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**Plastics piping systems for renovation of  
underground gas supply networks**

**Part 1:  
General**

*Systèmes de canalisations en plastique pour la rénovation des réseaux  
de gaz enterrés — Partie 1: Généralités*



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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 11299-1 was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*.

ISO 11299 consists of the following parts, under the general title *Plastics piping systems for renovation of underground gas supply networks*:

- Part 1: General
- Part 3: Lining with close-fit pipes

## Introduction

This part of ISO 11299 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 (this application).

These system standards are distinguished from those for conventionally installed plastics piping systems because they set requirements for certain characteristics in the as-installed condition, after site processing. This is in addition to specifying requirements for system components, as manufactured.

Each of the system standards comprises a Part 1: General (this document) and all applicable parts relating to the renovation technique family, 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 6: Lining with adhesive-backed hoses*

The requirements for any given renovation technique family are specified in this part of ISO 11299 and are applied in conjunction with the other relevant parts. For example, both this part of ISO 11299 and ISO 11299-3 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 standard.

A consistent structure of clause headings has been adopted for all parts in ISO 11299, in order to facilitate direct comparisons across renovation technique families.

Figure 1 illustrates the common part and clause structure and the relationship between ISO 11299 and the system standards for other application areas.

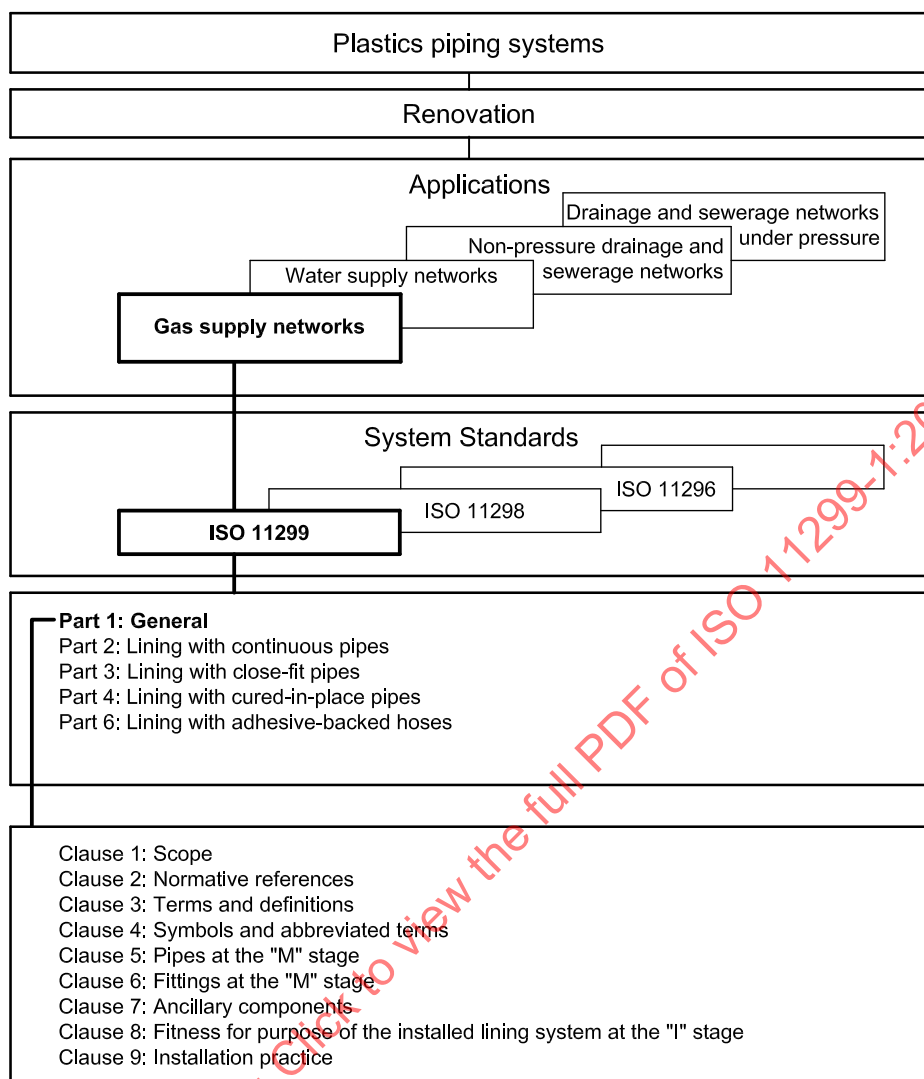


**Figure 1 — Format of the renovation system standards**

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# Plastics piping systems for renovation of underground gas supply networks

## Part 1: General

### 1 Scope

This part of ISO 11299 specifies the requirements and test methods for plastics piping systems for use in the renovation of underground gas supply networks. It is applicable to pipes and fittings as manufactured, as well as to the installed lining system. It is not applicable to sprayed coatings, the existing pipeline or any annular filler.

