

Gas Industry Standard

GIS/E20:2013

Specification for

Secondary iris stop bags



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Foreword

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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.

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Brief history

First published as BGC/PS/E20 Amended issue published as GBE/E20 Editorial update to reflect demerger November 2000 Editorial update to comply with GRM 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	November 1990 August 1993 June 2001 August 2004 May 2006 September 2013 June 2018
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1 Scope

This Gas Industry Standard (GIS) specifies the design, performance and material requirements for inflatable stop bags for use in the secondary position of an iris stop system where a secondary support is used to support the bag.

The field of application covers steel, cast grey and ductile iron pipes in the nominal size range 4 in (100 mm) to 48 in (1 200 mm).

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 10241, *Steel threaded pipe fittings*

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 2230, *Rubber products — Guidelines for storage.*

3 Terms and definitions

For the purposes of this GIS the following definitions apply:

3.1

bladder

inner inflatable component of stop bag

3.2

free standing

unconstrained and not contained within a pipe

3.3

hexagon connector

metallic connection fitting with female screwed thread, attached to neck of stop bag to allow connection to an air supply for inflation purposes

3.4

secondary support

circular tube whose diameter is approximately 0.25 times the pipe diameter

3.5

stop bag

inflatable bag used for stopping the flow of gas in a pipe, consisting of an internal rubber bladder and synthetic fibre outer cover with connection point to allow inflation

4 Design

4.1 General

Inflatable stop bags shall be capable of insertion into, or removal from, the pipe through a hole with a diameter of approximately 0.25 times the diameter of the pipe, as given in Table D.1. It shall be possible to position the stop bag in the pipe so that the secondary support can be inserted behind the bag. When inflated, the stop bag shall seat against this secondary support.

The stop bag design requirements may be met by the combination of a bladder with an outer cover of strong fabric.

4.2 Inner inflatable component (bladder)

The bladder shall be manufactured from a compound that meets the requirements of Table 1.

Table 1 — Bladder material tensile failure load and elongation requirements

	New material		Aged for 168 h at 70 °C	
	Parent	Seams	Parent	Seams
Tensile failure load	33.4 N min.	4 × 100 % elongation load min.	20 % reduction max.	20 % reduction max.
Elongation	500 % min.	-	30 % reduction max.	-

The 100 % elongation load is the average load required to cause 100 % elongation of three specimens of new material. The values shall be determined in compliance with BS 903-A2 using Type 2 dumb-bells. Dumb-bells from seams shall be taken at right angles to the seams.

The aging of specimens shall comply with BS 903:A19.

The bladder shall be moulded, dipped or fabricated from calendered sheet.

The finished bladder shall be, to visual inspection, free from any inclusion or defect likely to impair performance.

The bladder shall be sized so that when the finished stop bag is inflated inside the appropriate maximum tolerance pipe as given in Table 2, the bladder's elongation shall not exceed 100 %. The bladder shall be sized so that its flaccid diameter is at least 0.5 times that of the finished stop bag diameter.

All bladder joints shall be visually inspected to ensure that a proper bond has been achieved.

Bladder thickness shall be within the inclusive limits 0.5 mm to 1.5 mm and the thickness of each bladder shall not vary by more than 30 % over its full area, excluding overlapped seams.

4.3 Outer cover

To avoid rot, only materials manufactured from synthetic fibres shall be used. The cover be designed and manufactured to provide complete support for the bladder so that no excessive stressing of the bladder material is possible within the cover.

The materials shall be resistant to absorption of aliphatic or aromatic hydrocarbons and shall not be dissolved by them.

NOTE This is to prevent contamination of the inner bladder.

All threads used to stitch seams shall be of compatible material and stitched seams shall run parallel to, and at least 6 mm from, the free edge, to avoid separation under stress.

