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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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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Contents

Page

Foreword v

Introduction vi

1 Scope 1

2 Normative references 1

3 Terms and definitions 1
3.1 General 1
3.2 Techniques 3
3.3 Characteristics 4
3.4 Materials 5
3.5 Product stages 5
3.6 Service conditions 6

4 Symbols and abbreviated terms 6
4.1 Symbols 6
4.2 Abbreviated terms 6

5 Pipes at the "M" stage 6
5.1 Materials 6
5.2 General characteristics 6
5.3 Material characteristics 7
5.4 Geometric characteristics 7
5.5 Mechanical characteristics 7
5.6 Physical characteristics 7
5.7 Jointing 7
5.8 Marking 7

6 Fittings at the "M" stage 7
6.1 Materials 7
6.2 General characteristics 8
6.3 Material characteristics 8
6.4 Geometric characteristics 8
6.5 Mechanical characteristics 8
6.6 Physical characteristics 8
6.7 Jointing 8
6.8 Marking 8

7 Ancillary components 8

8 Fitness for purpose of the installed lining system at the "I" stage 9
8.1 Materials 9
8.2 General characteristics 9
8.3 Material characteristics 9
8.4 Geometric characteristics 9
8.5 Mechanical characteristics 9
8.6 Physical characteristics 10
8.7 Additional characteristics 10
8.8 Sampling 10

9 Installation practice 10
9.1 Preparatory work 10
9.2 Storage, handling and transport of pipes and fittings 10
9.3 Equipment 10
9.4 Installation 11
9.5 Process-related inspection and testing 11
9.6 Lining termination 11
9.7 Reconnecting to the existing pipeline system 12
9.8 Transfer of service lines 12

9.9 Final inspection and testing **12**
9.10 Documentation **12**
Bibliography **13**

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.

