BS EN 12007-4:2012

BSI Standards Publication

Gas infrastructure — Pipelines for maximum operating pressure up to and including 16 bar

Part 4: Specific functional requirements for renovation

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National foreword

This British Standard is the UK implementation of EN 12007-4:2012. It supersedes BS EN 12007-4:2000 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GSE/33, Gas supply.

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

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Foreword

This document (EN 12007-4:2012) has been prepared by Technical Committee CEN/TC 234 “Gas infrastructure”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2013, and conflicting national standards shall be withdrawn at the latest by February 2013.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.

This document supersedes EN 12007-4:2000.

Annex J provides details of significant technical changes between this European Standard and the previous edition.

EN 12007 *Gas infrastructure — Pipelines for maximum operating pressure up to and including 16 bar* consists of the following parts:

Part 1: General functional requirements

Part 2: Specific functional requirements for polyethylene (MOP up to and including 10 bar)

Part 3: Specific functional requirements for steel

Part 4: Specific functional requirements for renovation

Part 5: Specific functional recommendations of new service lines[1]

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.

[1] To be published.

1 Scope

This European Standard describes specific functional requirements for the renovation of pipework in existing gas infrastructures. This European Standard is intended to be applied with the requirements of EN 12007-1.

This European Standard does not apply to pipework in above ground installations.

This European Standard covers the various renovation technologies for gas piping in the range of sizes covering gas mains and gas service lines and is intended to be applied in association with EN 12007-1. Certain pipe networks originally for other purposes can be considered for renovation technologies to make them suitable for gas infrastructure.

This European Standard specifies common basic principles for gas infrastructure. Users of this European Standard should be aware that more detailed national standards and/or code of practice may exist in the CEN member countries. This European Standard is intended to be applied in association with these national standards and/or codes of practice setting out the above-mentioned basic principles.

In the event of conflicts in terms of more restrictive requirements in national legislation/regulation with the requirements of this European Standard, the national legislation/regulation takes precedence as illustrated in CEN/TR 13737 (all parts).

CEN/TR 13737 (all parts) give:

— clarification of all legislations/regulations applicable in a member state;

— if appropriate, more restrictive national requirements;

— a national contact point for the latest information.

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 12007-1, *Gas infrastructure — Pipelines for maximum operating pressure up to and including 16 bar — Part 1: General functional recommendations*

EN 12007-2, *Gas infrastructure — Pipelines for maximum operating pressure up to and including 16 bar — Part 2: Specific functional recommendations for polyethylene (MOP up to and including 10 bar)*

EN 12007-3, *Gas supply systems — Pipelines for maximum operating pressure up to and including 16 bar — Part 3: Specific functional recommendations for steel*

EN 12327, *Gas infrastructure — Pressure testing, commissioning and decommissioning procedures — Functional requirements*

3 Terms and definitions

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

3.1
gas infrastructure
pipeline systems including pipework and their associated stations or plants for the transmission and distribution of gas

3.2
pipeline operator
private or public organization authorized to design, construct and/or operate and maintain the gas infrastructure

3.3
competent person
person who is trained, experienced and approved to perform activities relating to gas infrastructures

Note 1 to entry: Means of approval, if any, will be determined within each country.

3.4
gas main
pipework in a gas infrastructure to which service lines are connected

3.5
pipework
assembly of pipes and fittings

3.6
station
plant or facility for the operation and/or processing of gas infrastructures

3.7
service line transfer
act of switching over the service line connection from the old pipe to the new one

3.8
pressure uprating
activities pertaining to the increase of the operating pressure beyond the existing maximum operating pressure level of a gas infrastructure

3.9
commissioning
activities required to pressurize pipework, stations, equipment and assemblies with the gas and to put them into operation

3.10
decommissioning
activities required to take out of service any pipework, stations, equipment and assemblies filled with gas and to disconnect them from the system

3.11
renovation
method by which the characteristics of the gas infrastructure are improved by re-using the existing structure or installing a new structure in its place

3.12
carrier pipe
existing pipework in which a renovation system is installed

Note 1 to entry: The carrier pipe can be either a conduit pipe or a support pipe.

3.13
support pipe
existing pipe which remains the gas carrying pipe and remains a structural integral part of the pressure system after lining

3.14
sleeve
purposely installed length of protective pipe through which a gas pipe passes

3.15
conduit pipe
pipe through which a gas pipe is inserted without necessarily providing support

3.16
annular space
space enclosed between the carrier pipe and the new pipe when the latter is inserted inside

3.17
close fit
after reshaping and relaxation, outer surface of the inserted pipe is in close contact with the internal surface of the old pipe

4 Design

4.1 General

Choice of renovation techniques to be used on pipework, up to and including 16 bar, shall be made by a competent person.

The selection of materials, dimensions and assembling techniques shall be the responsibility of the pipeline operator and comply with EN 12007-1.

Further guidance on the design of polyethylene (PE) pipelines of gas infrastructure is given in EN 12007-2.

Further guidance on the design of steel pipelines of gas infrastructure is given in EN 12007-3.

The uprating of renovated systems is the responsibility of the pipeline operator and shall conform to the relevant procedure. The Maximum Operating Pressure (MOP) of a renovated system shall be limited by the weakest point of the system.

4.2 Pressure uprating

Renovation of a gas infrastructure can be a part of a strategy plan for uprating the maximum operating pressure. Some renovation techniques lead to a reduction in diameter of the pipe, so that an increase in pressure is required to maintain the flow capacity of the system.

Up rating of MOP is the responsibility of the pipeline operator. The pipeline operator shall ensure that all pipeline components are capable of withstanding, in strength and tightness, the new pressure level.