Table 2 — Main maximum tolerance bore, stop bag and iris stop working pressures and bag end connection size

Main dimensions		Max. tolerance bore	Max. mains pressure	Max. bag differential pressure	Max. bag inflation (mains + bag differential) pressure	Threaded female inflation connection on bag
Pipe nominal size						
mm	in	mm	mbar	mbar	mbar	in BSP
100	4	112	2000	350	2350	¼
150	6	168	2000	350	2350	¼
200	8	224	2000	350	2350	¼
	9	245	2000	350	2350	¾
250	10	276	2000	350	2350	¾
300	12	324	1700	280	1980	¾
	14	368	1200	200	1400	¾
	15	403	1200	200	1400	¾
400	16	417	950	200	1150	¾
450	18	481	700	175	875	¾
500	20	520	700	140	840	¾
	21	559	700	140	840	¾
600	24	637	700	140	840	¾
	27	698	200	105	305	¾
	28	737 ^{a)}	200	105	305	¾
	30	788	200	105	305	¾
900	36	943	140	70	210	¾
	42	1098	70	50	120	¾
1200	48	1252	35	35	70	¾

^{a)} Non-standard pipe, value interpolated.

4.4 Fittings

The size of the female screw connector at the bag inlet shall be as given in Table 2.

The fittings controlling inflation and deflation shall have the maximum possible internal diameter consistent with adequate strength.

Crimping of compression rings shall not damage the cover material; if necessary, protective sleeving shall be provided. The crimp shall be positive so that sliding of the ring does not occur when manoeuvring the stop bag (see 5.2.3). To achieve this, recessed fittings shall be used under all crimped rings. Where the recess is cut in a non-metallic component, the part shall be solid under the recess.

5 Bladder and finished stop bag tests

5.1 General

The tests specified in 5.2 and 5.3 shall be carried out by the manufacturer.

5.2 Tests to be carried out on every stop bag and bladder

NOTE The tests specified in 5.2.2 and 5.2.3 may be carried out simultaneously at the discretion of the manufacturer.

5.2.1 Testing of bladders

5.2.1.1 This test is for faults in the bladder likely to cause rupture.

5.2.1.2 Before assembly into the stop bag, inflate the bladder to its flaccid diameter and visually examine it thoroughly for faults likely to cause rupture.

5.2.1.3 Visually examine all seams and connections thoroughly for adhesion.

5.2.2 Free standing pressure test for completed stop bag

5.2.2.1 This test is equivalent to the pre-insertion test carried out by the operator before insertion into the live pipe. This test is to detect any defects in the bladder likely to cause rupture.

5.2.2.2 The free standing stop bag (not inserted within a pipe) shall be inflated to the appropriate test pressure as given in Table 3.

Table 3 — Free standing test pressures

Pipe nominal size		Test pressure
mm	in	mbar
100 to 250	4 to 10	350
300	12	280
350 to 400	14 to 16	200
450	18	175
500 and 600	20 to 24	140
	27 to 30	105
900	36	70
	42	35
1 200	48	35

5.2.2.3 Continue the test for no less than 5 min, during which time visually examine the stop bag thoroughly for defects.

5.2.2.4 There shall be no defects discovered in the bladder during this test.

5.2.3 Test for leakage from within the bag

5.2.3.1 This test is to detect any leakage of air from the stop bag and its fittings into the atmosphere.

5.2.3.2 The free standing stop bag (not inserted within a pipe) shall be inflated to the appropriate test pressure as given in Table 3.

5.2.3.3 Continue the test for no less than 5 min.

5.2.3.4 There shall be no leakage from the stop bag or its fittings during this test.

5.3 Tests to be carried out on an agreed sample of completed stop bags

5.3.1 Test supervision

The tests specified in 5.3.2 to 5.3.7 inclusive shall be carried out by the manufacturer.

5.3.2 Dimensional tests

The stop bag shall be tested according to the test method specified in Annex A.

When inflated in a pipe of maximum tolerance bore, each inflatable stop bag shall comply with the dimensional limits for each size of bag stated in Figure A.1

5.3.3 Lower pressure tests

5.3.3.1 This test investigates whether the stop bag bursts or distorts under pressure while and unsupported inside open-ended pipe.

5.3.3.2 The stop bag shall be inserted into an open-ended pipe of the appropriate maximum tolerance bore as given in Table 2.

