Gas Industry Standard

GIS/E4:2013

Specification for

Inflatable, self-centring bag stoppers for use on distribution pipes of a nominal size up to and including 300 mm (12 in)

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Contents

Foreword

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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

First published as BGC/PS/E4	July 1977
Revised and re-issued as BGES/E4	November 1994
Editorial update to reflect demerger November 2000	June 2001
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1 Scope

This Gas Industry Standard (GIS) specifies requirements for inflatable, self-centring bag stoppers. These bag stoppers are for use with the low pressure range of flow stopping equipment of the supported bag type for use on cast iron, ductile iron, steel and polyethylene (PE) pipes of a size up to and including 300 mm (12 in) nominal inside diameter, carrying natural or manufactured gas. Additional requirements are given for oil-resistant bags.

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.

BS 1580-1, *Specification for Unified screw threads — Parts 1: Diameters ¼ in and larger.*

BS EN ISO 1421, *Rubber- or plastics-coated fabrics — Determination of tensile strength and elongation at break*.

BS EN ISO 2231, *Rubber- or plastics-coated fabrics — Standard atmospheres for conditioning and testing.*

BS EN ISO 4674-1, *Rubber- or plastics-coated fabrics — Determination of tear resistance — Part 1: Constant rate of tear methods.*

BS ISO 37, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties.*

BS ISO 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests.*

BS ISO 1817, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids.*

BS ISO 2230, *Rubber products — Guidelines for storage.*

BS ISO 23529, *Rubber — General procedures for preparing and conditioning test pieces for physical test methods*.

3 Terms and definitions

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

3.1
bagtube
assembly that is part of a bagging-off method for inserting and removing inflatable self-centring bag stoppers to isolate gas pipes for connections or abandonment

4 Design

4.1 Bag stoppers shall be suitable for working with flow stopping equipment in the supported mode (see Figure 1).

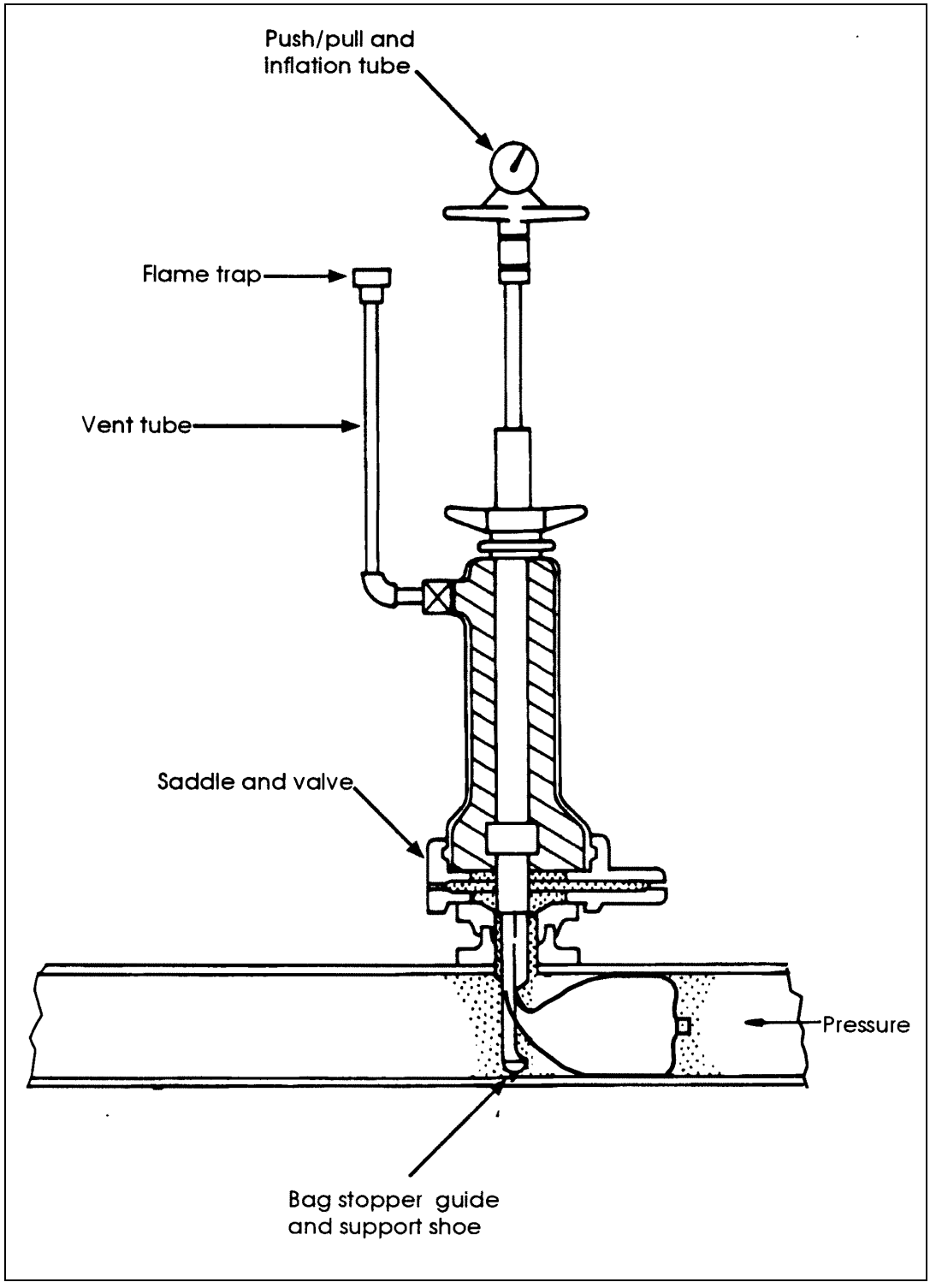


Figure 1 — Supported bag stopper and flow stopping equipment

4.2 The dimensions of bag stoppers shall conform to Table A.1.

4.3 Bag stoppers shall be capable of withstanding, without deterioration, the mechanical forces imparted during insertion into and withdrawal from the pipe under pressure using bagtubes.