4.3 Selection of renovation technique

The following factors shall be considered when selecting a renovation technique. These include but are not limited to:

— the future structure of the distribution network;

— the pressure level at which the pipework will operate after renovation;

— the required capacity of the pipework;

— the number of gas service lines connected to the section of pipework;

— the presence and number of branches, bends, valves;

— the current condition of the pipework to be renovated;

— the position of the pipework;

EXAMPLE 1 The covering depth of the pipework.

EXAMPLE 2 Disruption to traffic and pedestrians.

EXAMPLE 3 The location of adjacent plant.

EXAMPLE 4 Areas sensitive to break phenomena.

— the number, type and condition of pipe joints in the section of pipework;

— any supply obligations to consumers during and after renovation works.

NOTE 1 There is a range of renovation techniques use. These are described generally in Annex A. Annex A does not represent an exhaustive list of available techniques.

NOTE 2 The advantages and disadvantages of the techniques described in Annex A are outlined in Annex B. Further details of the different techniques are given in Annexes C to Annex I.

4.4 Consultation with third parties

When planning works on gas infrastructure, there should be communication with the owners of other plant and street authorities near the gas infrastructure. Any relevant information on the presence of any adjacent plant required to plan the intended works should be collected from these parties.

Further guidance is given in EN 12007-1.

5 Construction

5.1 General

Pipework shall only be laid or renovated by competent persons working to the specification provided by the pipeline operator and/or pipework manufacturer. General guidance on the construction of gas infrastructures up to and including 16 bar is given in EN 12007-1. Specific guidance is given in EN 12007-2 for polyethylene pipelines and in EN 12007-3 for steel pipelines.

A detailed procedure for the successive steps of the works should be made. Each technique has its specific considerations which are mentioned in the Annex C to Annex I.

Where, as a requirement of the renovation technique, it is necessary to raise the temperature of polyethylene pipe, the pipe temperature shall not exceed the maximum allowable temperature stated by the pipe manufacturer.

The safety of personnel engaged on gas supply works, and of members of the public shall be ensured during the whole period of the works. Considerations shall be given to the needs of the elderly or disabled.

Before assembly and laying parts of gas infrastructures the condition of all pipes and fittings shall be checked for conformity. Existing pipework should be checked for unwanted obstructions or blockages.

The construction of gas infrastructures should be organized so that the impact on the environment during construction is reduced to the minimum practicable level. Further guidance on environmental considerations is given in EN 12007-1.

Lubricants used to aid renovation by pipe insertion shall not have a detrimental effect on the existing or inserted pipe.

5.2 Disconnection/reconnection of sections of the gas infrastructure

Where it is necessary to disconnect a section of the gas infrastructure to undertake renovation works, care shall be taken to ensure that supplies in the other parts of the existing gas infrastructure are not adversely affected.

Care shall be taken to identify all service lines supplied from the section of gas main to be disconnected and consideration shall be given to the renovation of these service lines.

The pipes and fittings shall be correctly stored, handled and transported to ensure continued fitness for purpose as required in EN 12007-1, EN 12007-2 and EN 12007-3.

5.3 Excavation and no dig techniques

The position and size of excavations shall be determined taking into account the covering depth of the pipework to be renovated, the diameter of the new pipe and other factors which can affect the insertion process.

EXAMPLE 1 The proximity of other buried plant.

EXAMPLE 2 The length of the new section of pipe.

EXAMPLE 3 The position of service lines to be transferred.

Consultation should take place with other utilities before undertaking excavation work, so that adequate measures for the protection of other pipework, cables and underground constructions can be agreed.

The competent person on site should ensure that the most appropriate information on the location of existing gas supply pipework and other utility plant are available on site. The competent person should ensure that safe digging practices are followed at all times.

Adequate provision should be made for the effective temporary support of pipework, cables, and other apparatus during the progress of the work, and for their permanent support where the ground has been disturbed.

Further guidance on the precautions to be taken when excavating is given in EN 12007-1.

Excavations created in the process of renovating gas infrastructures shall be suitably backfilled and surface features such as roads and footways shall be reinstated according to standards agreed within the Member Countries.

5.4 Laying

5.4.1 Laying of pipework

Any new pipe installed shall be laid in accordance with the specific guidance if appropriate given in EN 12007-2 for polyethylene pipelines and in EN 12007-3 for steel pipelines. Further general guidance is given in EN 12007-1.

5.4.2 Cleaning of carrier pipe

When the carrier pipe contains quantities of dust, pitch or other contaminates which could affect the renovation process, consideration should be given to pipe cleaning. Pipe cleaning can be achieved by either mechanical, hydraulic or pneumatic means.

NOTE In certain renovation techniques the condition of the internal bore of the carrier pipe is a major factor in determining whether the technique can be successfully applied.

EXAMPLE Close-fit lining.

During any pipe cleaning care should be taken to:

— minimize any damage to the environment;

— the presence of pyrophoric dust;

— dispose waste material in accordance with national or local legislation.

5.4.3 Inspection of the pipework to be renovated

Where renovation techniques use the pipe as carrier pipe, it should be inspected internally prior to introduction of the new pipe, in order to locate possible obstructions and deficiencies which can damage or have otherwise detrimental effects on the new pipe or block the passage.

The inspection may be carried out with a camera.

6 Pressure testing

Pressure testing procedures to prove the integrity of renovated gas mains and service lines shall be selected from EN 12327.

The pressure testing shall be carried out in accordance with minimum test pressure levels given in EN 12007-1.

General guidance is given in EN 12007-1. Further guidance for polyethylene systems is given in EN 12007-2.

Where a tightness test cannot be carried out, for example joint repairs carried out under live conditions at operating pressure, the pipeline operator shall specify the test method.