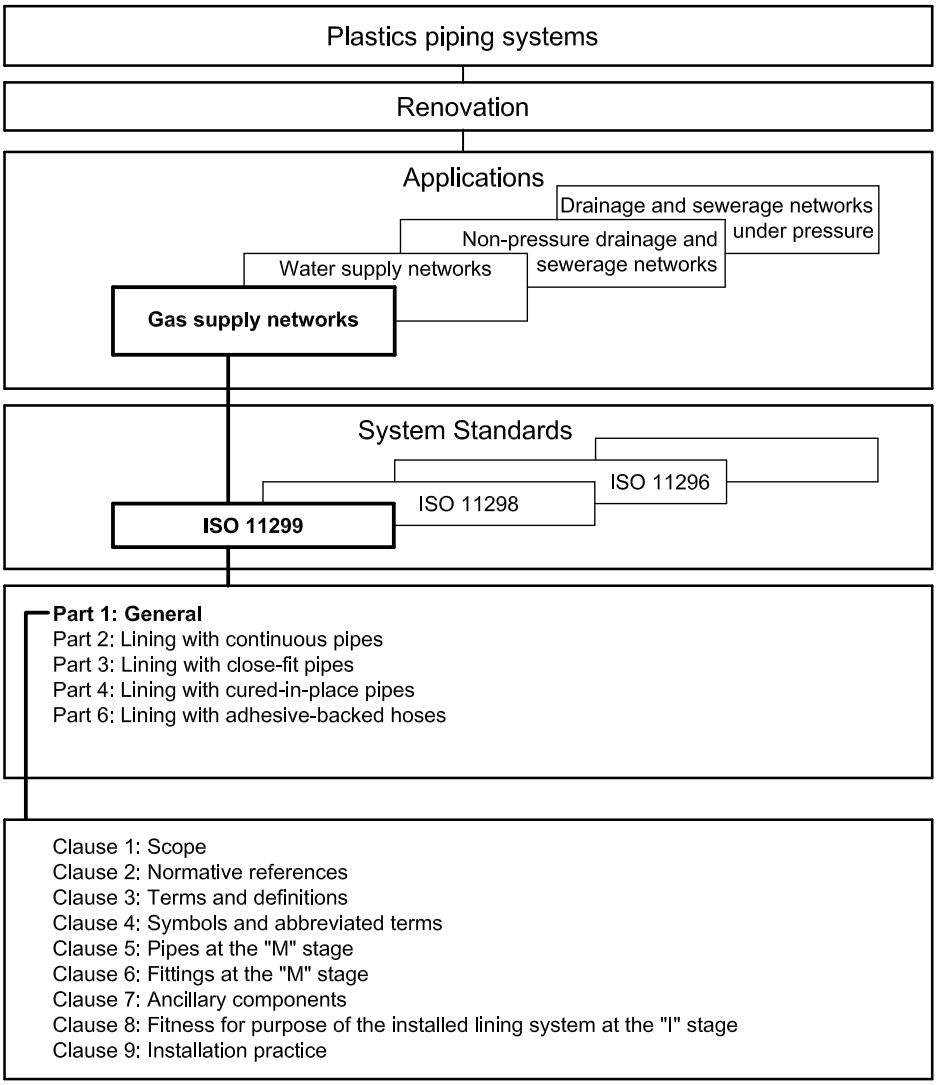


Figure 1 — Format of the renovation system standards

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^2.

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

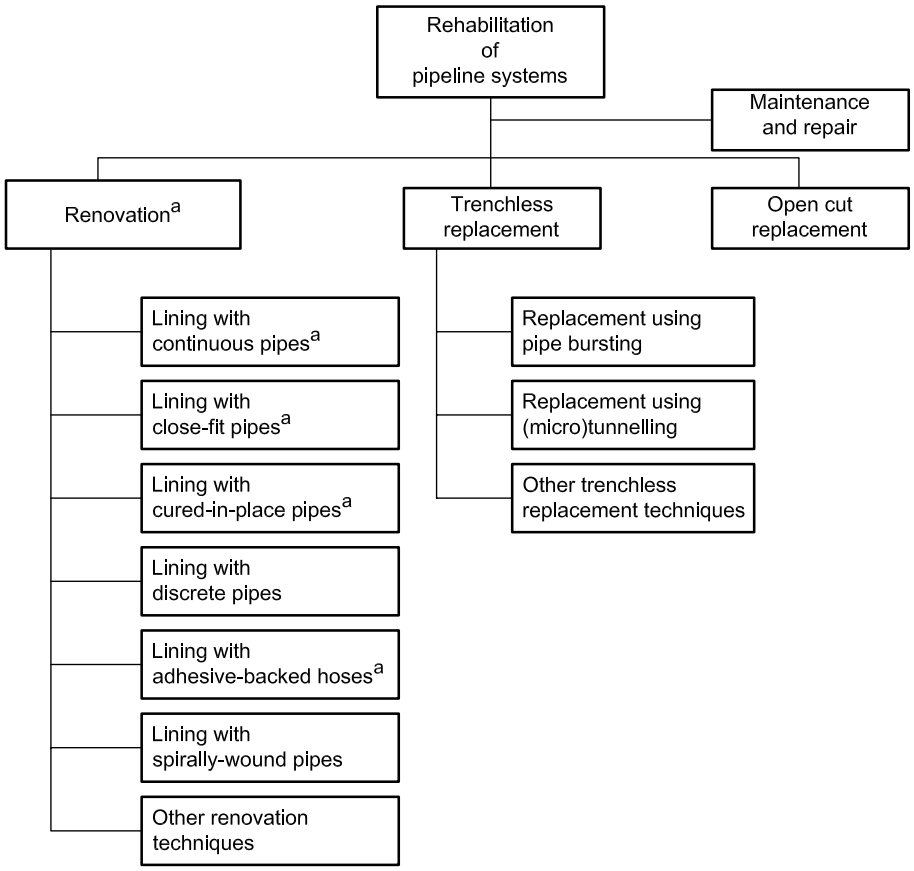
3.1.19
independent pressure pipe liner
liner which is capable on its own of resisting without failure all applicable internal loads throughout its design life

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[1].