4.4 The bag stopper shall be designed to minimize leakage between the bag stopper and the pipe.

4.5 When confined within a pipe (see Figure 1), the bag stoppers shall withstand inflation pressures as specified in Tables A.2, A.4, A.5 and A.6.

4.6 Bag stoppers shall be supplied with an effective curvature of the central rod within the limits shown in Figure 2.

4.7 The curvature of the central rod of the completed bag stopper, after bending to 90°, shall return to an unconstrained position within the limits shown in Figure 2.

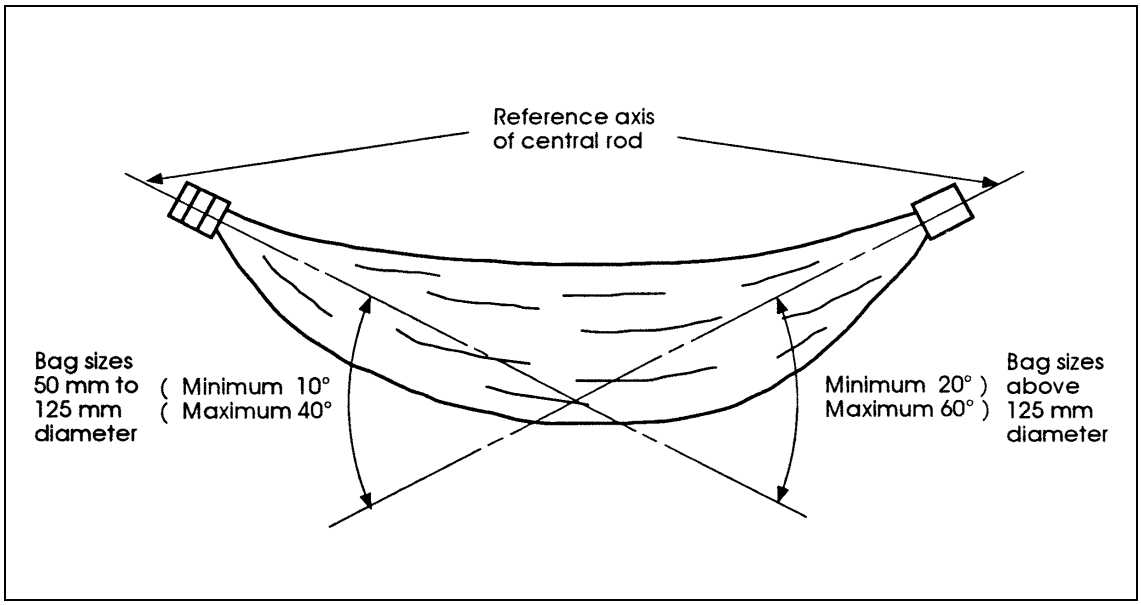


Figure 2 — Determination of effective curvature of completed bag stopper

4.8 The female screw connector at the bag inlet shall conform to BS 1580-1, 0.5 in unified thread (UNF) for all sizes of bag stopper.

4.9 The fittings that influence the inflation and deflation of the bag stopper shall, size for size, have the maximum possible internal diameter consistent with adequate strength so that the fitting does not split or deform during normal use of the bag.

4.10 Recessed metal fittings shall be used under all crimped retainers where sliding or movement of the retainer can occur.

4.11 The enclosure shall be such that it facilitates entry of the bag stopper into the pipe.

4.12 Crimping of compression rings shall not damage the outer cover material and, if necessary, protective sleeving shall be provided.

4.13 When the bag stopper is inflated in a pipe (see Figure 1) its size shall be such that the combination of frictional force and direct bag stopper support shall be sufficient to withstand the upstream gas pressure force.

5 Materials

5.1 General

The bag stopper shall be manufactured from a material, or combination of materials, strong enough to fulfil the design requirements specified in Clause 4. This shall be achieved by:

a) combining an inner inflatable component (bladder) with an outer covering of strong fabric (see **5.2**); or

b) manufacturing the bag stopper from either a single component or more than two components (see **5.3**).

5.2 Two component bag stoppers

5.2.1 Where the bag stopper contains a bladder, the bladder shall be manufactured from rubber, by either moulding, dipping or by fabrication from calendered sheet using vulcanized seams.

5.2.2 When deflated, the bladder thickness shall be within the limits 0.5 mm to 1.05 mm and the thickness of each bladder shall not vary by more than ±30 % over its area, excluding overlapped joints and necks.

5.2.3 Bladder seams shall be symmetrically placed.

5.2.4 The bladder material shall be free from inclusions, pinholes or any other defects likely to impair performance, and have a tensile failure load and elongation properties as specified in Table C.1.

5.2.5 Where the bag stopper consists of a bladder and an outer cover, the outer cover shall be designed and manufactured to provide complete support for the bladder.

5.2.6 Only materials manufactured from synthetic fibres shall be used for the outer covers or for the thread of any stitching.

5.2.7 The outer cover materials shall neither absorb any significant quantities of aliphatic or aromatic hydrocarbons nor be dissolved by them. The seams shall run parallel to, and at least 6 mm from, the free edge of the material.

5.2.8 The outer cover material shall conform to Tables 1, 2 and B.1.

5.3 Single or multi-component bagstoppers

Where the bag stopper is manufactured as a single component (i.e. it does not contain a separate bladder) or more than two components, the materials shall conform to the requirements specified for the outer cover in **5.2.6** to **5.2.8**.

6 Oil-resistant bag stoppers

6.1 Oil-resistant bagstoppers shall conform to Clauses **4**, **5**, **6.2**, **7**, and **8**.

6.2 The outer cover material shall conform to the tensile failure load and elongation requirements specified in Table B.1.