7 Service line transfer

Service line transfer shall be carried out in accordance with the specifications given by the pipeline operator and the technical requirements of the renovation technique. A strength test, a tightness test or a combined test shall be carried out on the renovated service line and/or connection between service line and gas main before commissioning the service line. These tests shall be in accordance with EN 12327.

If, for technical reasons, pressure testing of the service line pipework is not completed prior to connection it shall be tested at the same time as the new section of pipeline.

8 Commissioning and decommissioning

Commissioning and decommissioning shall be carried out in accordance with EN 12327. General guidance is given in EN 12007-1.

9 Record system

The requirements for the establishment and maintenance of a record system for gas infrastructures are given in EN 12007-1. The pipeline operator shall ensure that appropriate details of renovated pipework are included within this record system. The following data shall at least be included in the record system:

— type of pipes, diameters and lengths;

— the date of execution of the renovation;

— the technique used for the renovation; and

— the presence and type of carrier pipe.

Annex A
(informative)

Chart of renovation techniques

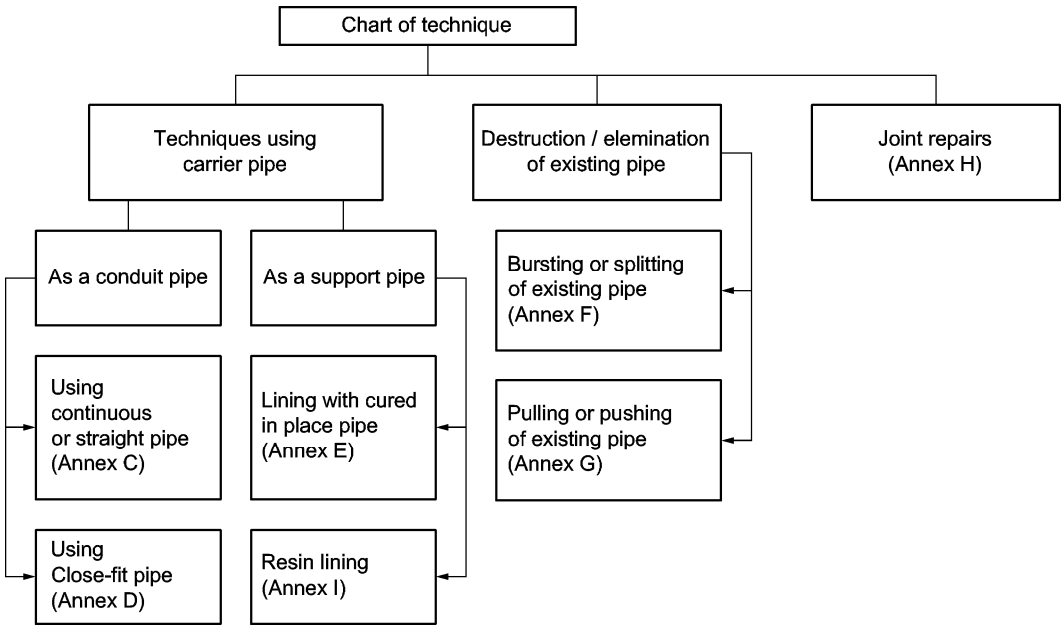

Figure A.1 — Chart of renovation techniques

Annex B
(informative)

Advantages and disadvantages of renovation techniques

Table B.1 — Advantages and disadvantages of renovation techniques (1 of 3)

Techniques	**Advantages**	**Disadvantages**
Continuous or discrete pipe (Annex C)	— With the exception of live insertion, minimal equipment is required. — Live insertion reduces supply disruption. — Inserted pipe does not rely on the integrity of the carrier pipe.	— Inspection and cleaning of the carrier pipe can be necessary. — It is difficult to cathodically protect the new pipework where steel is used as the inserted pipe. — Reduced capacity if the *MOP* is not increased. — It is difficult to locate gas leakages.
Close-fit pipe (Annex D)	— Minimal reduction in capacity. — Close-fit pipe does not rely on the integrity of the carrier pipe.	— Inspection and cleaning of the carrier pipe can be necessary. — Use of specialized equipment and personnel. — External fusion beads have to be removed. — It may be necessary to remove bends.

Table B.1 — Advantages and disadvantages of renovation techniques (2 of 3)

Techniques	Advantages	Disadvantages
Cured in place (Annex E)	— Service lines can be restored without open cut. — Capacity of the pipework is maintained. — Pipework with large radius bends can be renovated.	— Use of specialized equipment and personnel. — Problems can occur with gas leakage between the liner and the support pipe. — Inspection and cleaning of the support pipe is necessary. — It can have a shorter life expectancy than inserted pipework.
Bursting or splitting existing pipe (Annex F)	— Allows the replacement of a pipe at the same time location by another of greater diameter.	— It can be necessary to install a sleeve due to the risk of unacceptable damage to the new pipe. — Bends in the old pipe can cause problems. — Branches have to be reconnected by open cut. — Fragments can damage adjacent utilities or plant.
Pulling or pushing existing pipe (Annex G)	— Allows the replacement of a pipe at the same location by another of greater diameter. — No fragments of the old pipe remain in the ground.	— It can be necessary to install a sleeve due to the risk of unacceptable damage to the new pipe. — Large excavation is needed to remove redundant pipework.

Table B.1 — Advantages and disadvantages of renovation techniques (3 of 3)

Techniques	Advantages	Disadvantages
Joint repairs (Annex H)	— These techniques can be carried out without interrupting gas supply. — Some techniques can be carried out with minimum excavation.	— It does not have the same life time as an inserted pipe. — Some techniques need cleaning of the pipe.
Resin lining (Annex I)	— Capacity of the pipework is maintained. — Pipework with large radius bends can be renovated.	— It can have a shorter life expectancy than an inserted pipe. — Inspection and cleaning of the carrier pipe is necessary. — Branches have to be reconnected by open cut. — Product can be sensitive to the temperature at the time of application and can be affected by extremes of temperature in operation. — The technique relies on the mechanical properties of the support pipe.