5.3.3.3 The stop bag shall be inflated to the appropriate test pressure as given in Table 4.

NOTE The test pressures given in Table 4 are twice the recommended maximum working inflation pressures.

Table 4 — Lower test pressures

Pipe nominal size		Test pressure
mm	in	mbar
100 to 250	4 to 10	4 700
300	12	3 960
	14 to 15	2 800
400	16	2 300
450	18	1 750
500 and 600	20 to 24	1 680
	27 to 30	610
900	36	420
	42	240
1 200	48	140

5.3.3.4 Continue the test for no less than 5 min.

5.3.3.5 The stop bag shall not burst or incur serious distortion to seams or panels.

5.3.4 Pull tests for neck assembly

The stop bag shall be tested according to the test method specified in Annex B.

5.3.5 Tests to measure leakage past the stop bag

The stop bag shall be tested according to the test method specified in Annex C.

5.3.6 Stop bag insertion test

The stop bag shall be tested according to the test method specified in Annex D.

5.3.7 Upper pressure test

The stop bag shall be tested according to the test method specified in Annex E.

6 Marking

6.1 General

Identification of the stop bag type and relevant details shall be clearly marked on both bladder and outer cover.

All markings shall be in a suitably coloured indelible ink free from copper or manganese compounds or other compounds likely to accelerate the degradation of either the cover or the bladder.

6.2 Conformity marking

Products conforming to GIS/E/20 shall be permanently marked with the following information:

- a) the number and date of this standard, i.e. GIS/E20:2006 ¹⁾);
- b) 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.

6.3 Bladder markings

Bladder markings shall include the manufacturer's name, reference number or size of bladder and "use by" date.

¹⁾ Marking GIS/E20:2006 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.

6.4 Outer covering markings of the completed stop bag

The stop bag shall be a red-orange colour to identify it as a secondary iris stop bag. Outer cover markings of a completed stop bag shall include:

- a) the manufacturer's name or agreed abbreviation;
- b) nominal size of pipe (in mm or in);
- c) standard number, i.e. "E/20";
- d) maximum bag differential pressure (DP) in mbar, i.e. "maximum DP (in mbar)".
- e) "use by" date, e.g. "use by 10/06".

The outer cover markings shall be printed on the ends.

The hexagon connectors shall be stamped or vibro-etched with the nominal size of pipe in mm and "use by" date, e.g. "400 mm" and "10/06".

7 Assembly packaging and storing

7.1 Storage of bladders

The rubber bladders used for the stop bag construction shall be dusted internally and 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 stop bag.

7.2 Storage of stop bags

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

7.3 Use by date for stop bags and connectors

The stop bag and hexagon connector shall be marked with a "use by" date, which shall be 30 months from the date of manufacture.

7.4 Supply of stop bags

Stop bags shall not be supplied to the gas transporter less than 12 months before their "use by" date.

Annex A (normative)

Inflated stop bag dimension tests

A.1 Principle

This test is to establish whether the stop bag falls within the correct dimensional limits when inflated in a pipe of maximum tolerance bore.

The maximum working pressure and the maximum tolerance bore are given in Table 2.

A.2 Apparatus

A.2.1 *Completed stop bag.*

A.2.2 *Equipment for inflating the stop bag and measuring the inflation pressure.*

A.2.3 *Pipe, of appropriate maximum tolerance bore for the stop bag being tested, as specified in Table 2.*

A.3 Procedure

A.3.1 Inflate the stop bag to its maximum working pressure within the pipe, as given in Table 2.

A.3.2 Maintain this pressure for the time required to take the readings given in **A.3.3**.

A.3.3 Determine the minimum contact length by taking the average of eight readings from regularly spaced intervals around the stop bag circumference.

A.4 Result

The stop bag's dimensional limits shall be within those given in Figure A.1.

