

# Gas Industry Standard

GIS/TE/E1.9:2006

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Specification for

**Live mains abandonment equipment for low  
pressure mains**

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nationalgrid

Northern  
Gas Networks 

 **Scotia**  
Gas Networks plc

 **WALES&WEST**  
UTILITIES



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## Foreword

Gas Industry Standards (GIS) are revised, when necessary, by the issue of new editions. Users should ensure that they are in possession of the latest edition. Contractors and other users external to Gas Transporters should direct their requests for copies of a GIS to the department or group responsible for the initial issue of their contract documentation.

Comments and queries regarding the technical content of this document should be directed in the first instance to the contract department of the Gas Transporter responsible for the initial issue of their contract documentation.

This standard calls for the use of procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Compliance with this engineering document does not confer immunity from prosecution for breach of statutory or other legal obligations.

## Mandatory and non-mandatory requirements

For the purposes of a GIS the following auxiliary verbs have the meanings indicated:

- can** indicates a physical possibility;
- may** indicates an option that is not mandatory;
- shall** indicates a GIS requirement;
- should** indicates best practice and is the preferred option. If an alternative method is used then a suitable and sufficient risk assessment needs to be completed to show that the alternative method delivers the same, or better, level of protection.

## Disclaimer

This engineering document is provided for use by Gas Transporters and such of their contractors as are obliged by the terms of their contracts to comply with this engineering document. Where this engineering document is used by any other party, it is the responsibility of that party to ensure that the engineering document is correctly applied.

## Brief history

First published as T/SP/TE/E1.9 Includes editorial update to comply with GRM Edited by BSI in accordance with BS 0-3:1997	October 2004 August 2006
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## 1 Scope

This Gas Industry Standard specifies requirements for stub end abandonment equipment for use on low pressure (LP) mains in the size range 3 in (75 mm) to 12 in (300 mm) diameter.

This applies to the initial seal and the primary seal for enabling the main to be permanently sealed against the ingress of gas.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

### Formal standards

BS EN 10216-1, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 1: Non-alloy steel tubes with specified room temperature properties.*

BS EN 10217-1, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 1: Non-alloy steel tubes with specified room temperature properties.*

### Gas Industry Standards

GIS/E59, *Specification for foam plug flow stop devices for low pressure and medium pressure gas mains and services.*

## 3 Terms and definitions

For the purposes of this standard the following terms and definitions apply.

### 3.1

#### initial seal

seal used to stop the flow of mains gas

### 3.2

#### primary seal

element that will provide the primary seal within the abandoned main

## 4 Construction and materials

4.1 All components shall be suitable for use with second family gases, which include natural gas.

4.2 The equipment shall be resistant to petroleum-based products such as oil, petrol and diesel, etc. It shall be no more than 21 kg in mass to conform to current manual handling legislation for single person movement.

## 5 Design

5.1 The equipment shall be suitable for flow stopping and abandoning low pressure mains in the size range 3 in (75 mm) to 12 in (300 mm) diameter. The initial seal shall be capable of flow stopping the main to be abandoned, and acting as a containment barrier between the gas and the primary seal. The initial seal shall be capable of flow stopping, the main to be abandoned, for a minimum period of 24 h during which the leak rate past the seal shall be no more than the values specified in Table 1.

**5.2** The primary seal shall have a maximum permitted leak rate of 2 L/min. The maximum length of main to be abandoned shall be 60 m.

**5.3** A means shall be provided of ensuring that the parent main, to which the main to be abandoned is attached, does not become blocked with any of the equipment used to provide mains abandonment. Gas generated by the introduction of the primary seal shall not cause the main, which is to be abandoned, to become over-pressurized beyond its normal working pressure. Also gas generated shall not leak past the initial seal.

**5.4** The design life of the abandonment equipment shall be 50 years. However the condition of the main to be abandoned shall be taken into account since, the overall life of the abandoned main will be a function of the equipment life and the remaining life of the main itself.

## **6 Initial seal performance**

### **6.1 Flow stopping**

The flow stopping properties of the initial seal shall be in accordance with, GIS/E59, except that the flow rates past the initial seal shall be no more than the values specified in Table 1 for a test pressure of 100 mbar.