Annex C
(informative)

Renovation with continuous or discrete pipe

C.1 Definition

This technique involves inserting a new gas pipe of smaller diameter into the existing pipe. The existing pipework therefore becomes a carrier pipe.

C.2 Description

Two techniques are commonly used:

— live insertion: where the section of existing pipe to be renovated is not decommissioned prior to and during the insertion work;

— dead insertion: where the section of existing pipe to be renovated is decommissioned prior to and during insertion work.

C.3 Conditions of application

The choice of insertion technique is influenced by some of the following factors:

a) Dead insertion is generally used:

   1) when insertion can be done after decommissioning and disruption of the gas supply during the work period; or

   2) when it is known or suspected that the existing pipework needs to be cleaned before renovation; or

   3) when it is known or suspected that some obstructions in the existing pipework have to be located and/or to be removed.

b) Live insertion can be used if:

   1) the annular space is sufficient to supply consumers while they are still connected to the live carrier pipe; and

   2) it is possible to separate the pipe insertion or lining process from the transfer of service lines from the old pipework to the new pipework.

c) Live insertion should be used where:

   1) the downstream gas infrastructure cannot be disrupted; or

   2) the disruption of gas supply to the consumers concerned has to be limited in time.

C.4 Implementation

C.4.1 Preparation

Prior to renovation the following activities are generally carried out:

— the length of sections to be inserted is determined taking into account such factors as, but not limited to, the location of existing connections, bends in the pipework, valves, syphons; and

— where consumers are affected by dead insertion work, the number of sections to be re-commissioned before the end of each day is determined.

NOTE A by-pass can be used to maintain the supply.

C.4.2 Execution

C.4.2.1 General

During the insertion process the activities in C.4.2.2 and C.4.2.3 shall be carried out.

C.4.2.2 Dead insertion

C.4.2.2.1 Isolation and decommissioning

EN 12327 gives normative requirements for isolation and decommissioning operations.

C.4.2.2.2 Cleaning of the pipe

Where dust, pitch or contaminants are found when existing pipework is cut, it shall be cleaned using equipment suitable for the task. It can be necessary to introduce a hauling cable into the existing pipework to facilitate this. Contaminants should be properly disposed of following the cleaning operation in line with local or national legislation relating to the environment.

C.4.2.2.3 Inspecting the pipe to be renovated

A “dummy pipe“, gauging pig or camera is sometimes inserted into the section to be lined to check that:

— nothing will damage the new pipe; and

— the new pipe will pass freely into the existing pipework.

Techniques are available using special controllable devices to allow internal removal of plugs and other obstacles.

C.4.2.2.4 Introduction of the new pipe

The new pipe can be inserted into the existing pipework:

— by pulling: the hauling cable is attached to the pipe using a suitable hauling device; or

— by pushing: care is taken to ensure that the pushing clamp of the machine does not cause unacceptable damage to the new pipe.

The tensile or compressive stress imposed on the new pipe is controlled to ensure that it remains below the pre-determined limit.

Protective equipment is generally used to prevent unacceptable damage to the new pipework by the edge of the carrier pipe.

C.4.2.2.5 Testing

Testing is carried out according to Clause 6. Pressure levels and test methods are chosen in function of the *MOP* of the system and the materials used.

C.4.2.2.6 Service line transfer

A suitable pipe cutting tool is used to cut the carrier pipe to facilitate the transfer of service lines taking all possible precautions to avoid unacceptable damage to the new pipe.

For testing, see Clause 7.

C.4.2.2.7 Commissioning

The new pipe is connected to the existing gas infrastructure using a procedure provided by the pipeline operator prior to commissioning. EN 12327 gives requirements for the commissioning of pipework.

C.4.2.3 Live insertion

C.4.2.3.1 Introduction of the new pipe

The pipe to be renovated can be divided into sections. Each section allows the “live insertion“ of a new pipe in one operation.

The new pipe can be assembled to the required length prior to insertion.

Where required in the procedure, the external beads of the butt-fusion will be removed with care.

The new pipe is inserted into the existing pipe through a gland assembly. There are two methods commonly used for live insertion:

— the first involves introducing gas into the inserted pipe as it is being inserted into the carrier pipe by means of a special nose cone. During this process the inserted pipe contains gas throughout the operation; and

— the second involves the inserted pipe containing air at atmospheric conditions. Gas is introduced into the inserted pipe after insertion is completed when the final connection to the existing system is made.

Small diameter pipes can be inserted by hand by using manual clamps. For larger sizes hydraulic or pneumatic pushing machines are used.

When inserting using coiled pipe a length of straight pipe is butt fused onto the start of the coil to prevent obstruction of the pipe due to the natural bend of the coiled pipe.

On completion of the insertion procedure the pipe end is sealed by the application of an approved foaming product into the annular space.

After removing the gland assembly the new pipe is connected to the existing gas infrastructure using a technique approved by the pipeline operator.

C.4.2.3.2 Pre-testing

Prior to insertion a strength and tightness check is carried out on the new pipe. Testing is carried out according to Clause 6. Pressure levels and test methods are chosen with reference to the MOP of the system and the materials used.

C.4.2.3.3 Service line transfer

The order of service line transfer from the existing pipework to the inserted pipe is constrained by the need to maintain supplies to service lines which remain temporarily connected to the original gas main.

Generally the service lines furthest from the source of gas into the annular space are transferred first, working methodically towards the source of supply.

After disconnecting the service line from the existing pipe an approved foaming product is injected into the annular space upstream of the service line to isolate the flow. This can be carried out from the point at which the service line was connected to the existing pipe.