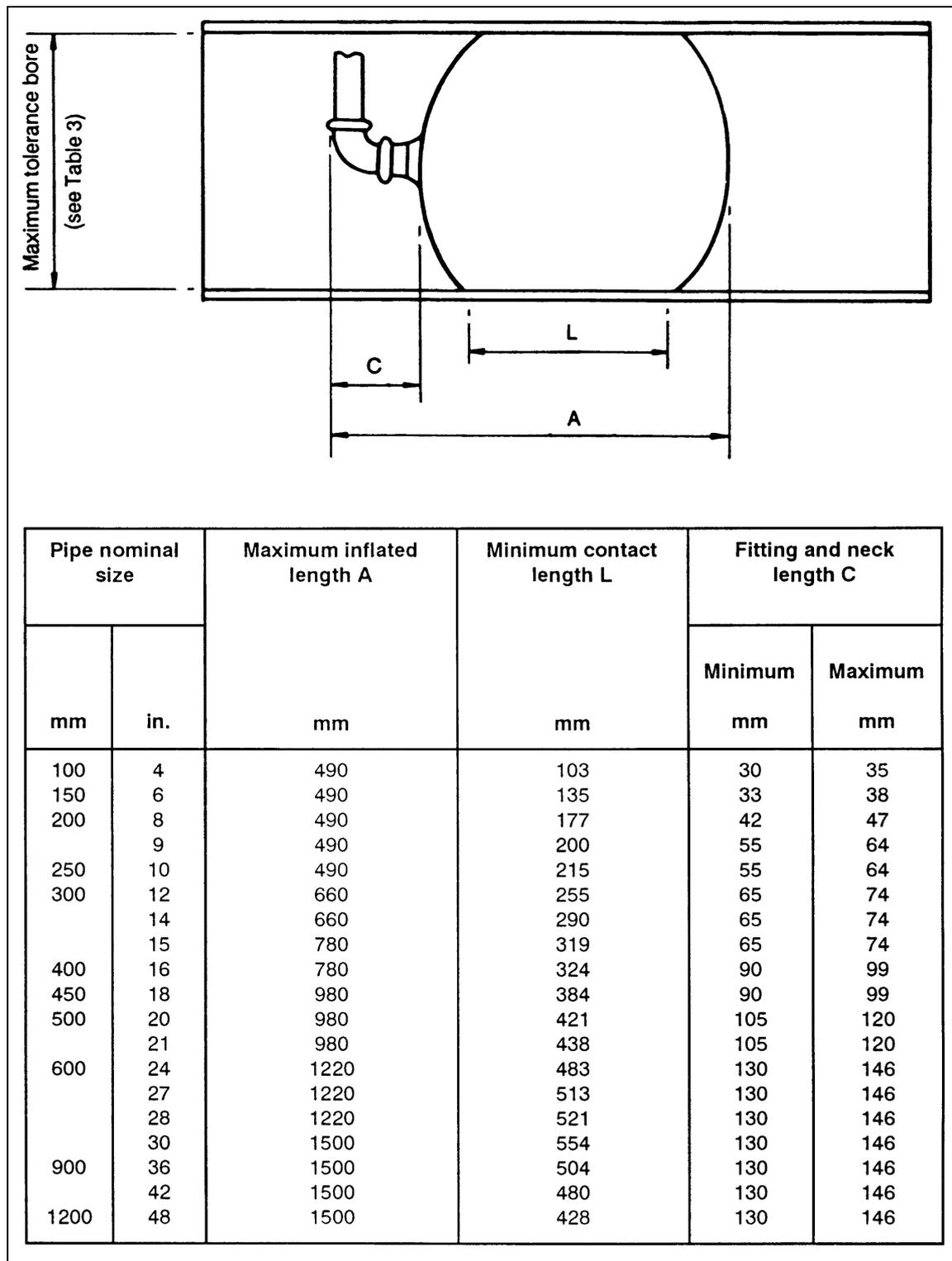


Figure A.1 — Dimensions of inflated stop bag inside test pipe for dimension tests

Annex B (normative)

Neck pull tests

B.1 Principle

This test simulates the forces that act on the neck assembly when the secondary stop bags are inserted or withdrawn from the pipe.

B.2 Apparatus

B.2.1 Completed stop bag.

B.2.2 Test plate, as shown in Figure B.1.