**Table 1 — Flow rates**

<b>Diameter of pipe</b> in	<b>Flow</b> L/min
3	22
4	22
6	30
8	30
10	60
12	60

### **6.2 Containment**

When tested in accordance with Annex A the pressure build up in the initial seal shall be no more than 100 mbar and the displacement ( $X$ ) of the initial seal shall be less than 5 mm.

## **7 Primary seal performance**

### **7.1 Contamination**

When tested in accordance with Annex B the pressure drop shall be no more than 1 mbar.

### **7.2 Primary seal life**

When tested in accordance with Annex C the lower edge of the failure band, when extrapolated to 50 years, shall be not less than 1.5 times the maximum working pressure.

## **8 Remote positioning**

When tested in accordance with Annex D the foam sealant shall be contained within the primary seal and shall be within 500 mm  $\pm$  50 mm of the end of the pipe.

## 9 User instructions

User instructions shall be provided with each item of equipment.

## 10 Marking

Products conforming to GIS/TE/E1.9 shall be permanently marked with the following information:

- a) the number and date of this standard, i.e. GIS/TE/E1.9:2006 <sup>1)</sup>;
- b) the name or trademark of the manufacturer or their appointed agent;
- c) the manufacturer's contact details;
- d) where authorized, the product conformity mark of a third party certification body, e.g. BSI Kitemark.

NOTE Attention is drawn to the advantages of using third party certification of conformance to a standard.

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<sup>1)</sup> Marking GIS/TE/E1.9:2006 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the specification. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

## **Annex A (normative)**

### **Initial seal containment test**

#### **A.1 Principle**

The capability of the initial seal to contain the primary seal material within the pipe and any physical displacement is determined.

#### **A.2 Apparatus**

**A.2.1** *Cap end.*

**A.2.2** *Steel pipe*, of length 8 m in the chosen diameter.

**A.2.3** *Pressure monitoring device*, capable of measuring up to 125 mbar in steps of 1 mbar with an accuracy of  $\pm 1$  mbar.

**A.2.4** *Pressure source*, of 100 mbar.

**A.2.5** *Rule.*

#### **A.3 Test sample**

A 6 in (150 mm) diameter initial seal shall be tested to cover the size range 3 in (75 mm) to 6 in (150 mm) and a 12 in (300 mm) initial seal shall be tested to cover the size range 8 in (200 mm) to 12 in (300 mm).

#### **A.4 Procedure**

Set up an 8 m length of steel pipe. Locate the initial seal to one end of the steel pipe and initiate the sealing process.

After a 30 min period measure the distance between the initial seal and the end of the steel pipe. Then cap the end of the steel pipe nearest to the initial seal and connect a pressure monitoring device in accordance with Figure A.1.

Fill the main for a length 5 m to the rear of the initial seal. During this process monitor the pressure build up on the upstream side of the initial seal. Measure any displacement ( $X$ ) of the initial seal (see Figure A.1).

#### **A.5 Expression of results**

Record and report the following:

- a) pressure build up on the upstream side of the initial seal, in mbar;
- b) distance between the initial seal and the end of the steel pipe, in mm, before introducing the primary seal material;
- c) distance between the initial seal and the end of the steel pipe, in mm, after introducing the primary seal material.

#### **A.6 Test report**

The test report shall include the following information:

- a) reference to this standard, i.e. GIS/TE/E1.9:2006;
- b) results of the termination;
- c) any additional factors which may have affected the results of the test, including any resulting from requirements within this standard.