7 Type approval testing

7.1 General

7.1.1 Type approval tests shall be carried out on all sizes of each design of bag stopper that the contractor offers.

NOTE Tests may be carried out by a laboratory accredited to BS EN ISO/IEC 17025.

7.1.2 The type approval tests shall be carried out on three bag stoppers of each size in the sequence shown in Table 1. Additional tests required for bag stoppers shall be carried out on three bag stoppers of each size to the requirements shown in Table 2.

Table 1 — Type approval test sequence

Sequence	Clause reference	Test
1	**A.1**	Bag stopper dimensional tests
2	**A.2**	Pull test
3	**A.3**	Cycling tests
4	**A.4**	Leakage past the bag stopper test
5	**A.5**	Free-standing pressure test
6	**A.6**	Resistance to buckling test
7	**A.7**	Bag stopper dimensional tests Repeat **A.1**
8	**A.8**	Burst test

7.1.3 Failure of one bag stopper to complete the test sequence satisfactorily shall constitute a failure of the type approval test for that size and a further six bag stoppers shall be tested, all of which shall pass before type approval of that size is granted.

Table 2 — Additional type approval tests

Name	Clause reference	Test
Outer cover test	Annex B	Properties of outer cover material
Non oil-resistant bladder test	Annex C	Bladder material test (where bag stopper consists of an outer cover and bladder)
Oil-resistant bladder test	Annex D	Bladder material test (where bag stopper consists of an outer cover and bladder)
Distillate test	Annex E	Additional pull, burst and pressure tests for oil-resistant bag stoppers only

8 Production test

8.1 General

All equipment used for testing bladders and outer covers shall be free of oil or grease. Air used for inflation shall be from an oil-free supply.

8.2 Testing of bladders

Before assembly into the outer covers, the bladders shall be inflated to their flaccid diameter and examined thoroughly for inclusions or faults likely to cause rupture. All seams and connections shall also be scrutinized for satisfactory adhesion.

8.3 Free-standing pressure test

A free-standing pressure test shall be carried out as specified in **A.5**.

8.4 Leakage from within the bag stopper test

A leakage from within the bag stopper test shall be carried out as specified in **A.5**.

9 Process control

9.1 General

To ensure ongoing quality, the contractor shall, at intervals not exceeding one week, carry out the tests specified in **9.2** to **9.5** inclusive on one of each size of bag stopper produced in that week. The bag stoppers used for testing shall be destroyed. Records of the tests shall be kept for inspection by the gas transporter.

9.2 Bag stopper dimensional tests

Bag stopper dimensional tests shall be carried out as specified in **A.1.**

9.3 Pull test

A pull test of the stopper neck assembly shall be carried out as specified in **A.2**.

9.4 Resistance to buckling test

A resistance to buckling of the bag stopper neck test shall be carried out as specified in **A.6**.

9.5 Burst test

A burst test of the bag stoppers shall be carried out as specified in **A.8.**

10 Marking

10.1 Identification details shall be clearly marked on the bladder, hexagon of the female screw connector and the outer cover as specified in **10.2** to **10.6**.

10.2 All markings on the bladders or outer covers shall be made with a suitably coloured indelible ink, free from copper, manganese or other compounds likely to cause the degradation of either the bladder or the outer cover.

10.3 Bladders conforming to GIS/E4 shall be permanently marked with the following information:

a) the manufacturer's name or agreed abbreviation;

b) size of bladder;

c) the number and date of this standard, i.e. GIS/E4:2013 [1)];

d) date of manufacture (month/year) of the bladder.

10.4 Outer covers of a completed bag stopper conforming to GIS/E4 shall be permanently marked with the following information:

a) the manufacturer's name or agreed abbreviation and contact details;

b) nominal size of bag stopper in mm, (e.g. “150 mm”);

c) the number and date of this standard, i.e. GIS/E4:2013 [1)];

d) normal inflation pressure (in bar) as “norm. infl. (in bar)”;

e) use-by date (month/year), see **11.3**, (e.g. ”use by 10/06”) (bag stopper to be destroyed at end of use-by month);

f) “oil res” for oil-resistant bags.

10.5 The outer cover markings shall be printed on the ends.

10.6 Hexagon connectors conforming to GIS/E4 shall be stamped or vibro-etched with nominal size and use-by date, see **11.3**, e.g. “150 mm” and “10/06”.

11 Assembly packaging, storing and dating

11.1 Storage of bladders

The rubber bladders used for the bag stopper construction shall be dusted internally and externally with French chalk, polyvinyl chloride dust or similar, and carefully packed and stored in the manner specified in BS ISO 2230.

The bladders shall be drawn from storage, for final attachment to the outer fabric cover, in accordance with BS ISO 2230. The contractor shall follow the same procedure when supplying the completed item to the gas transporter.

Bladders more than 12 months old shall not be incorporated in any bag stopper.

11.2 Storage of bag stoppers

After the completed bag stopper is tested and dried if necessary, they shall be stored in boxes out of direct sunlight at a temperature below 25 °C. If bag stoppers are packed in bundles, any ties shall not permanently distort the bladders.

11.3 Use by date for bag stoppers and connectors

The bag stopper and hexagon connector shall be marked with a use by date (see **10.4** and **10.5**), which shall be 30 months from the date of manufacture.

11.4 Supply of bag stoppers

Bag stoppers shall not be supplied to the gas transporter less than 12 months before their use by date.

[1)] Marking GIS/E4:2013 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)
Type test methods

A.1 Bag stopper dimensional tests

A.1.1 *Principle*

These tests are to ensure that the minimum contact length and maximum bag stopper length meet the required dimensions.

A.1.2 *General*

Assembled bag stoppers shall be stored for a minimum period of two weeks before testing.