B.2.3 Equipment for inflating the stop bag and measuring the inflation pressure.

B.3 Procedure

B.3.1 Inflate the bag to the pressure given in Figure B.1.

B.3.2 Exert pulling load of 1.1 kN on the neck connection for no less than 5 min.

B.4 Result

The neck connection shall withstand the load without any distortion or disengagement of the end connection.

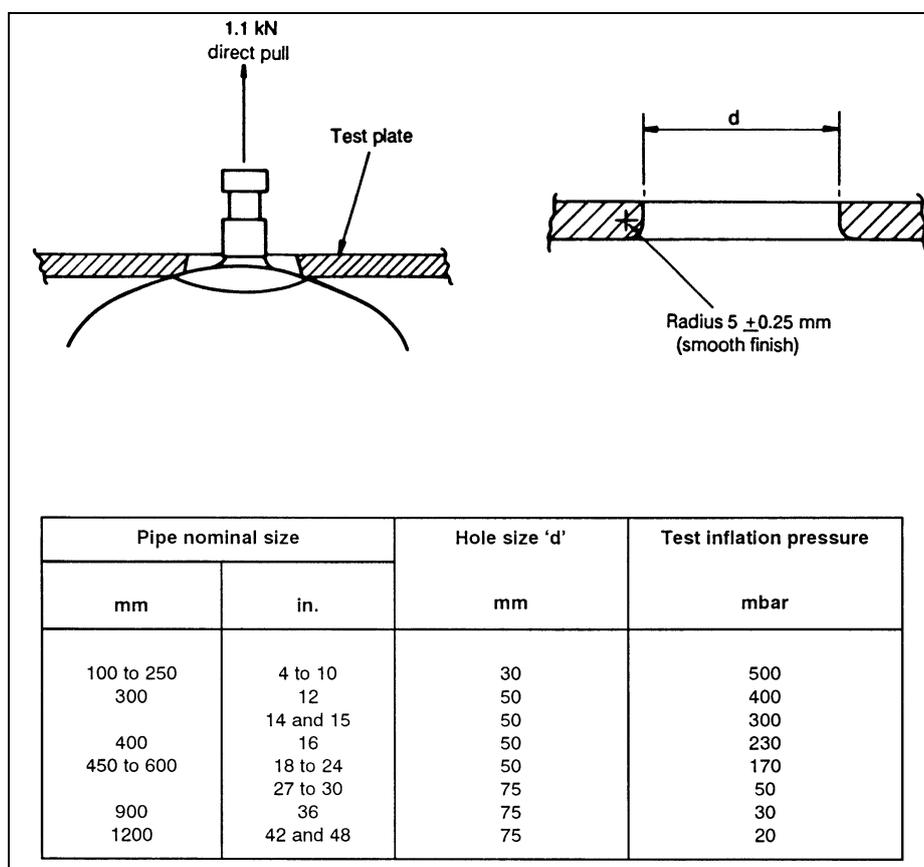


Figure B.1 — Test plate dimensions and bag pressures for neck pull tests

Annex C (normative)

Leakage past the stop bag

C.1 Principle

This test investigates the amount of leakage past the stop bag under working conditions.

C.2 Apparatus

C.2.1 *Completed stop bag*, at recommended working inflation pressure.

C.2.2 *Secondary support tube*, appropriate for the stop bag being tested, as specified in Figure C.2.

C.2.3 *Pipe*, of appropriate maximum tolerance bore for the stop bag being tested, as specified in Table 2.

C.2.4 *Flow meter*.

C.2.5 *Air supply inlet*.

C.3 Procedure

C.3.1 Set up the apparatus as illustrated in Figures C.1 and C.2 and Table D.1.

C.3.2 Ensure that the stop bag is seated against a secondary support tube as illustrated in Figure C.1.

C.3.3 Ensure that the pipe is pressurized to the maximum pipe pressure (P_1) given in Table 2.

C.3.4 Inflate the stop bag to the maximum bag inflation pressure (P_2) given in Figure C.1.