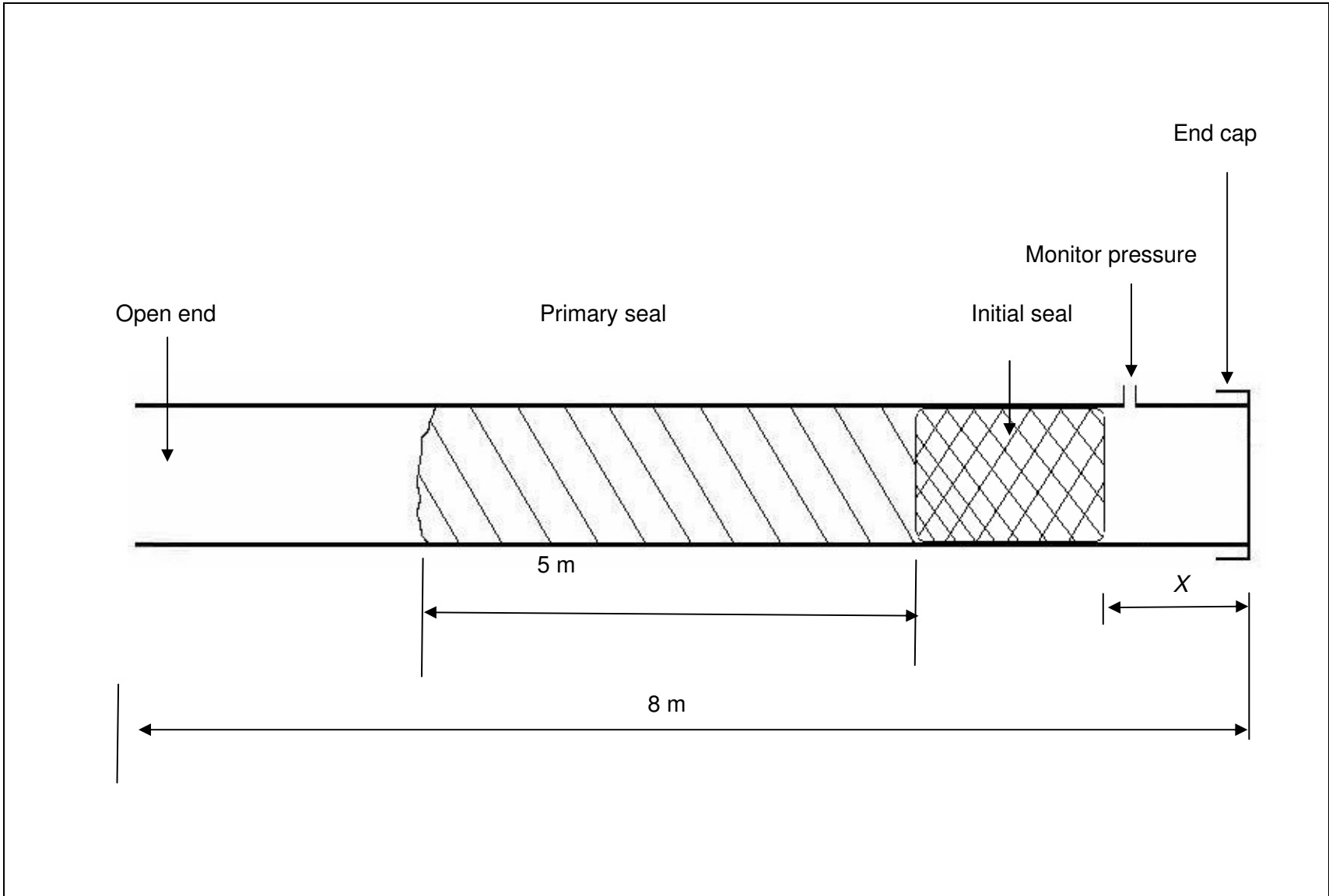


Figure A.1 — Assembly for containment test

## **Annex B (normative)**

### **Contamination test**

#### **B.1 Principle**

The effect of contaminants, likely to be found in the gas main, on the performance of the primary seal material is determined.

#### **B.2 Apparatus**

**B.2.1** *Steel pipe*, 3 in diameter, 1 m length.

**B.2.2** *End caps*.

**B.2.3** *Monoethylene glycol*.

**B.2.4** *Water*.

**B.2.5** *Distillate*.

**B.2.6** *General light oil*.

**B.2.7** *Pressure monitoring device*, capable of measuring up to 125 mbar in steps of 1 mbar with an accuracy of  $\pm 1$  mbar.

**B.2.8** *Pressure source*, of 100 mbar.

#### **B.3 Test sample**

Four 3 in (75 mm) diameter steel pipes shall be used.

#### **B.4 Procedure**

**B.4.1** Prepare four steel pipes as follows.

- Immerse new, degreased pipe in water and allow to drain for 5 min.
- Immerse new, degreased pipe in monoethylene glycol and allow to drain for 5 min.
- Immerse new, degreased pipe in distillate and allow to drain for 5 min.
- Immerse new, degreased pipe in general light oil and allow to drain for 5 min.