This part of ISO 11299 establishes the general requirements common to all relevant renovation techniques.

### 2 Normative references

There are no general normative references.

NOTE See other parts of ISO 11299 for the normative references applicable to specific renovation technique families.

### 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, plus 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 leak tightness

NOTE Expressed in bar. 1 bar = 0.1 MPa =  $10^5$  Pa; 1 MPa = 1 N/mm<sup>2</sup>.

**3.1.16**

**simulated installation**

installation of a lining system into a simulated host pipeline, using representative equipment and processes, in order 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**

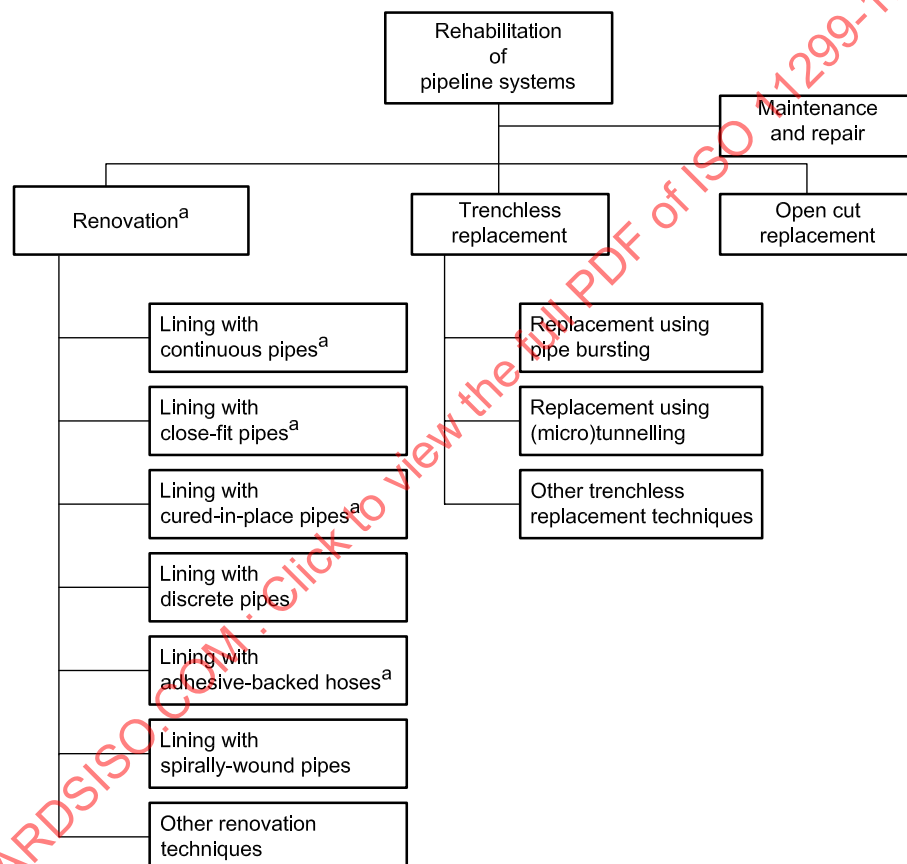
liner which relies on the host pipe for some measure of radial support in order to resist without failure all applicable internal loads throughout its design life

**3.1.21****service line**

pipework from the mains to the point of delivery of the gas into the installation pipework

**3.2 Techniques**

The various techniques for renovation of underground gas supply networks, 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 11299, see ISO 11295<sup>[1]</sup>.



<sup>a</sup> This part of ISO 11299 is applicable.

**Figure 2 — Technique families for renovation of underground gas supply networks using plastics pipes within the scope of pipeline rehabilitation techniques**

The technique families within the scope of this part of ISO 11299 are defined as follows.

**3.2.1****lining with continuous pipes**

lining with pipe made continuous prior to insertion, and which has not been 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 for which the cross-section is reduced to facilitate installation and reverted after installation to provide a close fit to the existing pipe

NOTE There are two options for achieving the reduction in cross-section:

- a) reduction at the pipe manufacturing plant; the pipe is usually supplied coiled on a reel from which it is directly inserted;
- b) reduction on site; the pipe is usually fed through the reduction equipment and 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 adhesive-backed hoses

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

## 3.3 Characteristics

### 3.3.1

#### nominal size

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 assigned to a nominal size (DN/OD)

NOTE 1 The nominal outside diameter is the minimum mean outside diameter  $d_{em,min}$  defined in 3.3.5.

