Gas Industry Standard

GIS/TE/D1.2:2006

Specification for

Non-tap mains sealing plugs for use in access holes from 2 in to 6 in diameter and for use up to 2 bar MOP

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Contents

Foreword

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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

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Brief history

Edited by BSI in accordance with BS 0-3:1997 Reviewed on behalf of the Gas Distribution Networks' Technical Standard Forum by BSI Reviewed by TSF	August 2006 September 2013 June 2018

1 Scope

This Gas Industry Standard specifies the essential requirements for the design and performance of non-tap plugs used to seal 2 in to 6 in circular access holes, drilled into mains during flow stopping operations. These are used up to a maximum working pressure of 2 bar only and suitable for use on grey cast iron, ductile iron and steel pipes from 200 mm to 1 219 mm nominal diameters.

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 78-2, *Specification for cast iron spigot and socket pipes (vertically cast) and spigot and socket fittings — Part 2: Fittings*.

BS 1211, *Specification for centrifugally cast (spun) iron pressure pipes for water, gas and sewage*.

BS EN 682, *Elastomeric seals — Materials requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids*.

BS EN 969, *Specification for ductile iron pipes, fittings, accessories and their joints for gas pipelines — Requirements and test methods*.

BS EN 1563, *Founding — Spheroidal graphite cast iron*.

BS EN 10216-1, *Seamless steel tubes for pressure purposes — Part 1: Technical delivery conditions*.

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/L2, S*pecification for steel pipe 21.3 mm to 1 219 mm outside diameter for operating pressures up to 7 bar.*

GIS/C5, *Specification for distribution pipe fittings cast in grey cast iron for use up to 7 bar maximum operating pressure*.

GIS/C6, *Specification for distribution pipe fittings cast in ductile iron for use up to 7 bar maximum operating pressures*.

3 Material requirements

3.1 All materials shall conform to the relevant British Standard or other recognized standard.

3.2 Elastomeric materials shall satisfy the requirements of BS EN 682 for the appropriate hardness class

4 Design requirements

4.1 Made available in the 2 in, 2 ½ in, 3 in, 4 in, 5 in and 6 in diameter sizes.

4.2 Universal for use on the nominal pipe diameters from 200 mm to 1 219 mm on:

- grey cast iron pipe conforming to BS 78-2, BS 1211 and GIS/C5;
- ductile iron pipe conforming to BS EN 969, BS EN 1563 and GIS/C6;
- steel pipe conforming to BS EN 10216-1, BS EN 10217-1 and GIS/L2.

4.3 Sufficiently protected against corrosion to give at least 50 years' useful life in the working environment in which the fitting is proposed to be used.

NOTE Corrosion protection depth detail will be as agreed between the gas transporter and purchaser.

4.4 Remain securely in place without leakage or visible deformation up to the 2 bar maximum operating pressure and resist push-out forces well in excess of the imposed pressure forces.

4.5 Provided with a section on the body suitably shaped for tightening with a spanner or adjustable wrench of a type widely available in the industry.

4.6 Capable of plug insertion and removal in a totally gas free mode of operation using the manufacturer's recommended drilling machine and associated equipment.

4.7 The material used for the seal shall be MDPE (Medium Density Polyethylene) in the BP Rigidex 002/40 grade which has the ductility to allow radial expansion, compresses easily to form a good seal, has sufficient tensile strength to resist blow-out and good environmental stability. Any other material used for the seal shall be relatively soft compared with the pipe material so as not to transmit high radial and hoop stresses at the hole and possess good elongation properties coupled with a reasonable tensile strength and good environmental stability.

4.8 Designed for safe working within the temperature range of –10 °C to 40 °C.

4.9 The seal shall have stress relaxation characteristic giving a projected minimum life in service of 50 years and a resistance to environmental stress cracking over the same period.

4.10 Ability to seal on all types of pipes from 200 mm to 1 219 mm nominal diameter whether used on cast iron, ductile or steel pipes.

4.11 The contractor shall supply detailed instructions for the correct assembly and installation with each individual non-tap plug within the delivery package.

4.12 The design of the fitting shall be such that an excavation can be safely backfilled and the normal mains pressure applied as soon as possible after installation. It shall be noted that excessive loadings caused by incorrect backfill may influence the performance of the non-tap plug and this shall be stated in the installation instructions.

4.13 The sealing material used in the fitting shall be sufficiently flexible to allow deformation into the thread-form to allow the use of the non-tap plug on threaded holes as well as plain (unthreaded) holes in pipe.

4.14 Designed to seal on the range of metallic pipe wall thicknesses from 12 mm to 43 mm on cast iron, ductile iron and steel pipes.