**B.4.2** Cap one end of each of the steel pipes and fill with sealant using the filling tube. The volume of sealant kit used shall be sufficient to fill the annulus to excess in accordance with Figure B.1.

**B.4.3** Allow a maximum cure time of 24 and then subject each assembly to a pneumatic pressure test with the end cap removed. Apply a pressure of 100 mbar for 5 min. The pressure drop shall be no more than 1 mbar.

**B.4.4** A minimum period of one month shall elapse before subjecting the sealed annular gap to a further pneumatic pressure test of 100 mbar for 5 min.

**B.4.5 Expression of results**

Record and report the following for each contaminant:

- a) contaminant used;
- b) cure time;
- c) initial test pressure after 30 min period and any pressure drop;
- d) test pressure and any pressure drop after 24 h period;
- e) test pressure and any pressure drop after one month period.

**B.5 Test report**

The test report shall include the following information:

- a) reference to this standard, i.e. GIS/TE/E1.9:2006;
- b) results of the termination;
- c) any additional factors which may have affected the results of the test, including any resulting from requirements within this standard.

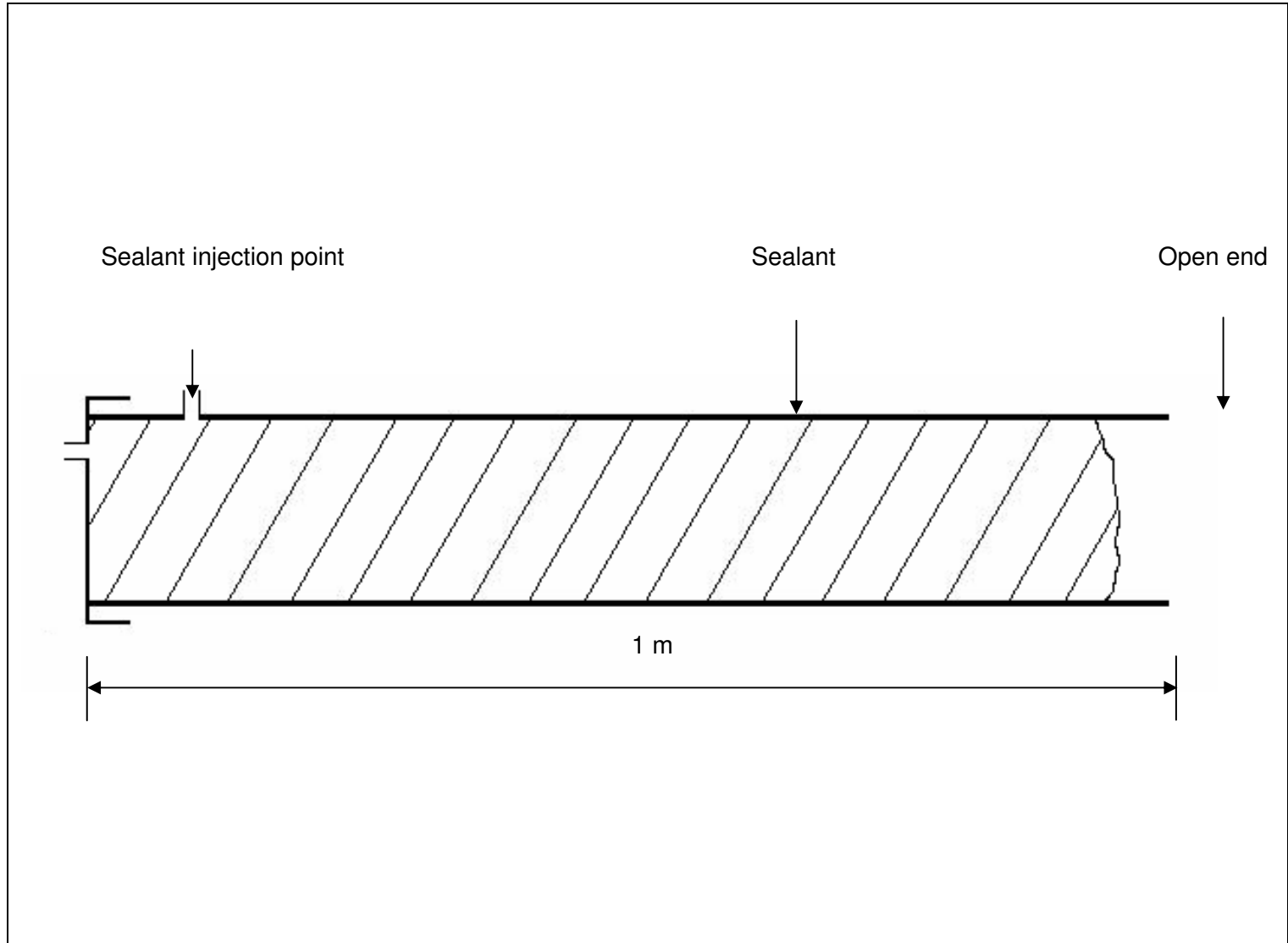


Figure B.1 — Assembly for contamination test

## Annex C (normative)

### Primary seal life test

#### C.1 Principle

The design life of the primary seal is determined. The test is based upon short term testing at elevated pressures and extrapolating the results to give a life prediction after 50 years.

#### C.2 Apparatus

**C.2.1** *Steel pipes* (12), 2 m long in the chosen size range.

**C.2.2** *End caps*.

**C.2.3** *Pressure monitoring device*, capable of measuring up to 125 mbar in steps of 1 mbar, with an accuracy of  $\pm 1$  mbar.

**C.2.4** *Pressure source*, of 100 mbar.

**C.2.5** *Rule*.

#### C.3 Test sample

A 6 in (150 mm) diameter primary seal shall be tested to cover the size range 3 in (75 mm) to 6 in (150 mm) and a 12 in (300 mm) primary seal shall be tested to cover the size range 8 in (200 mm) to 12 in (300 mm).

Twelve samples of each size range shall be tested.