A minimum contact length test shall be carried out using either Method A (see **A.1.3**) or Method B (see **A.1.4**). This shall be followed by a maximum overall length test (see **A.1.5**).

A.1.3 *Procedure for minimum contact length test A*

Insert the bag stopper into the test pipe as shown in Figure A.1 and inflate to the test pressure specified in Table A.2.

Measure the minimum contact length, *B,* as shown in Figure A.1 a).

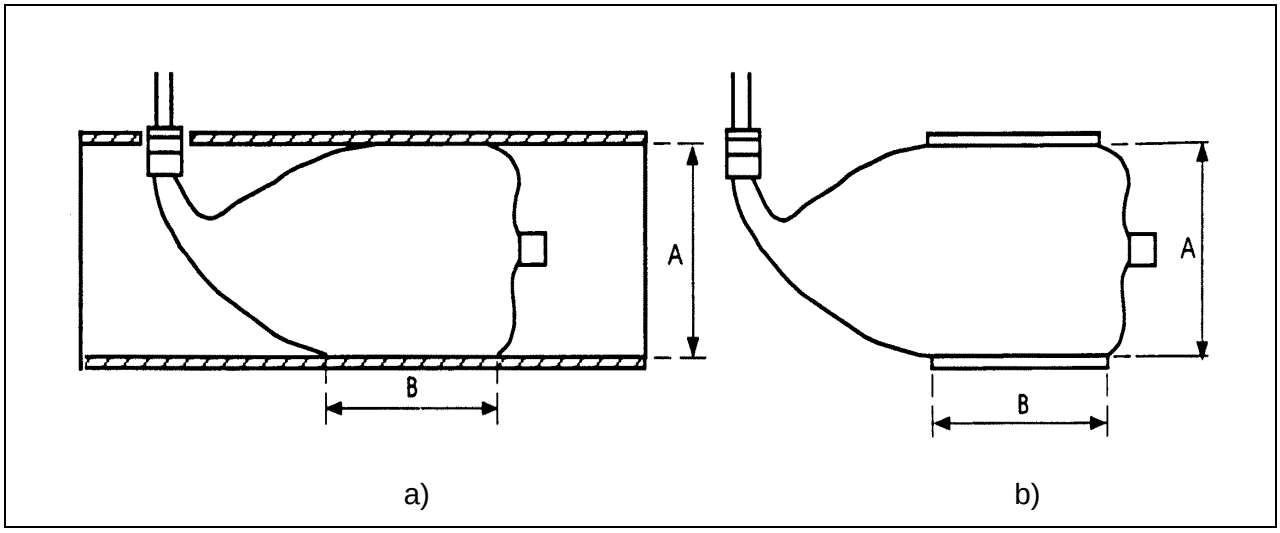


Figure A.1 — Minimum contact length determination

Table A.1 — Dimensions of bag stoppers

Bag stopper nominal size	**Test pipe diameter, *A* (see Figure A.1)**	**Minimum contact length, *B* (see Figure A.1)**	**Maximum overall length, *C* (see Figure A.2)**
mm (in)	mm	mm	mm
50 (2)	57	37	240
75 (3)	84	50	250
100 (4)	112	75	280
125 (5)	139	80	380
150 (6)	168	100	380
175 (7)	192	110	460
200 (8)	224	115	460
225 (9)	245	120	510
250 (10)	276	125	510
300 (12)	324	152	510

A.1.4 *Procedure for minimum contact length test B*

Insert the bag stopper into a test pipe of length *B* (see Figure A.1 b) and Table A.1).

Inflate the bag stopper to the test pressure specified in Table A.2, ensuring it contacts the whole of the inside length of the test pipe with its neck at 90º to the pipe axis, as shown in Figure A.1 b).

Measure the minimum contact length, *B,* as shown in Figure A.1b).

A.1.5 *Procedure for maximum overall bag stopper length test*

On completion of the chosen minimum contact length test, deflate the bag stopper and remove from the test pipe.

Ensure it is fully deflated and fully extended and measure the maximum overall stopper length, *C,* as shown in Figure A.2.

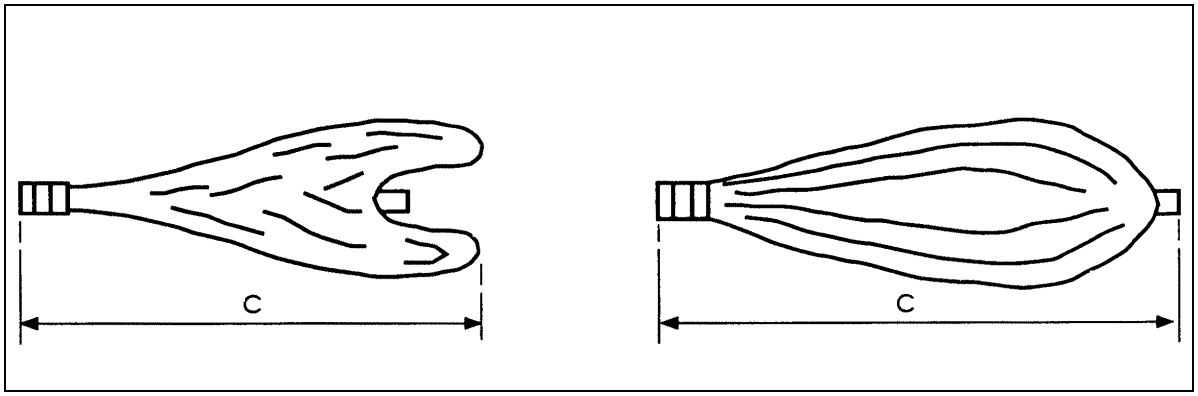


Figure A.2 — Maximum overall bag stopper length determination

A.1.6 *Results*

The minimum contact length, *B*, shall equal or exceed the values specified in Table A.1.