5 Type approval tests

Non-tap plug assemblies shall satisfy the type approval tests specified in Table 1 in order to be suitable for the duty required in service.

Table 1 — Performance requirements for type approval tests

Performance requirement	Types of tests required
Shall remain securely in place without leakage or visible deformation up to the 2 bar maximum operating pressure.	Annex A – Sealing ability test
Shall be designed to resist blow-out forces.	Annex B – Resistance to push-out forces test
Shall be capable of insertion and removal in a totally gas free mode of operation.	Annex C – Equipment assembly test
Shall seal off access holes in pipes for at least 50 years.	Annex D – Pressure life test

6 Production tests

6.1 The contractor shall carry out a functional check to ensure conformity with the plug insertion and removal using the manufacturer's recommended drilling machine and associated equipment. Dimensions shall conform to the approved drawings.

6.2 The contractor shall carry out a pneumatic leak test to 3 bar on the non-tap plug assembly before dispatch the purchaser.

7 Marking

Products conforming to GIS/TE/D1.2 shall be permanently marked with the following information:

a) the number and date of this standard, i.e. GIS/TE/D1.2:2006 [1)];

b) the name or trademark of the manufacturer or their appointed agent;

c) the manufacturer's contact details;

d) the pressure rating;

e) the nominal size of plug;

f) the pipe diameter range

g) the product/batch identification (on end cap);

h) 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.

8 Packaging

The contractor shall provide adequate packaging of fittings to prevent damage by normal handling and storage.

[1)] Marking GIS//TE/D1.2:2006 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 standard. 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)
Sealing ability test

A.1 Principle

This test is to ensure that the sealing ability of the non-tap plug assembly is adequate.

NOTE This test may be carried out in conjunction with the equipment assembly test in Annex C.

A.2 Apparatus

A.2.1 *Test pipes*, manufactured from grade 420/12 of spheroidal graphite iron in accordance with BS EN 969. They shall have access holes for each size in the range of plugs being tested.

A.2.2 *Maximum diameter test pipe*, for designed pipe range of the non-tap plug provided with plug access holes as necessary.

A.2.3 *Minimum diameter test pipe*, for designed pipe range of the non-tap plug provided with plug access holes as necessary.

A.2.4 *Three non-tap plugs*, for each of the lowest diameter, highest diameter and mid range of plugs being tested.

A.2.5 *Test medium*, air or nitrogen supply up to 3 bar.

A.2.6 *Test assembly*, bench-mounted clamp method to hold the maximum to minimum diameter test pipes securely in position when drilling plug holes and carrying out the required tests on the non-tap plug.

A.2.7 *Pressure gauge*, up to 3 bar.

A.2.8 *Leak detector solution and applicator brush*.

A.3 Test procedure

A.3.1 To assess the sealing ability on pipe, assemble non-tap plug on test pipe at 50 % of the recommended torque and fill the test assembly with the test medium to 15 mbar pressure and leave to condition for 1 h at a temperature of between 20 °C and 26 °C.

A.3.2 Attach pressure gauge to test assembly and adjust pressure to 15 mbar and test for 1 hour, record results on pressure gauge and apply leak detector solution.

A.3.3 Increase test pressure to 3 bar using air and record results on pressure gauge and apply leak detector solution.

A.3.4 Keep the non-tap plug at this torque for a minimum of 24 h and take pressure measurement, record results and apply leak detector solution.

A.3.5 Further tighten the non-tap plug to twice the recommended torque and repeat **A.3.2** to **A.3.4**.

A.3.6 Repeat above for each size of non-tap plug and diameter pipe being tested and at the lower temperature of 0 °C.

A.4 Results

A.4.1 No leakage shall occur at any pressure from 15 mbar to 3 bar inclusive, either initially or after a period of 24 h at temperatures tested.

A.4.2 No detrimental mechanical failure, tearing, or extrusion of the elastomeric seal or other parts of the non-tap plug assembly shall occur.

A.4.3 No visible signs of leakage shall occur when leak detector solution applied under test conditions.

Annex B (normative)
Resistance to push-out forces test

B.1 Principle

This test ensures that the non-tap plug does not blow out of the pipe when subjected to excessive pressure way beyond its maximum operating pressure.

B.2 Apparatus

B.2.1 *Hydrostatic testing equipment*, for pressure raising to at least 50 bar.

B.2.2 *Hydrostatic pressure measuring equipment*, and assemblies.

B.2.3 *Test pipe*, of 24 in nominal diameter steel with hole drilled suitable for diameters of non-tap plug.

B.3 Test procedure

B.3.1 Assemble the pressure raising equipment and measuring equipment onto test pipe.