#### C.4 Procedure

**C.4.1** Degrease 12 sections of steel pipe 2 m long. Inject the annular gap sealant in accordance with the manufacturer's instructions. The volume of annular gap sealant kit used shall be sufficient to fill the annulus to excess. Allow a maximum of 24 h cure time before testing.

**C.4.2** Subject three samples to a pressure, which will ensure failure between 1 h and 3 h, in accordance with Figure C.1. Note the pressure at which failure occurs,  $P$ , and the time to failure  $T_p$ . Plot the results on a log/log plot of pressure against time, in min, see Figure C.2.

Pressurize three samples and hold at a pressure  $P_1$ , a second set of three samples at a pressure of  $P_2$  and a third set of samples at a pressure of  $P_3$ .

Establish  $P_1$  by drawing a straight line joining the initial point ( $T_p, P$ ) to the 50 year/1.5 times specified maximum working pressure point ( $P_{mw}$ ).  $P_1$  shall be the pressure corresponding to six months on the time axis.

Determine  $P_2$  and  $P_3$  to give points equidistant on a logarithmic scale between  $P_1$  and  $P$ .

The duration of the tests shall be either six months or until a failure occurs, whichever is the shorter period.

Plot the results obtained on the graph to show the failure band. Extrapolate the lower edge of the failure band to 50 years.

### **C.5 Expression of results**

Record and report the following:

- a) test pressure ( $P$ ), in mbar, and time, in min, at which the first three samples fail;
- b) test pressure, in mbar, and duration, in min, of the three samples at test pressure  $P_3$ ;
- c) test pressure, in mbar, and duration, in min, of the three samples at test pressure  $P_2$ ;
- d) test pressure, in mbar, and duration, in min, of the three samples at test pressure  $P_1$ .

### **C.6 Test report**

The test report shall include the following information:

- a) reference to this standard, i.e. GIS/TE/E1.9:2006;
- b) results of the determination;
- c) plot of the results, in the form of Figure C.2;
- d) any additional factors which may have affected the results of the test, including any resulting from requirements within this standard.