The maximum overall bag stopper length, *C*, shall not exceed the values specified in Table A.1.

A.2 Pull test of the bag stopper neck assembly

A.2.1 *Principle*

This test is to ensure that the bag stopper neck assembly can achieve a maximum direct pull of 1.1 kN without damage to bag stopper.

A.2.2 *Procedure*

Ensure the test plate hole, as shown in Figure A.3, is the correct size for the bag stopper being tested as specified in Table A.2.

Insert the fully deflated bag stopper neck though the test plate hole as shown in Figure A.3 and attach to the inflation source and pulling arrangement.

Inflate to the test inflation pressure for the bag stopper size shown in Table A.2.

If necessary during rest of test, increase inflation pressure to prevent it from pulling through the test plate hole when subjected to the pulling force.

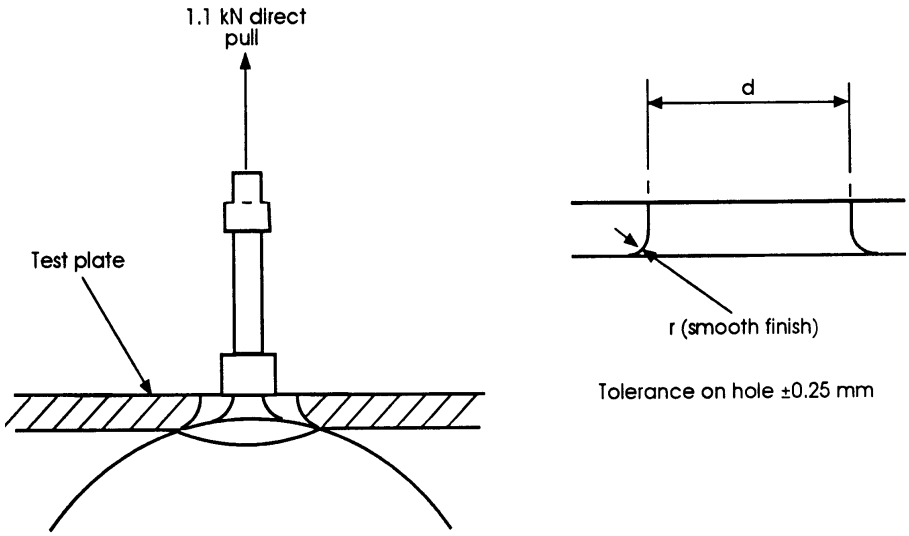
Isolate the bag stopper from the inflation source to ensure air cannot feed back during the test into the bag stopper which may increase the inflation pressure above the values specified in Table A.2.

Gradually apply the 1.1 kN direct pull as shown in Figure A.3 using the measured pulling arrangement.

Record the results.

Table A.2 — Test plate dimensions and test inflation pressures for pull tests

Bag stopper nominal size	**Test plate hole size, *d***	**Test plate hole radius, *r***	**Test inflation pressure**
mm (in)	mm	mm	bar
50 (2)	25	5	0.60
75 (3)	25	5	0.50
100 (4)	25	5	0.40
125 (5)	25	5	0.30
150 (6)	38	5	0.25
175 (7)	38	5	0.20
200 (8)	51	5	0.14
225 (9)	51	5	0.10
250 (10)	64	5	0.10
300 (12)	76	5	0.07



NOTE For the values of *d* and *r*, see Table A.2.

Figure A.3 — Assembly of test plate for direct pull and test plate dimension

A.2.3 Results

The neck assembly shall achieve a maximum direct pull of 1.1 kN against the test plate.

A.3 Cycling tests

A.3.1 *Principle*

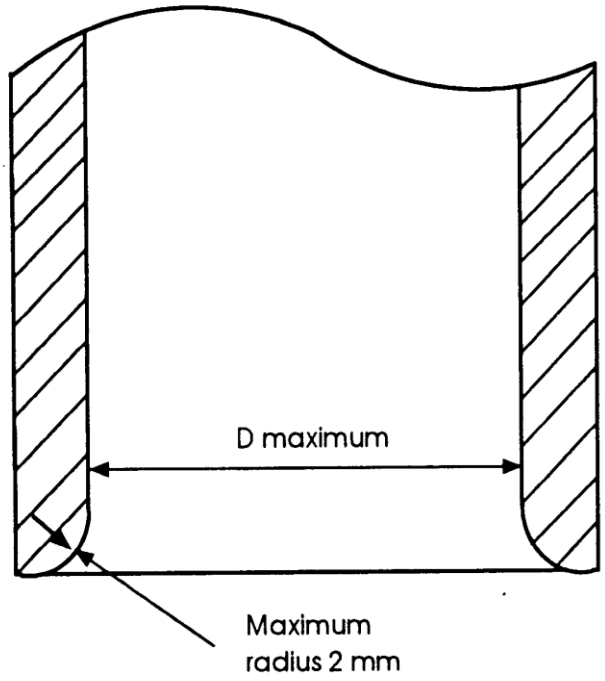
These tests are to ensure that the bag stopper can easily be pushed into and pulled out of the bag stopper inflation tube more than 50 times and that it can withstand 1.5 times the maximum inflation pressure for at least 100 h.

A.3.2 *Procedure for insertion test*

Ensure that the deflated bag stopper can be fully pushed into and pulled out of a bag stopper inflation tube of the maximum diameter dimensions of bag stopper inflation tube specified in Table A.3, and shown in Figure A.4.

Ensure that the tested tube is long enough to completely contain the bag stopper being tested.

The maximum force required shall not exceed 620 N. The test shall be repeated 50 times and the force required shall be measured during the 1st and 50th cycles.



NOTE For the values of *D*, see Table A.3.