NOTE 2 This is expressed in millimetres.

### 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  $\pi$  ( $\approx 3,142$ ), and rounded up to the next 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

$e_m$

arithmetical mean of a number of measurements of the wall thickness, regularly spaced around the circumference and in the same cross-section of a component, including the measured minimum and the measured maximum values of the wall thickness in that cross-section

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

NOTE 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****standard dimension ratio****SDR**

ratio of the nominal outside diameter,  $d_n$ , to the nominal wall thickness,  $e_n$

**3.3.11****internal pressure resistance**

capacity to withstand internal hydrostatic pressurization

**3.4 Materials****3.4.1****virgin material**

material in a form such as granules, powder or liquid 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

**3.5 Product stages**

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

**3.5.1****“M” stage**

stage as manufactured, i.e. before any subsequent site processing of components associated with the particular renovation technique

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

**3.5.2****“I” stage**

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

NOTE 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 For plastics piping systems conveying gas, it corresponds to the maximum continuous operating pressure, expressed in bar, which can be sustained at 20 °C, based on the minimum design coefficient.

## 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        |
| $e_n$        | nominal wall thickness        |

### 4.2 Abbreviated terms

|       |                                              |
|-------|----------------------------------------------|
| DN/OD | nominal size related to the outside diameter |
| "I"   | as installed                                 |
| "M"   | as manufactured                              |
| PN    | nominal pressure rating                      |
| SDR   | standard dimension ratio                     |
| STP   | system test pressure                         |

## 5 Pipes at the "M" stage

NOTE For pipes at the "I" stage, see Clause 8.

### 5.1 Materials

Only the use of virgin and the manufacturer's own reprocessible materials shall be permitted.

### 5.2 General characteristics

No general requirements apply.

The choice of colour shall follow national identification requirements. Colours used nationally for sewers and/or water supply pipes should not be used for gas supply pipes within that nation and vice versa.

### 5.3 Material characteristics

No general material requirements apply.

NOTE Attention is drawn to any national requirements which may 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 of the jointing techniques used to attach and/or assemble components, the part of ISO 11299 relevant to each technique family applies.

NOTE Integral joints are considered as part of the pipe.

### 5.8 Marking

Pipes specified in detail in other parts of ISO 11299 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 at intervals not greater than 1 m along the pipe length, with at least the following information:

- a) a reference to the relevant part of ISO 11299;
- b) the manufacturer's name and/or trademark;
- c) the nominal outside diameter (e.g.  $d_n$ );
- d) the SDR or wall thickness or PN as applicable;
- e) the material;
- f) the manufacturer's information in clear figures or in code, providing traceability to the production period (specified by at least the year and month), and the production site if the manufacturer is producing at several sites;
- g) the approval mark, if applicable;
- h) the word "GAS".

## 6 Fittings at the "M" stage

### 6.1 Materials

Only the use of virgin and the manufacturer's own reprocessible materials shall be permitted.

## 6.2 General characteristics

No general requirements apply.

The choice of colour shall follow national identification requirements. Colours used nationally for sewers and/or water supply pipes should not be used for gas supply pipes within that nation, and vice versa.

## 6.3 Material characteristics

No general material requirements apply.

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

## 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 part of ISO 11299 relevant to each technique family applies.

## 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 11299 shall be marked with at least the following information:

- a) a reference to the relevant part of ISO 11299;
- b) the manufacturer's name and/or trademark;
- c) the nominal size or other dimension (e.g.  $d_n$ );
- d) the SDR or wall thickness or ring stiffness (as applicable);
- e) the material;
- f) the manufacturer's information in clear figures or in code, providing traceability to the production period (specified by at least the year and month), and the production site if the manufacturer is producing at several sites;
- g) the approval mark, if applicable.

## 7 Ancillary components

No general requirements apply.

NOTE Attention is drawn to any national requirements which may apply.

## 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 of the relevant part of ISO 11299.

### 8.2 General characteristics

The installed lining system shall meet the fitness for purpose requirements given in the relevant part of ISO 11299.

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

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

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

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

**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.**

### 8.3 Material characteristics

No general requirements for material characteristics of the installed pipeline system apply.

### 8.4 Geometric characteristics

The installed lining system shall have a minimum free bore in accordance with the design requirements (e.g. flow capacity, structural stability, 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 width and height are 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<sup>[1]</sup>.

### 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 installation or thermal effects.

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 1** This part of ISO 11299 does not cover the calculation of residual stresses or other design issues.

**NOTE 2** This part of ISO 11299 does not cover 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<sup>[1]</sup>.

The system supplier shall document compliance with all relevant mechanical requirements.