An appropriate length of the existing pipe is removed to allow the fusion or the mechanical fixing of the service line to the new pipe in accordance with a procedure given by the pipeline operator.

For testing, see Clause 6 and Clause 7.

C.4.2.3.4 Testing

Testing is carried out according to Clause 6. Pressure levels and test methods are chosen with reference to the MOP of the system and the materials used.

Annex D
(informative)

Lining with close-fit pipe

D.1 Definition

These techniques temporarily deform the PE pipe to facilitate its insertion into the pipe to be renovated.

The pipe being renovated acts purely as a carrier pipe and the new PE pipe is not physically attached to it.

D.2 Description

There are a range of techniques which can be used. These include but are not limited to:

— thermal-mechanical deformation: technique which can be carried out hot or cold and which refers to thermal-mechanical deformation. In this procedure PE pipe is pulled through a die to reduce its diameter. In hot procedure the material is heated prior to being passed through the die to a temperature not exceeding the value which is allowed. The pipe is pulled into the existing pipework under tension to maintain the reduced diameter. The reversal process is actioned using the appropriate method.

— mechanical deformation: technique which refers to a reduction of PE pipe diameter by mechanical deformation. In this procedure PE pipe is forced between two hemispherical rollers of a machine. The reversal process takes place as a function of time and temperature. To accelerate this reversal process, the drawn pipe may be filled with water and subjected to internal pressure. The process can be speeded-up further by increasing the pressure within limits provided by the pipeline operator.

— use of memory effect of PE pipe: a previously extruded PE pipe of normal shape is, under mechanical and thermal effects, forced into a new form thus reducing the outside diameter of the new shape and is normally purchased in this form. After insertion the pipe is brought back to its original shape by thermal and/or mechanical pressure. The pipe is expanded to its original circular cross section, by using the appropriate method, in order to restore the original polymer morphology prior to reshaping.

D.3 Conditions of application

The techniques in D.2 can be used:

— to renew all types of old pipes for diameters between 100 mm and 600 mm; and

— for the different pressure levels used in the distribution system. The use of PE pipe can enable the Maximum Operating Pressure (MOP) of the gas infrastructure to be increased.

For each method the pipe to be renovated is decommissioned in sections. The number and length of the sections will be determined by practical factors.

EXAMPLE The number and distribution of consumers supplied from the pipe to be renovated.

D.4 Implementation

D.4.1 Materials

The materials and components used shall conform to the requirements given in relevant standards.

D.4.2 Preparation

For close fit insertion techniques the following points should be considered:

— that the length of pipe to be inserted is compatible with factors such as the tensile stresses to be imposed, the space available to implement the technique with the equipment required, and the length of time during which the gas supply can be isolated;

— the position and size of excavations required; and

— the different types of materials which comprise the pipework to be renovated.

EXAMPLE Steel, cast iron.

D.4.3 Execution

For each of the techniques the phases are as follows:

a) Isolation and decommissioning

EN 12327 gives normative requirements for isolation and decommissioning operations.

b) Cleaning the pipework

If dust, pitch or contaminants are found when the existing pipework is cut, cleaning is required using equipment suitable for the task. A hauling cable introduced into the pipework could be used. Contaminants should be properly disposed of following the cleaning operation by respecting the local or national legislation relating to environment.

c) Inspecting the pipe to be renovated

A "dummy pipe", gauging pig or camera may be inserted into the section to be lined to check that:

1) nothing will interfere with or damage the pipe;

2) the new pipe will pass freely into the existing pipework.

Techniques are available using special controllable devices to allow internal removal of plugs and other obstacles.

d) Preparing existing pipework

For existing connections, sections of the old pipe are cut out before the pipe is drawn in, special bridge tees or special tapping sleeves are welded into the new line with spacers included.

e) Introduction of the new pipe

The new pipe can be inserted into the existing pipe by pulling or pushing. If required in the procedure the external beads of the butt-fusions will be removed with care.

If during a thermal-mechanical deformation the draw-in process is interrupted, the reversal process can be expected to begin immediately after the release of the tensile force. The process is to be completed without interruption.

Generally, the drawn-in PE pipe presses itself against the inner wall of the old pipe. However, no gas tight seal is established between the outside of the new pipe and the internal diameter of the renovated pipe.

f) Testing

Testing is carried out following Clause 6. Pressure levels and test methods are chosen as a function of the *MOP* of the system and the materials used

g) Service line transfer

A suitable pipe cutting tool is used to cut the carrier pipe to facilitate the transfer of service lines taking all possible precautions to avoid unacceptable damage to the new pipe.

Service lines and other connections are made directly to the new PE pipe. Special techniques are sometimes used to cut a window in the carrier pipe to prevent unacceptable damage to the new pipe.

For testing, see Clause 6 and Clause 7.

h) Commissioning

The new pipe is connected to the existing gas infrastructure using a procedure provided by the pipeline operator prior to commissioning. EN 12327 gives functional requirements for the commissioning of pipework

Annex E
(informative)

Lining with cured-in-place pipe

E.1 Definition

This technique involves the insertion of a hose into the pipe to be renovated and uses the inversion method. The hose is made of plastic or plastic reinforced by textile fibre.

E.2 Description

The hose is applied under pressure to the whole of the inner surface of the pipe. The hose is bonded to the existing pipe by use of a curing resin with which the hose has previously been coated.

The lining systems are designed to remain leak proof, fracture resistant, and be properly bonded to the support pipe.

E.3 Conditions of application

This technique can be used to renovate all types of old pipes provided the variations in the internal diameter over a section of the gas main do not exceed the manufacturer's specifications.

The lining systems are designed:

— to be generally free of wrinkles and blisters;

— to perform satisfactorily at operating temperatures in the range 5 °C to 25 °C in addition to any further range specified by the manufacturer of the system.