Figure A.4 — End finish of tube for insertion tests

Table A.3 — Maximum diameter of bag stopper inflation tubes for insertion test

Bag stopper nominal size mm (in)	**Maximum diameter of bag stopper inflation tube, *D*** mm
50 (2)	24
75 (3)	24
100 (4)	24
125 (5)	35
150 (6)	35
175 (7)	46
200 (8)	46
225 (9)	46
250 (10)	46
300 (12)	46

A.3.3 *Procedure for pressure test*

Inflate the bag stopper to 1.5 times the inflation pressure specified in Table A.4 for a minimum period of 2 min then deflate.

Repeat this test 50 times.

Inflate the bag stopper to 1.5 times the inflation pressure specified in Table A.4 for a minimum period of 100 h.

Table A.4 — Inflation and test pressures

Bag stopper nominal size	Bag stopper inflation pressure	Maximum upstream working pressure
mm (in)	bar	bar
50 (2)	1.00	0.40
75 (3)	0.70	0.34
100 (4)	0.60	0.34
125 (5)	0.55	0.28
150 (6)	0.50	0.28
175 (7)	0.45	0.28
200 (8)	0.40	0.26
225 (9)	0.37	0.18
250 (10)	0.35	0.16
300 (12)	0.28	0.10

A.3.4 *Results*

It shall be easy to push the bag stopper into, and pull it out of, the bag stopper inflation tube more than 50 times. The force required shall not exceed 620 N.

The bag stopper shall be capable of withstanding 1.5 times the maximum inflation pressure required for at least 100 h without leakage, damage or deterioration in performance.

A.4 Leakage past the bag stopper test

A.4.1 *Principle*

This test is to ensure that there is no leakage past the bag when it is inserted in the pipe in the supported mode.

A.4.2 *Procedure*

Ensure that the bag stopper is in the supported mode (see Figure A.5).

Ensure that the bag stopper is in a test pipe of appropriate diameter for the nominal size of the bag stopper under test, as specified in Table A.1.

The bag stopper inflation pressure and upstream working pressure shall conform to Table A.4 for the nominal size of the bag stopper under test.

Record any leakage past the bag stopper.

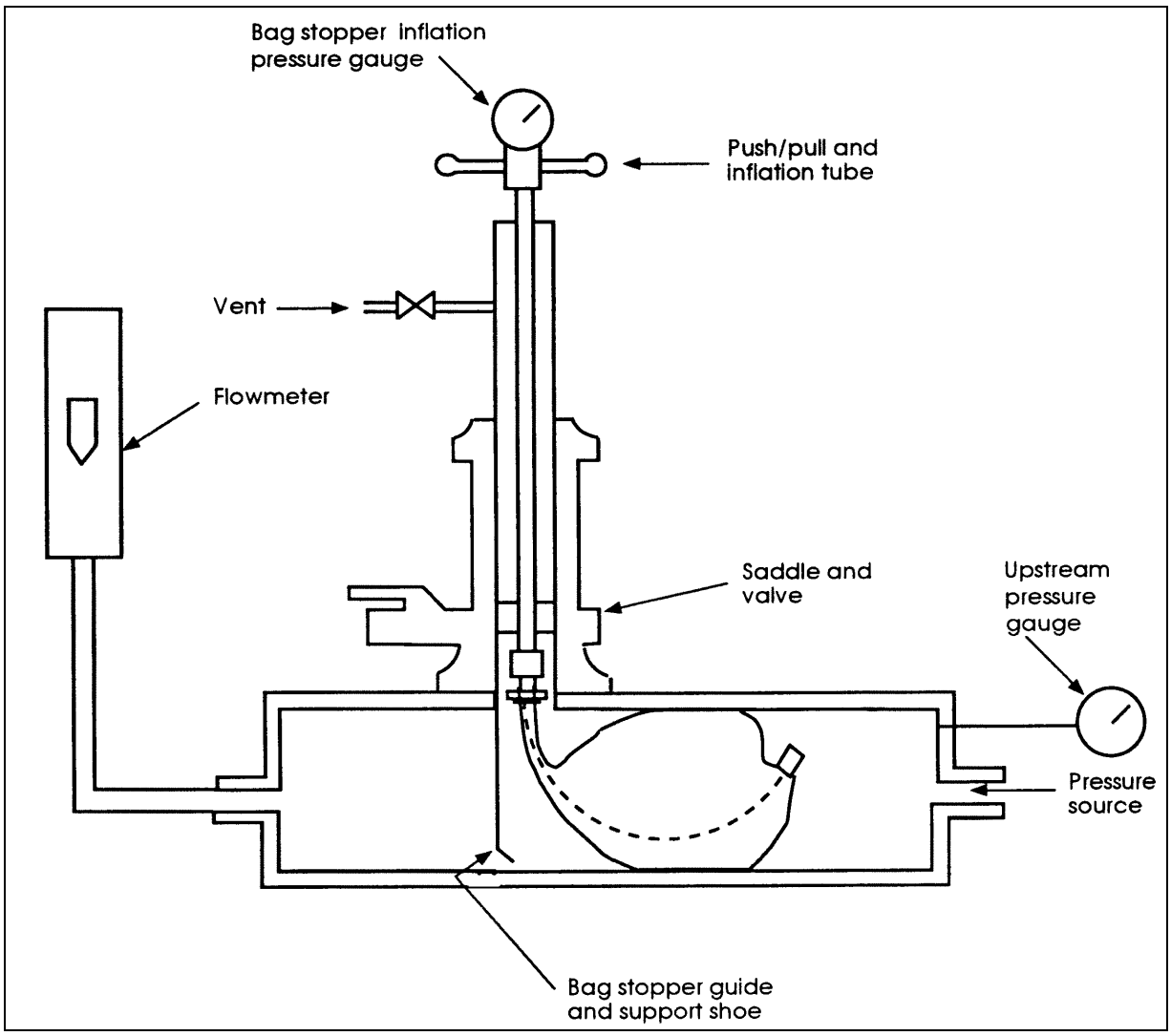


Figure A.5 — Test equipment for leakage past the bag stopper test, showing bag in supported mode

A.4.3 *Results*

Leakage past the bag stopper shall not exceed 1.8 scmh.