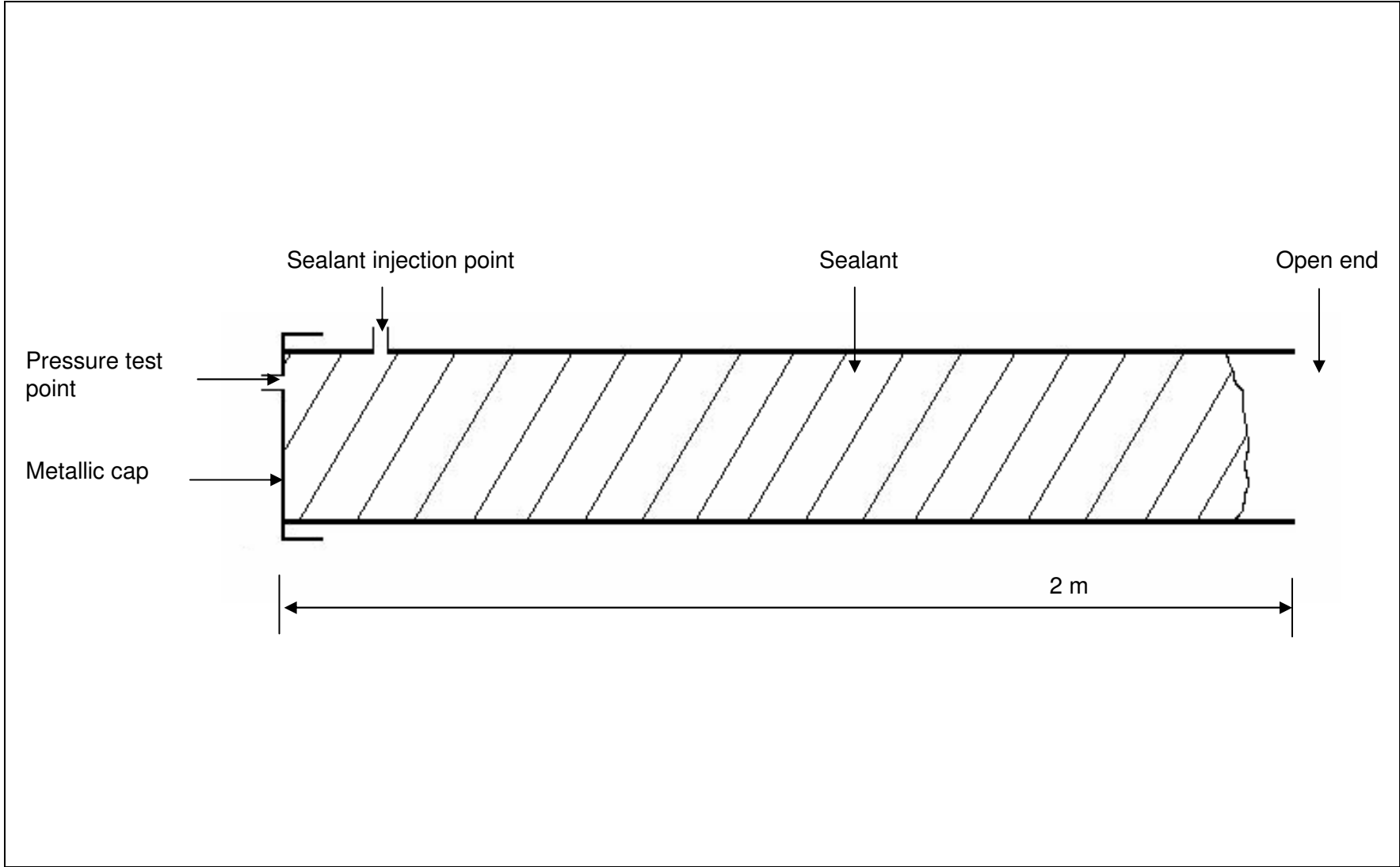


Figure C.1 — Assembly for primary seal life test

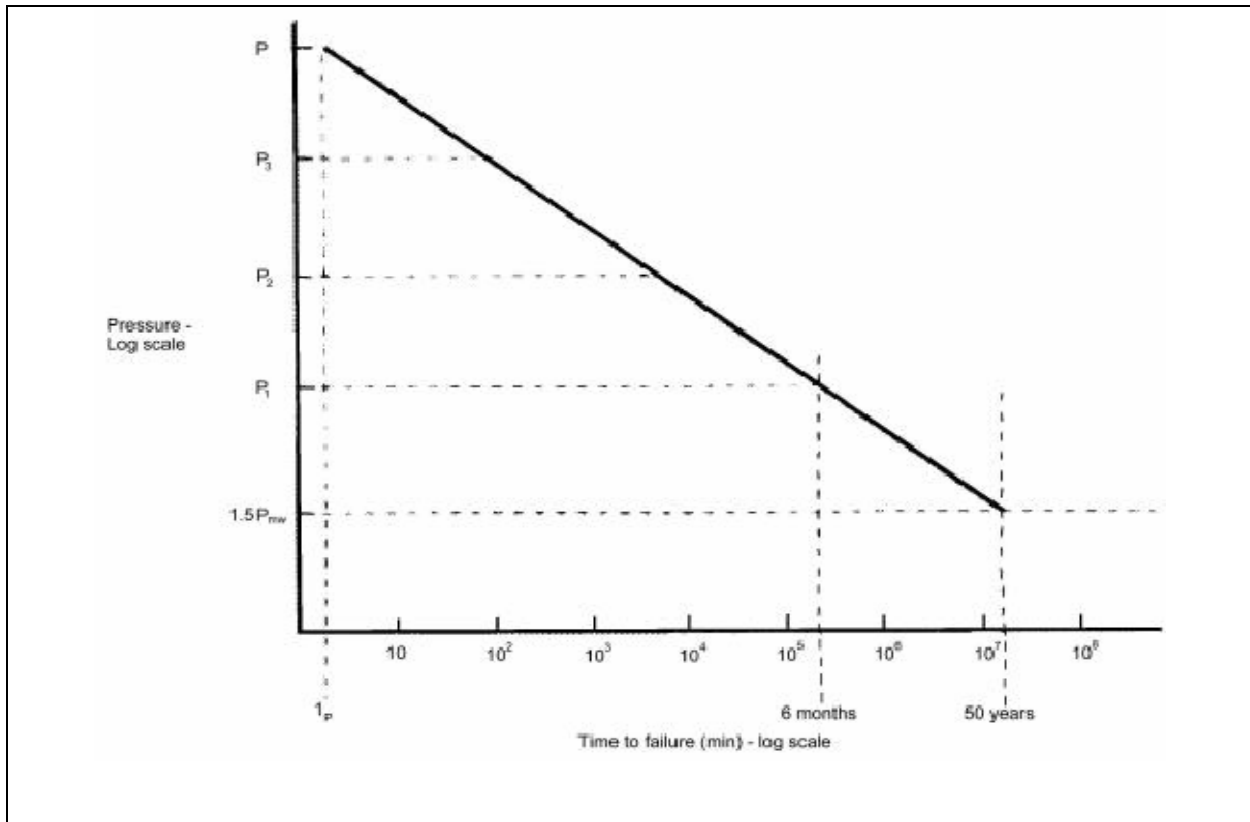


Figure C.2 — Pressure/life testing

## **Annex D (normative)**

### **System test**

#### **D.1 Principle**

The capability of the initial and primary seals to be remotely positioned, and deployed at a distance of 60 m within a representative main, is determined.

#### **D.2 Apparatus**

**D.2.1** *Pipe*, 60 m length and 6 in diameter.

**D.2.2** *Pressure source*, of 75 mbar.

**D.2.3** *Pressure monitoring equipment*, with an accuracy of  $\pm 1$  mbar, capable of measuring up to 100 mbar in steps of 1 m bar.

**D.2.4** *Standard vent tube*.

**D.2.5** *Close circuit television camera (CCTV) and monitor*.

**D.2.6** *Underpressure camera launch equipment*.

#### **D.3 Test sample**

A 60 m length of 6 in diameter pipe shall be used to cover the range of pipes between 3 in diameter and 12 in diameter.

#### **D.4 Procedure**

**D.4.1** Prepare a 60 m length of steel pipe conforming to either BS EN 10216-1 or BS EN 10217-1. Connect one end of the pipe to a pressure source. The pressure source shall incorporate a pressure relief device to ensure that the system shall not exceed a pressure of 100 mbar during any of the operations.

**D.4.2** Drill access holes in order to connect a vent and a camera launch equipment. Locate the initial seal inside the other end of the pipe and connect the initial seal access equipment in accordance with the manufacturer's instructions. Provide a suitable external restraint system prior to introducing pressure into the assembly to ensure that any failure will be contained. Introduce the camera into the main and pressurize the system to 75 mbar, see Figure D.1.

