$e_{n,M}$

one of a range of discrete wall thicknesses of the dry fibre components of the *lining tube* (3.2.15) wall thicknesses dictated by the sum of the thicknesses of the individual layers of *carrier material* (3.2.8) and *reinforcement* (3.2.20) used for tube construction at the “M” stage, prior to their impregnation with the *resin system* (3.2.21) and excluding any internal or external membranes

Note 1 to entry: Applicable only where dry tube manufacture and resin impregnation undertaken as separate processes.

3.2.23**nominal CIPP “I” stage wall thickness**

$e_{n,I}$

one of a range of discrete *CIPP liner* (3.2.9) wall thicknesses at the “I” stage, dictated by the sum of the thicknesses of the individual layers of materials used for *lining tube* (3.2.15) construction, excluding any internal or external membranes

3.3 Terms related to characteristics**3.3.1****nominal size DN/OD****DN/OD**

numerical designation of the size of a component related to the outside diameter

Note 1 to entry: It is a convenient round number approximately equal to the manufacturing dimension in millimetres (mm). It is not applicable to components designated by thread size.

[SOURCE: ISO 4427-1:2019, 3.1.1]

3.3.2

nominal outside diameter

d_n

specified outside diameter assigned to a nominal size DN/OD

Note 1 to entry: Nominal outside diameter is expressed in millimetres.

[SOURCE: ISO 4427-1:2019, 3.1.2]

3.3.3

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

[SOURCE: ISO 4427-1:2019, 3.1.4]

3.3.4

minimum mean outside diameter

$d_{em,min}$

minimum value for the mean outside diameter as specified for a given nominal size

[SOURCE: ISO 4427-1:2019, 3.1.5]

3.3.5

mean diameter

d_m

diameter of the circle corresponding to the middle of the pipe wall cross-section

Note 1 to entry: In the case of a *CIPP liner* ([3.2.9](#)), measured to mid-thickness of the *composite* ([3.2.11](#))

[SOURCE: ISO 23856:2021, 3.3 — modified]

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 for the wall thickness at any point around the circumference of a component, as specified

[SOURCE: ISO 4427-1:2019, 3.1.10]

3.3.9

nominal wall thickness

e_n

numerical designation of the wall thickness of a component which is a convenient round number, approximately equal to the manufacturing dimension in millimetres

[SOURCE: ISO 4427-1:2019, 3.1.8, modified by removal of Note 1 to entry which is not relevant to this document.]

3.3.10 total thickness

e_{tot}
nominal thickness of *CIPP liner* (3.2.9) comprising the *composite* (3.2.11) and any *semi-permanent* (3.2.17) and *permanent membranes* (3.2.16)

3.3.11 composite thickness

e_c
thickness of *composite* (3.2.11) at the “I” stage (3.4.2).

3.3.12 standard dimension ratio SDR

numerical designation of a pipe series, which is a convenient round number, approximately equal to the dimension ratio of the nominal outside diameter, d_n , and the nominal wall thickness, e_n

[SOURCE: ISO 4427-1:2019, 3.1.14]

3.3.13 first break

first major discontinuity of the stress-strain curve characterised by a sudden drop in stress associated with local failure of the *composite* (3.2.11)

Note 1 to entry: It is also generally accompanied by an audible crack.

3.3.14 ring stiffness

measure of the resistance per unit length of a pipe to diametric deflection in response to external loading applied along one longitudinal diametric plane, as defined by the formula:

$$S = \frac{E_S \cdot I}{d_m^3}$$

where

E_S is the apparent modulus of elasticity as determined in a ring stiffness test

d_m is the mean diameter of the pipe (see 3.3.5)

I is the second moment of area of the pipe wall per unit length, i.e.:

$$I = \frac{e^3}{12}$$

where e is the wall thickness (in the case of a *CIPP liner* (3.2.9) *composite thickness* e_c (3.3.11))

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

[SOURCE: ISO 23856:2021, 3.17.3 — modified]

3.3.15 initial ring stiffness

S_0
value of *ring stiffness* (3.3.14) obtained when determined in accordance with ISO 7685

[SOURCE: ISO 23856:2021, 3.17.1 — modified]

3.3.16**long-term creep ring stiffness** S_x

value of *ring stiffness* (3.3.14) at x years, determined in accordance with ISO 10468

[SOURCE: ISO 23856:2021, 3.17.2 — modified]

3.3.17**long-term flexural modulus** E_x

value representing the projected long-term creep behaviour of the *composite* (3.2.11) in bending, expressed as an applied stress divided by extrapolated long-term strain after elapsed time of x years

3.3.18**projected failure pressure at 50 years** p_{50}

value at 50 years derived from the pressure regression line obtained from long-term pressure tests performed in accordance with ISO 7509 and analysed in accordance with ISO 10928

[SOURCE: ISO 23856:2021, 3.12.10 — modified.]

3.3.19**minimum long-term failure pressure**

least value for long-term burst failure pressure, which is evaluated in accordance with the procedures described in ISO 10928 and includes a factor of safety, $FS_{\min}$

Note 1 to entry: This term is expressed using the symbol $p_{x,\min}$, where x denotes the elapsed time in years at which the long-term failure pressure is determined (see 4.1).

[SOURCE: ISO 23856:2021, 3.12.5 — modified.]

3.4 Terms related to product stages

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

3.4.1**“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.

3.4.2**“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](#).

3.5 Terms related to materials

NOTE No such terms applicable to this part of ISO 11300.

3.6 Terms related to service conditions

3.6.1

PN

nominal pressure

alphanumeric designation for a pressure, which is the maximum sustained hydraulic internal pressure for which a pipe is designed in the absence of other loading conditions than internal pressure

Note 1 to entry: Nominal pressure is expressed in bars¹⁾.

Note 2 to entry: The designation for reference or marking purposes consists of the letters PN plus a number.

[SOURCE: ISO 23856:2021, 3.12.2, modified by addition of Note 1 to entry.]

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.

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 valve

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.

3.6.6

service temperature

maximum sustained temperature at which a system is expected to operate

Note 1 to entry: Service temperature is expressed in degrees Celsius (°C)

1) 1 bar = 0,1 MPa = 0,1 N/mm² = 10⁵·N/m²