A.5 Free-standing pressure test

A.5.1 *Principle*

This test is to ensure that the bag stopper can withstand the test pressure without leakage from within the assembly when freestanding (not inserted into pipe or in supported mode).

A.5.2 *Procedure*

The freestanding test pressure for each nominal pipe size shall be as specified in Table A.5.

Inflate the bag stopper to the required test pressure and maintain for not less than 1 min, during which time the bag stopper shall be thoroughly visually examined for defects or any signs of leakage or loss in pressure. Any leakage or loss in pressure shall be recorded.

Table A.5 — Freestanding test pressure

Bag stopper nominal size mm (in)	Free standing test pressure bar
50 (2)	1.25
75 (3)	0.90
100 (4)	0.75
125 (5)	0.75
150 (6)	0.75
175 (7)	0.75
200 (8)	0.65
225 (9)	0.50
250 (10)	0.50
300 (12)	0.50

A.5.3 *Results*

The freestanding bag stopper shall withstand the test pressure with no defects or leakage from within the assembly and fittings.

A.6 Resistance to buckling of bag stopper neck

A.6.1 *Principle*

This test is to ensure that there is no buckling or restriction to the bag stopper neck assembly.

A.6.2 *Procedure*

Bend the neck of the bag, just beyond the extremity of the inflation adaptor, through an angle of 90° around a bar 12 mm in diameter, and hold in position for 5 s.

Release and let bag stopper neck return to the natural position.

Record any buckling or restriction of the neck tubing.

A.6.3 *Results*

The bag stopper shall show no signs of buckling or restriction of the neck tubing when the neck is returned to its natural position.

A.7 Bag stopper dimensional tests

At this point in the sequence, **A.1** shall be repeated.

A.8 Burst test

A.8.1 *Principle*

This test is to ensure that the bag stopper can withstand the required inflation pressure without bursting.

A.8.2 *Procedure*

Install the bag stopper, as shown in Figure A.1a), in a pipe of test pipe diameter, *A*, as specified in Table A.1.

Inflate to the appropriate pressure specified in Table A.6.

If the bag stopper shows any defect, record the pressure at that point. If it bursts, record the pressure at that point.

Table A.6 — Inflation pressures for burst test

Bag stopper nominal size	Inflation pressure
mm (in)	bar
50 (2)	4.00
75 (3)	2.80
100 (4)	2.40
125 (5)	2.20
150 (6)	2.00
175 (7)	1.80
200 (8)	1.60
225 (9)	1.50
250 (10)	1.40
300 (12)	1.12

A.8.3 *Results*

The bag stopper shall not burst or display any other related defect before the required inflation pressure is reached.

Annex B (normative)
Outer cover material test: elongation and tension

B.1 Principle

The elongation and tension set properties of outer cover materials are determined.

Table B.1 — Properties of outer cover material

Property	New material	After ageing
Breaking load	670 N minimum	500 N minimum
Tension set	5 % maximum	6 % maximum
Tear strength	70 N minimum	50 N minimum

B.2 Apparatus

Two grips, capable of accommodating test pieces 50 mm wide:

a) one capable of being attached to a rigid support so that when the test specimen is inserted, centrally and normally, it hangs in a vertical plane;

b) one constructed so that dead loads can be added to it to bring the total weight up to 50 % of the breaking load of the coated fabric under test.

B.3 Test specimens

B.3.1 Assembled bag stoppers shall be stored for a minimum period of two weeks before testing.

B.3.2 Material shall be aged by keeping at 70 °C for 168 h followed by immersion in water for 1 h.

B.3.3 Cut five specimens of 450 mm × 50 mm with the length parallel to the warp threads, and three specimens with the length parallel to the weft threads. Space the selection so as to cover fairly evenly the full width and available length of the sample, avoiding uncoated edges or selvedge ends. Identify each specimen accordingly.

B.3.4 Before testing, the specimens shall be conditioned in accordance with BS EN ISO 2231.

B.4 Procedure

B.4.1 Determine the mean value of breaking load from five specimens, each from warp and weft directions.

B.4.2 Determine the minimum value of tear strength of five specimens, each from warp and weft directions.

B.4.3 Establish tension set (tensile failure load) using the method specified in Annex C for bladder material.

B.4.4 Determine the breaking load by testing one specimen in accordance with BS EN ISO 1421 in atmospheric conditions similar to those used for conditioning in accordance with BS EN ISO 2231.

B.4.5 Draw pencilled lines across each specimen at right angles to its longest dimension approximately 100 mm from each end and exactly 250 mm apart.

B.4.6 Draw a third line to cut these two lines at their mid points. Make all measurements along this line.

B.4.7 With the atmospheric conditions similar to those used for conditioning in accordance with BS EN ISO 2231, insert a specimen centrally and normally in the fixed grip so that the pencilled line at the end is not less than 50 mm from the jaws. Insert the other end of the specimen similarly in the loose grip. Attach the fixed grip to the support.

B.4.8 Smoothly apply a load that will bring the weight of the loose grip up to 50 % of the breaking load and note the time. After 10 min, measure and record to the nearest 0.5 mm the distance L_1 between the pencilled lines.

B.4.9 Remove the load, withdraw the specimen from the grips and place it on a flat surface. Ten minutes after removing the load, re-measure and record to the nearest 0.5 mm the distance L_1 between the pencilled lines.

B.4.10 Repeat the procedure with the remaining specimens.

B.5 Calculations

B.5.1 The elongation and tension set for each specimen shall be calculated in accordance with **B.5.2** and **B.5.3** and the means for the sets of three warp and weft specimens, shall be documented to nearest 0.2 %.