**D.4.3** Insert the un-activated initial seal along the full length of the pipe to within 500 mm of the pressure source using the camera as a guide. Once the initial seal is in position inject the foam sealant in accordance with the manufacturer's instructions. Once the bag has inflated retract the camera and vent the pipe work downstream of the initial seal.

**D.4.4** When the initial seal has fully inflated to contain the upstream pressure, remove the access equipment and insert a length of nylon fill tube through the camera hole and push up to the back of the inflated foam bag. Introduce enough foam to fill a 3 m length of main. Once this has cured remove the pipe from the pressure source.

**D.4.5** Inspect the initial seal to ensure that the foam sealant has been contained and that it is within 500 mm  $\pm$  50 mm of the end of the pipe.

### D.5 Expression of results

Record and report the following:

- a) source pressure of the steel pipe, in mbar.
- b) time to cure for the initial seal, in min.
- c) length of the primary seal, in m.
- d) position of the initial seal from the end of the pipe, in mm.

### D.6 Test report

The test report shall include the following information

- a) reference to this standard, i.e. GIS/TE/E1.9:2006;
- b) results of the determination.
- c) any additional factors which may have affected the results of the test, including any resulting from requirements within this standard.

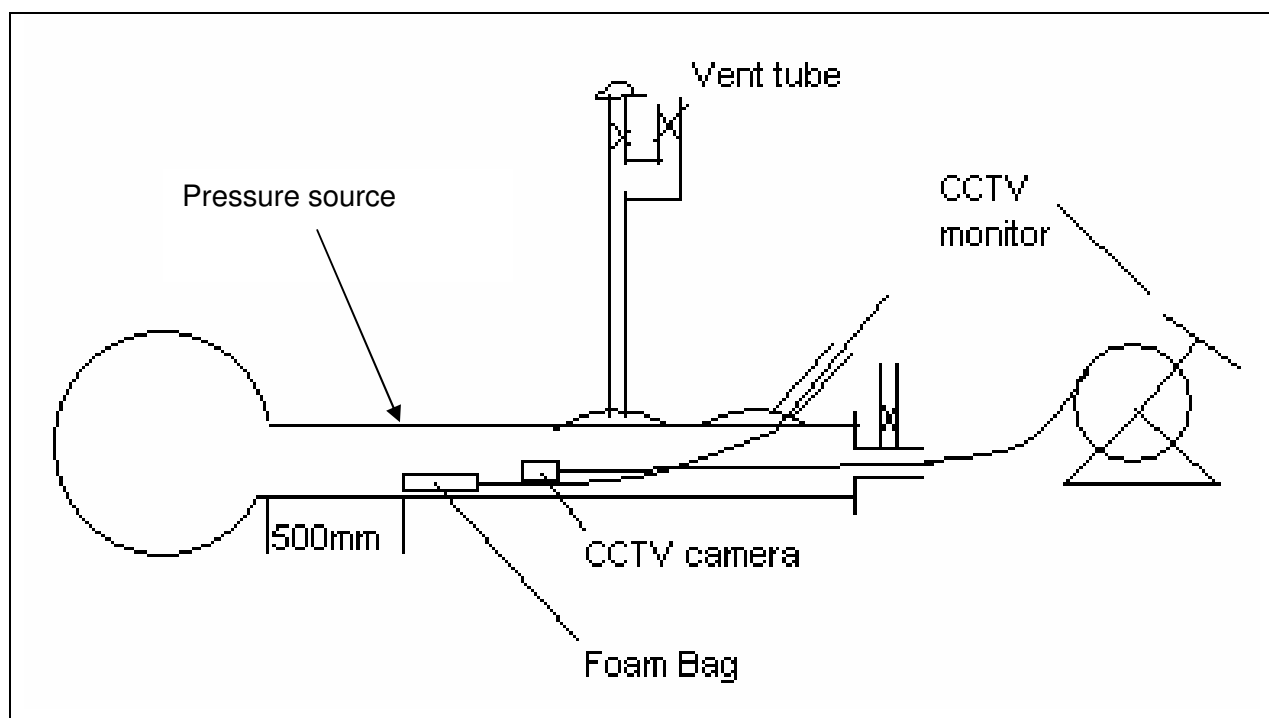


Figure D.1 — System test