E.4 Implementation

E.4.1 Preparation

For lining techniques using cured in place pipe the following points should be considered:

— that the length of pipe to be renovated is compatible with factors such as: the diameter-length ratio which determines the level of air pressure necessary to ensure the inversion of the hose, the space available and the time during which the gas supply can be isolated;

— the inside diameter of the pipe to be treated and particularly any changes in pipe type or diameter is determined;

— the pipeline operator ensures that the condition of branches is such that no additional excavations will be necessary and that in particular they are not leaking;

— the position and size of the excavations required.

E.4.2 Execution

The operation includes the following phases:

a) Isolation and decommissioning

EN 12327 gives normative requirements for isolation and decommissioning operations.

b) Cleaning the pipework

Cleaning is carried out using equipment suitable for the task. A hauling cable introduced into the pipework could be used to facilitate this. Inspection of the inside of the pipe is carried out after cleaning using appropriate systems. Any residue or moisture on the inside of the pipe can prevent good adhesion of the lining material. Grit blasting of the inside of the pipe can be required to ensure the correct level of cleanliness. Contaminants should be properly disposed of following the cleaning operation by respecting the local or national legislation relating to the environment.

c) Inspecting the pipe to be renovated

A detailed inspection of the inside of the pipe is carried out to check the diameter and any variations in diameter, locate the position of any branch connectors and also check that nothing will interfere with or damage the hose. Techniques are available using special controllable devices to allow internal removal of plugs and other obstacles.

d) Introduction of the cured-in-place pipe

Before inserting the cured in place pipe, any branch connections on the section being renovated are plugged off. After the lining process is completed the plugs are removed and connections to the liner remade.

The hose, coated with polymerisable resin, is inserted into the existing pipework where air pressure is used to invert the hose and bond its outer surface to the inside of the existing pipework.

Following installation the resin cures by polymerization over a period of time laid down in the manufacturer's specifications.

Special attention should be paid to check if the polymerization of the entire lining has occurred as desired. The pipework should be inspected with a camera.

e) Testing

Testing is carried out following Clause 6. Pressure levels and test methods are chosen as a function of the *MOP* of the system and the materials used.

f) Service line transfer

The hose is pierced from the inside to commission the service line.

For testing, see Clause 6 and Clause 7.

g) Commissioning

The new pipe is connected to the existing gas infrastructure using a procedure provided by the pipeline operator prior to commissioning. EN 12327 gives functional requirements for the commissioning of pipework.

Annex F
(informative)

Renovation by bursting or splitting existing pipe

F.1 Definition

This technique consists of bursting or splitting the existing pipe and replacing the existing pipe with a new pipe located in the void created. The new pipe can be of the same diameter or larger than the existing pipework.

F.2 Description

The technique consists of creating a void in place of the existing pipework to enable it to be replaced by a new pipe.

The existing pipe may be:

— burst, where the material is brittle;

EXAMPLE 1 Grey cast iron pipe.

— split, where the material is ductile.

EXAMPLE 2 Steel pipe.

F.3 Conditions of application

During pipe bursting or splitting there is a risk of causing unacceptable damage to the new pipe. A protective sleeve can be used to prevent this damage.

Other utilities equipment should be precisely located to avoid damage by the fragments of the old pipe, displacement of the surrounding soil or vibrations.

Damage by vibrations to buildings in the vicinity should be avoided.

The type of soil should be known to assure displacement into the surrounding soil is possible.

F.4 Implementation

F.4.1 Preparation

For bursting or splitting the following points should be considered:

— the material and condition of the pipe to be renovated is known;

EXAMPLE 1 If it has been decided to replace a grey cast iron pipe by bursting, it is recommended that the positions of any repairs of a different material which cannot be burst are determined.

— the length of pipe to be inserted is compatible with factors such as the space available and the time during which the gas supply can be disrupted;

— the locations and sizes of excavations to be made are determined taking account of the depth of the pipe to be renewed, the type of the new pipe and other operations.

EXAMPLE 2 The use of discrete or continuous pipe.

EXAMPLE 3 Making the connections using arc welding for steel or butt fusion for PE pipes.

EXAMPLE 4 The use of a sleeve.

F.4.2 Execution

a) Isolation and decommissioning

EN 12327 gives normative requirements for isolation and decommissioning operations.

b) Cleaning the pipework

If dust, pitch or contaminants are found when the existing pipework is cut, cleaning is required using equipment suitable for the task. A hauling cable introduced into the pipework could be used to facilitate this. Contaminants should be properly disposed of following the cleaning operation by respecting the local or national legislation relating to the environment.

c) Introduction of the new pipe

Prior to the operation all excavations required for launch and reception of the new pipe, together with any excavations required for any service connections are carried out.

Existing service lines and branches which are on the section to be renewed are cut off prior to the operation.

A device consisting of a pneumatic driven bladed cutting head is drawn through the pipe to be replaced, fragmenting or cutting and expanding the pipe as it progresses. The fragments are pushed into the surrounding soil.

Where used, a sleeve is simultaneously drawn behind the splitting or bursting head into the void. This serves to stabilize the ground and to protect the new pipe from any damage from fragments of the old pipe. Windows are cut into the sleeve for any service connections, and upon completion the new pipe is inserted through the sleeve.

d) Testing

Testing is carried out following Clause 6. Pressure levels and test methods are chosen as a function of the MOP of the system and the materials used.

e) Service line transfer

For testing, see Clause 6 and Clause 7.

f) Commissioning

The new pipe is connected to the existing gas infrastructure using a procedure provided by the pipeline operator prior to commissioning. EN 12327 gives functional requirements for the commissioning of pipework.