C.3.5 Record leakage past stop bag using the flow meter.

C.4 Result

The leakage rate shall be below the maximum given in Table C.1.

Table C.1 — Pressures and acceptable leakage rate for leakage past the stop bag

Pipe nominal size		Maximum iris stop working pressure: P_1	Maximum bag inflation pressure: P_2	Maximum acceptable leakage rate
mm	in	mbar	mbar	scmh
100 and 150	4 and 6	2000	2350	6.0
200	8	2000	2350	8.0
250	9 and 10	2000	2350	10.0
300	12	1700	1980	11.0
	14 and 15	1200	1400	11.5
400	16	950	1150	12.0
450	18	700	875	12.0
500 and 600	20 to 24	700	840	13.5
	27 to 30	200	305	15.0
900	36	140	210	15.0
	42	70	120	18.0
1200	48	35	70	18.0

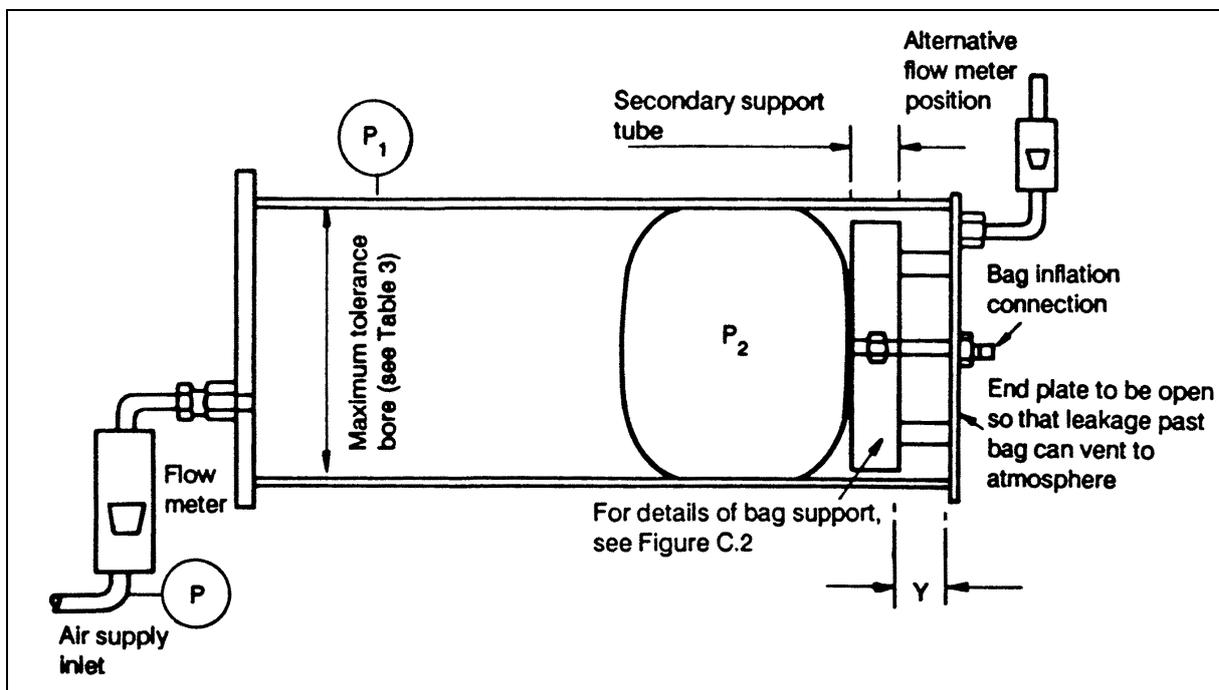
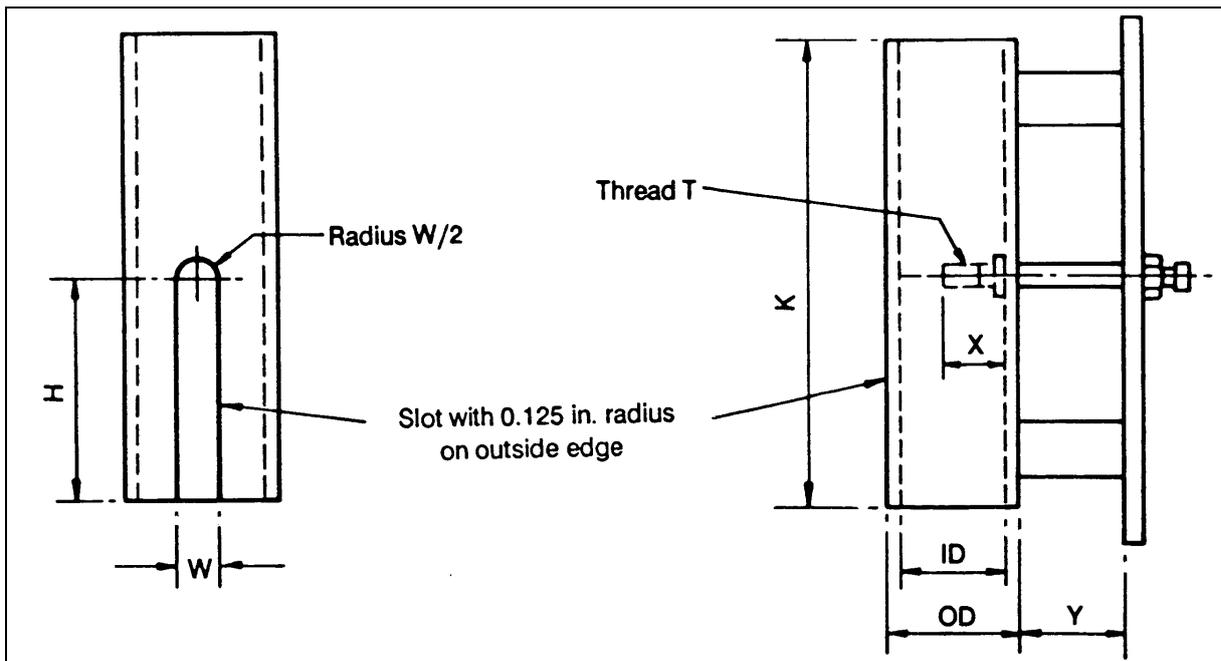