B.3.2 Insert the non-tap plug into steel pipe, assemble and tighten to recommended torque following manufacturer's non-tap plug installation instructions.

B.3.3 Raise pressure gradually until push-out occurs or 40 bar is achieved and record results.

B.3.4 Safely decommission assembly following equipment guidelines

B.4 Results

When tested the non-tap plug shall resist push-out forces to at least 20 bar pressure without deformation or movement.

Annex C (normative)
Equipment assembly test

C.1 Principle

This test ensures the capability of the safe insertion and removal of the non-tap plug from the pipe under “live” gas pressure conditions up to 2 bar MOP providing a “gas-free” environment for operatives.

NOTE This test may be carried out in conjunction with the sealing ability test in Annex A.

C.2 Apparatus

C.2.1 *Manufacturer’s recommended drilling equipment*, and plug insertion tool assembly with equipment safety, operating and installation instructions for use of equipment and insertion and removal of non-tap plugs.

C.2.2 *Test pipes*, manufactured from grade 420/12 of spheroidal graphite iron in accordance with BS EN 969. They shall have access holes for each size in the range of plugs being tested.

C.2.3 *Maximum diameter test pipe*, for designed pipe range of the non-tap plug provided with plug access holes as necessary.

C.2.4 *Minimum diameter test pipe*, for designed pipe range of the non-tap plug provided with plug access holes as necessary.

C.2.5 *Three non-tap plugs*, for each of the lowest diameter, highest diameter and mid range of plugs being tested.

C.2.6 *Slide valve*, with diameter suitable to be used on drilling equipment.

C.2.7 *Test medium*, air, nitrogen or natural gas.

C.2.8 *Pressure gauge assembly*, suitable to 3 bar.

C.2.9 *Leak detector solution*.

C.3 Test procedure

C.3.1 Ensure the manufacturer’s safety, operating and installation instructions are followed throughout this procedure when using drilling equipment assembly and plug insertion tool.

C.3.2 Assemble drilling equipment on pipe in preparation for drilling and attach slide valve to drilling equipment assembly.

C.3.3 Fill pipe with test medium to 3 bar pressure.

C.3.4 Close the slide valve and test the drilling equipment assembly following manufacturer’s instructions.

C.3.5 Open the slide valve, attach the drill arrangement and drill the circular hole for the non-tap plug.

C.3.6 Keeping the test medium in pipe pressurized at 3 bar, check drilling equipment assembly for audible or visible leakage and using leak detector solution, where necessary.

C.3.7 Withdraw drill and close slide valve.

C.3.8 Remove drill arrangement and replace with plug insertion tool with non-tap plug assemble ready for insertion.

C.3.9 Open slide valve and test the drilling equipment assembly as in **C.3.4** and **C.3.6**.

C.3.10 Insert the non-tap plug into pipe following the manufacturer's instructions on use of plug insertion tool and tightening to their recommended torque.

C.3.11 Carry out a pressure test on the pipe at 3 bar for 1 h using the pressure gauge assembly and record the results.

C.3.12 Remove the plug insertion tool and then remove the slide valve.

C.3.13 Remove the drilling equipment assembly.

C.3.14 Check non-tap plug for visible leakage using leak detector solution.

C.3.15 Repeat for other plug sizes and maximum and minimum test pipes.

C.4 Results

C.4.1 No leakage is permitted from the non-tap plug or drilling equipment and slide valve assembly whether audible, recorded on pressure gauge or visible through the use of the applied leak detector solution.

C.4.2 The non-tap plug shall be easily inserted and removed using the manufacturer's recommended drilling equipment assembly, plug insertion tool and following the safety, operating and installation instructions.

Annex D (normative)
Pressure-life test

D.1 Principle

This test ensures the non-tap plug assembly is able to demonstrate a minimum of a 50-year service life.

D.2 Apparatus

D.2.1 *Test pipes*, manufactured from grade 420/12 of spheroidal graphite iron in accordance with BS EN 969.

D.2.2 *Maximum diameter test pipe*, for designed pipe range of the non-tap plug provided with plug access holes as necessary.

D.2.3 *Minimum diameter test pipe*, for designed pipe range of the non-tap plug provided with plug access holes as necessary.

D.2.4 *Three non-tap plugs*, for each of the lowest diameter, highest diameter and mid range of plugs being tested.

D.2.5 *Test medium*, air or nitrogen.

D.2.6 *Pressure gauge assembly*.

D.2.7 *Leak detector solution*.

D.3 Test procedure

D.3.1 Ensure the standard test pressure is 1.5 times the maximum working pressure.