Annex G
(informative)

Renovation by the pulling or pushing of the existing pipe

G.1 Definition

This technique consists of pushing or pulling the existing pipe and replacing the existing pipe with a new pipe located in the void created. The new pipe can be of the same diameter or larger than the existing pipework.

G.2 Description

The technique consists of creating a void in place of the existing pipe. The existing pipe can be pulled or pushed out to a receiving trench where it is cut into sections to facilitate its complete removal and proper disposal.

G.3 Conditions of application

During pipe pulling or pushing there is a risk of causing unacceptable damage to the new pipe. A protective sleeve can be used to prevent this damage.

The route of the pipe needs to be checked for presence of bends.

The location of underground pipework and cables should be determined to reduce the risk of causing damage.

G.4 Implementation

G.4.1 Preparation

When utilising this technique consideration is given to ensure that the length of pipe to be replaced in one section is compatible with factors such as the stresses to be imposed, the space available and the time during which the gas supply can be isolated.

G.4.2 Execution

a) Isolation and Commissioning

EN 12327 gives functional requirements for these operations.

b) Introduction of the new pipe

Prior to the operation all excavations required for launch and reception of the new pipe, together with any excavations required for any service line connections are carried out.

Existing service lines and branches which are on the section to be renewed are cut off prior to the operation.

A guide system is installed using rollers for PE or guide rails in the case of metallic pipe in discrete lengths.

Pulling rods or pulling cable are installed into the pipe to be replaced. In case of using pulling rods, the rods are connected to the old pipe by the use of an anchoring plate at the starting point. If necessary this anchoring plate is used as an expansion cone during insertion.

The new pipe to be inserted, or a sleeve if used, is connected to the anchoring plate. The pulling device is installed in the receiving trench and cracking wedges are also installed in the receiving and intermediate trenches. The pulling rod is connected to the pulling device and sections of the existing pipework are pulled or pushed in the direction of the receiving trench, whereby the cracking wedges destroy the pipework in the receiving and intermediate trenches. The broken pieces of pipework should be collected and properly disposed of.

After the complete removal of the existing pipework the new pipe is completely inserted, within a protective sleeve if necessary. Where a sleeve is used, access windows are cut into the sleeve for any service connections, and upon completion, the new pipe is inserted through the sleeve.

c) Testing

Testing is carried out following Clause 6. Pressure levels and test methods are chosen as a function of the *MOP* of the system and the materials used.

d) Service line transfer

For testing, see Clause 6 and Clause 7.

e) Commissioning

The new pipe is connected to the existing gas infrastructure using a procedure provided by the pipeline operator prior to commissioning. EN 12327 gives functional requirements for the commissioning of pipework.

Annex H
(informative)

Joint repairs

H.1 Definition

This technique consists of the repair of leaking pipework joints.

H.2 Description

These techniques require access to the pipework, either internally or externally, in order to repair pipework joints.

H.3 Conditions of application

H.3.1 General

These techniques can be used to repair leaking lead/yarn, mechanical and welded joints normally found in cast iron, ductile iron and steel pipework. Most techniques are usually carried out under live conditions at the operating pressure of the system. However some of the techniques require the pipework to be decommissioned prior to applying the repair technique.

The techniques described include the use of internal sealing methods such as emulsion sealing, anaerobic spraying, Mono-Ethylene Clycol (MEC) spraying and internal clamps, and external methods such as anaerobic injection, encapsulation and leak clamps.

H.3.2 Internal methods

H.3.2.1 Commissioned pipework − MEG and anaerobic spraying

The application of these techniques is limited by the MOP of the system, the size of the connection that can be made to the pipework and any significant change of direction of the pipework.

H.3.2.2 De-commissioned pipework

H.3.2.2.1 Emulsion sealing

The process is designed to internally seal screwed joints on iron or steel pipework. It will not be successful on a pipe that has been subjected to extensive corrosion.

H.3.2.2.2 Internal clamps

This technique is used to seal large diameter lead/yarn and mechanical joints. The clamps can be installed by using remote techniques or by manned entry. Access is required to one end of the pipework for remote equipment and to both ends for manned entry.

H.3.3 External methods − Commissioned pipework

These techniques are designed to externally seal the outside of the joint. For encapsulation and leak clamps, access is required to the complete joint and they are designed to externally seal the outside of the joint. Access is only required to the top of the joint for anaerobic repair methods.

H.4 Implementation

H.4.1 Internal repairs

H.4.1.1 Commissioned pipework − MEG and anaerobic spraying

H.4.1.1.1 Preparation

A small diameter hole is drilled in the pipework to enable the equipment to be inserted into the pipework. This can be achieved by drilling and tapping the pipework or fitting a saddle/tee clamped or welded to the pipework.

H.4.1.1.2 Execution

The equipment is designed to operate under live conditions and is inserted into the gas main through the previously drilled hole in the pipework. There are basically two methods of application of internal joint sealing. The first system is designed to spray the sealant directly into the joint and the second system to atomize the sealant into the gas stream.

a) Spraying sealant into joints

Where the equipment has been designed to spray into the joint, such as anaerobic spraying, a joint location method is used to ensure that the joints can be located accurately.

EXAMPLE TV camera, electronic joint location instruments.

When the joint has been located a measured amount of fluid is sprayed into the joint.

b) Spraying into the gas stream

The equipment is either pushed or pulled at a controlled rate through the pipework whilst spraying is in progress. The fluid is picked up in the gas stream and is deposited into the joint to cause the yarn or rubber gasket to swell.

H.4.1.2 De-commissioned pipework

H.4.1.2.1 Emulsion sealing

H.4.1.2.1.1 Preparation

When using these techniques the pipework should be disconnected from the gas supply and EN 12327 gives functional requirements for these operations. Meters, filters, regulators, valves and any branches not intended to be treated, should also be disconnected from the gas supply.