[a] 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 π ($\approx$ 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 reprocessable 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 reprocessable 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 reprocessable 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:

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

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[1].

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[1].

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

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 for a single installation operation to 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 For relevant information see ISO 11295:2010, A.1.

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 For further details of equipment specific to individual renovation techniques, see ISO 11299-2, ISO 11299-3[2], ISO 11299-4 and ISO 11299-6, 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 data information.

Inspection equipment (profiling) shall additionally provide calibrated profiles of the liner at any required location, and shall be capable of automatic operation if the liner profile exceeds a preset deformation. Each profile shall be labelled on screen with location and degree of deformation.

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

The equipment shall conform to all relevant safety standards.

9.3.3 Lifting equipment

All lifting equipment shall be covered by a 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.

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 preparing access through to 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.

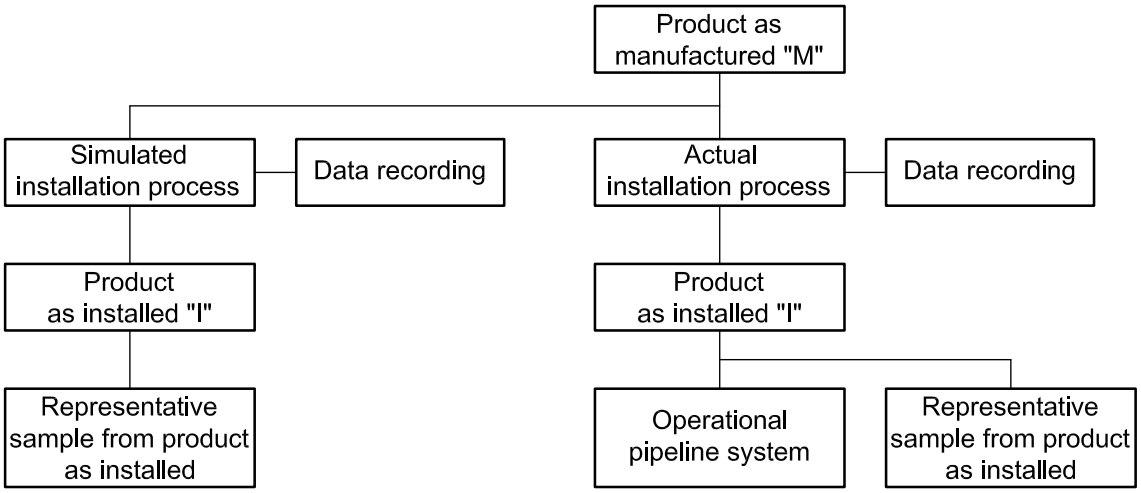


Figure 3 — Relationship between samples taken from simulated and actual installations

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 the installation equipment, making good any corrosion protection equipment on the host pipe, and preparing the ends of the installed lining system for subsequent reconnection.

9.7 Reconnecting 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 Transfer of service lines

The transfer of service lines from the existing pipeline to the installed lining system shall be undertaken after having considered the following parameters:

— number of service lines connected to the section of pipeline under renovation;

— renovation technique used;

— any pressure upgrade applied to the installed lining system;

— disconnection of the service line from the existing pipeline;

— eventuality of live installation (with maintaining gas supply to service lines during installation in the annular space between existing pipeline and lining system).

According to the renovation technique used, the transfer of service lines can be performed either by cutting from outside the existing pipeline with an appropriate tool and then by carrying out the connection of the service line to the existing pipeline or by piercing from inside the installed lining system or even, in case of live installation, by the use of annular filler upstream from every service line to be transferred.

9.9 Final inspection and testing

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

NOTE 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 only (including any integral joints), leaktightness verification can be carried out before the re-opening of any service line connections.

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

9.10 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 11299-3, *Plastics piping systems for renovation of underground gas supply networks — Part 3: Lining with close-fit pipes*

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