D.3.2 Carry out the test on three non-tap plugs of each set of the lowest, highest and mid-range diameters on both maximum and minimum diameter test pipes. All non-tap plugs need not necessarily be under test simultaneously.

D.3.3 Subject each non-tap plug to a pressure that will ensure failure within 1 h. 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 minutes of the type shown in Figure D.1.

D.3.4 Pressurize each non-tap plug and hold at a pressure P_1, a second set of three fittings at a pressure P_2 and a third set of three fittings at a pressure P_3.

D.3.5 Establish pressure P_1 by drawing a straight line jointing the initial point (T_p, P) to the 50 year / 1.5 times specified maximum working pressure point. P_1 is the pressure corresponding to 6 months on the time axis.

D.3.6 Determine pressures P_2 and P_3 to give points equidistant on a logarithmic scale between P_1 and P.

D.3.7 Ensure the duration of the tests is either 6 months or until failure occurs, whichever is the shorter period.

D.3.8 Plot the results obtained on the graph to show the failure band.

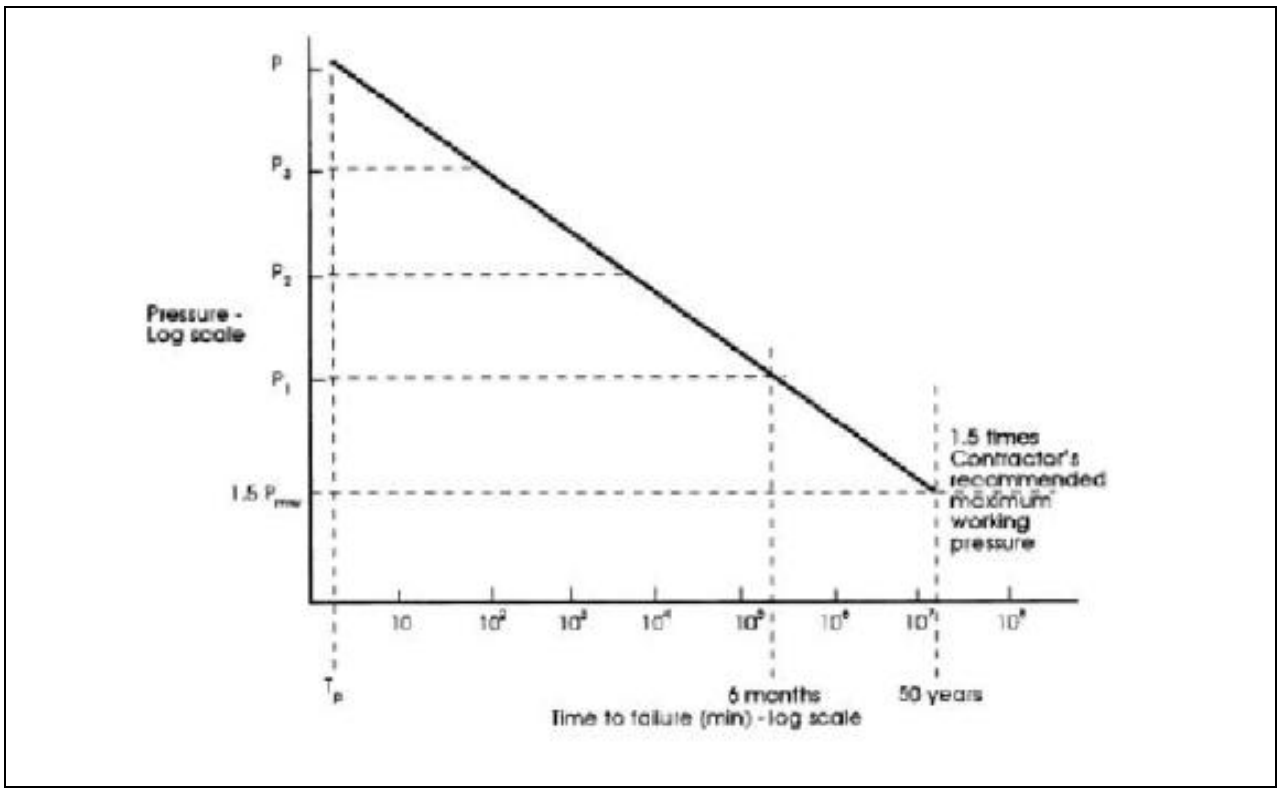

Figure D.1 — Graph of pressure against time for pressure-life test

D.4 Results

The results obtained shall be plotted on the graph to show the failure band. When the lower edge of their failure band is extrapolated to 50 years, the corresponding pressure shall not be less than 1.5 times the contractor's maximum recommended working pressure.