H.4.1.2.1.2 Execution

If dust, pitch or contaminants are found when the existing pipework is cut, cleaning can be required using equipment suitable for the task. Special arrangements could also be necessary to dispose of any contaminants following the operation.

The pipe is filled with emulsion sealant in accordance with the manufacturer specification. After the required curing time the product is drained and removed.

H.4.1.2.2 Internal clamps

H.4.1.2.2.1 Preparation

The pipework to be repaired should be disconnected from the gas supply and EN 12327 gives functional requirements for these operations.

H.4.1.2.2.2 Execution

a) Cleaning the pipework

Cleaning of the internal joint should be carried out using equipment suitable for the task. After cleaning the pipework, the inside of the joint should be inspected. Any residue on the inside of the pipe can prevent good adhesion of the clamp. Grit blasting of the inside of the pipe can be necessary to ensure the correct level of cleanliness.

b) Manned entry of pipework

If manned entry is used, then appropriate safety apparatus and methods of communication shall be available on site. When the joint has been located, cleaning of the joint should take place using appropriate equipment for the task. The clamp should be fitted in accordance with the manufacturer's specification.

c) Remote fitting of clamps

After location of the joint, cleaning should take place and the clamp should be fitted in accordance with the manufacturer's specification.

H.4.2 External repairs − Commissioned pipework

H.4.2.1 Preparation

Access is required to the joint to be repaired and for encapsulation and clamping systems sufficient space should be available around the joint to enable the equipment to be fitted. For anaerobic injection, access to the top portion of the gas main is normally only required.

H.4.2.2 Execution

All equipment should be designed to operate under live conditions and repairs should be carried out according to the manufacturer's instructions. For encapsulation and clamps the joint should be cleaned. Anaerobic injection methods require access to the lead/yarn or rubber gasket of a mechanical joint and this can be achieved by drilling a small diameter hole through the lead seal, backing ring or through the back of the joint.

H.5 Testing

Testing is carried out following Clause 6. Pressure levels and test methods are chosen as a function of the MOP of the system and the materials used.

H.6 Commissioning

If the pipework has been disconnected from the gas infrastructure, it should be commissioned using a procedure provided by the pipeline operator. EN 12327 gives functional requirements for the commissioning of pipework.

Annex I
(informative)

Resin lining

I.1 Definition

This technique consists of completely coating the inside of the pipework with a resin.

I.2 Description

The process used consists of injecting a resin such as epoxy in the pipework. Immediately after injection of the resin, a pig is pulled or pushed through the pipework to spread the resin over the whole of the inner surface of the pipework to form a film completely coating the inner wall of the pipework. Alternatively the resin may be applied by other methods to form a complete film over the inner surface:

EXAMPLE 1 Spraying.

EXAMPLE 2 Fill and drain.

This film provides a gastight lining in the existing pipework.

The resin lining is designed to remain ductile and properly bonded to the existing pipework which remains as a support pipe.

I.3 Conditions of application

This technique can be used to renovate corroded metal pipework, provided that any corrosion hole or crack does not exceed the limits given in the manufacturer's specification.

Fittings, such as elbows, plugs, tees and valves, can influence the lining process. The pipework system is normally taken out of service.

I.4 Implementation

I.4.1 Preparation

When utilizing this technique, the following steps are undertaken:

— the pipework to be treated is normally disconnected from the gas supply;

— fittings, meters, filters, regulators and valves are removed if necessary;

— each branch, not intended to be treated, should be disconnected or plugged off.

I.4.2 Execution

a) Isolation and decommissioning

EN 12327 gives functional requirements for these operations.

b) Cleaning the pipework

If dust, pitch or contaminants are found when the existing pipework is cut, cleaning is required using equipment suitable for the task. Any residue or moisture on the inside pipewall can prevent bonding. Internal inspection can be necessary after cleaning, using appropriate systems. Contaminants should be properly disposed of following the cleaning operation by respecting local or national legislation relating to the environment.

c) Inspecting the pipework to be relined

It could be necessary:

1) to check the diameter and any variations in diameter for selection of the lining pig;

2) to check that nothing will interfere with or damage the resin lining.

Techniques are available using special controllable devices to allow internal removal of obstacles such as protruding ends of plugs, internal welding beads etc.

d) Injection of the resin

The resin is prepared and injected in the pipework. Immediately after injection of the resin an appropriate lining pig, if necessary, is brought into the pipework and the pig is pulled or pushed through the pipework to be treated. Excess resin is collected at the end of the pipework and should be properly disposed of to avoid contamination of the environment.

EXAMPLE Preparation by mixing of two component epoxy resin.

Following completion of the work, fittings, meters and other ancillaries are reconnected.

I.4.3 Testing

Testing is carried out following Clause 6. Pressure levels and test methods are chosen as a function of the *MOP* of the system and the materials used.

I.4.4 Commissioning

The treated pipework is connected to the existing gas infrastructure using a procedure provided by the pipeline operator prior to commissioning. EN 12327 gives functional requirements for the commissioning of the pipework.

Annex J
(informative)
Technical changes between this European Standard and EN 12007-4:2000

Clause	Change
Title	Change of "recommendation" in the title to "requirement reflecting the main character of the text.
General	Change of recommendations in the text to requirements where technically appropriate
General	Update of normative references
5.2	Rephrasing of the paragraph with reference to EN 12007-1, -2 and -3.
6	Deletion of the “example: leakage survey’
Annex B ,Table B1	Addition of a disadvantage of bursting or splitting existing pipe; ‘fragments can damage adjacent utilities or plant’

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[1] CEN/TR 13737 (all parts), *Implementation Guide for functional standards prepared by CEN/TC 234 Gas infrastructure*

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