B.5.2 The elongation, expressed as a percentage, shall be calculated from the following equation: $(L_1 - 250)/2.5$.

B.5.3 The tension set, calculated as a percentage, shall be calculated from the following equation: $(L_1 - 250)/2.5$.

B.6 Test results

B.6.1 The breaking load shall be in accordance with BS EN ISO 1421.

B.6.2 The tear strength shall conform to BS EN ISO 4674-1.

B.6.3 The load and the breaking load shall be recorded. The load shall be 50 % of the breaking load (see **B.4.4**).

Annex C (normative)
Bladder material test: non oil-resistant bladder material

C.1 Principle

The elongation and tension set properties of non oil-resistant bladder materials are determined in accordance with BS ISO 188 and BS ISO 37.

C.2 Test specimens

C.2.1 Bladder material shall be stored for a minimum period of two weeks before testing.

C.2.2 Preparation and conditioning of test specimens shall be in accordance with BS ISO 23529 and dumb-bells for seams shall be taken at right angles to the seam. Type 2 dumb-bells shall be used in accordance with BS ISO 37.

C.2.3 Ageing of specimens shall be in accordance with BS ISO 188 by accelerated ageing using the air oven method.

C.3 Procedure

C.3.1 For new bladder material, apply the tensile failure load and elongation specified in Table C.1 and record results.

C.3.2 Carry out accelerated ageing using the air oven method for 168 h at the relevant material type temperatures in accordance with BS ISO 188.

C.3.3 For aged bladder material, apply the tensile failure load and elongation specified in Table C.1 and record results.

Table C.1 — Non oil-resistant bladder material tensile failure load and elongation requirements

Property	**New bladder material**		**Aged for 168 h in accordance with BS ISO 188**	
	Parent	**Seams**	**Parent**	**Seams**
Tensile failure load	33.4 N minimum	4 × 100 % elongation load minimum [a)]	20 % reduction maximum	20 % reduction maximum
Elongation	500 % minimum	-	30 % reduction maximum	-
[a)] The 100 % elongation load is the average load required to cause 100 % elongation of three specimens of new material.				

C.4 Results

The values for tensile and elongation properties shall conform to the requirements of BS ISO 37. The tensile failure load and elongation shall conform to Table C.1. The values for tensile and elongation properties shall conform to BS ISO 37 using Type 2 dumb-bells.

Annex D (normative)
Bladder material test: oil-resistant bladder material

D.1 Principle

The elongation and tension set properties of oil-resistant bladder materials are determined in accordance with BS ISO 188 and BS ISO 37.

D.2 Test specimens

D.2.1 Bladder material shall be stored for a minimum period of two weeks before testing.

D.2.2 Preparation and conditioning of test specimens shall be in accordance with BS ISO 23529 and dumb-bells for seams shall be taken at right angles to the seam. Type 2 dumb-bells shall be used in accordance with BS ISO 37.

D.2.3 Ageing of specimens shall be in accordance with BS ISO 188 by accelerated ageing using the air oven method.

D.3 Procedure

D.3.1 For new bladder material, apply the tensile failure load and elongation specified in Table D.1 in accordance with BS ISO 188 and BS ISO 37 and record results.

D.3.2 Carry out accelerated ageing using the air oven method for 168 h at the relevant material type temperatures in accordance with BS ISO 188 (see Table D.1).

D.3.3 Apply the tensile failure load and elongation specified in Table D.1 and record results.

D.3.4 Totally immerse the bladder material in distillate at 20 ºC for 168 h.

D.3.5 Apply the tensile failure load and elongation specified in Table D.1 and record results.

D.3.6 Carry out accelerated ageing using the air oven method for 168 h at the relevant material type temperatures in accordance with BS ISO 188.

D.3.7 Apply the tensile failure load and elongation specified in Table D.1 and record results.

Table D.1 — Oil-resistant bladder tensile failure load and elongation requirements

Property	New material		Aged for 168 h at 70 °C		Immersed in distillate at 20 °C for 168 h		Desorbed for 168 h at 70 °C	
	Parent	Seams	Parent	Seams	Parent	Seams	Parent	Seams
Tensile failure load	33.4 N min	4 × 75 % elong-ation load min	20 % reduction max	20 % reduction max	4 × 75 % elong-ation load min	4 × 75 % elong-ation load min	30 % reduction max	30 % reduction max
Elong-ation	375 % min	—	30 % reduction max	—	30 % reduction max	—	40 % reduction max	—

D.4 Results

The values for tensile and elongation properties shall conform to the requirements of BS ISO 37. The tensile failure load and elongation shall conform to Table D.1. The values for tensile and elongation properties shall conform to BS ISO 37 using Type 2 dumb-bells.

Annex E (normative)
Distillate test for oil-resistant bag stoppers

E.1 Principle

This test is to ensure that the oil-resistant bag stopper can resist the pull, burst and inflation test after total immersion in distillate, i.e. it is oil-resistant.

E.2 Test specimens

Assembled bag stoppers shall be stored for a minimum period of two weeks before testing.

Ageing of specimens shall be carried out in conformance with BS ISO 188 and **B.3.2**.

E.3 Procedure

Carry out immersion in conformance with BS ISO 37 using type 2 dumb-bell-shaped sections.

Immerse bag stopper in distillate for 168 h at 20 ºC.

Carry out the pull test as given in **A.2** and the burst test as given in **A.8** within 2 h of removing the bag stopper from the distillate.

Record the results.

Carry out the freestanding pressure test as specified in **A.5.**

Record the results.

E.4 Results

The stopper shall pass the tests specified in **A.2** and **A.8** with no deterioration of the bag stopper material and assembly.

The bag stopper shall withstand inflation pressures of not less than 75 % of the values specified in Table A.6 when confined within a pipe as shown in Figure 1, without failure.

Bibliography

BS EN ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories.*