Figure C.1 — Equipment for testing leakage past the stop bag



Pipe nominal size		K	Y
mm	in.	mm	mm
100	4	95	50
150	6	154	50
200	8	208	50
	9	225	50
250	10	257	50
300	12	303	50
	14	349	50
	15	384	50
400	16	393	100
450	18	459	100
500	20	493	100
	21	533	100
600	24	613	100
	27	670	150
	28	710	150
	30	762	150
900	36	919	200
	42	1078	250
1200	48	1232	250

NOTE - For dimensions not shown above see Table D.1.

Figure C.2 — Dimensions of simulated secondary stop bag support

Annex D (normative)

Stop bag insertion test

D.1 Principle

This test investigates whether a completed stop bag can be inserted, positioned and inflated in the appropriate size pipe through the specified hole.

D.2 Apparatus

D.2.1 *Completed stop bag.*

D.2.2 *Stop bag inflation tube*, comprising an elbow male to female conforming to BS EN 10241.

D.2.3 *Secondary support tube*, appropriate for the stop bag being tested.

D.2.4 *Pipe*, of appropriate maximum tolerance bore for the stop bag being tested, as specified in Table 2, including a drilled hole of dimensions specified in Table D.1.

D.3 Procedure

D.3.1 Set up the apparatus as illustrated in Figures D.1 and D.2.

D.3.2 Attempt to insert and position a secondary stop bag in the pipe through the specified hole.

D.3.3 Attempt to fit the secondary support and inflate the stop bag inflated to its recommended differential pressure, given in Table 2.

D.3.4 Deflate the stop bag and remove it from the pipe.

D.3.5 The force applied to the stop bag during these operations shall not exceed 600 N.

D.4 Result

The stop bag shall be capable of passing through the appropriate sized hole in the pipe and being correctly positioned in the pipe ready for inflation.

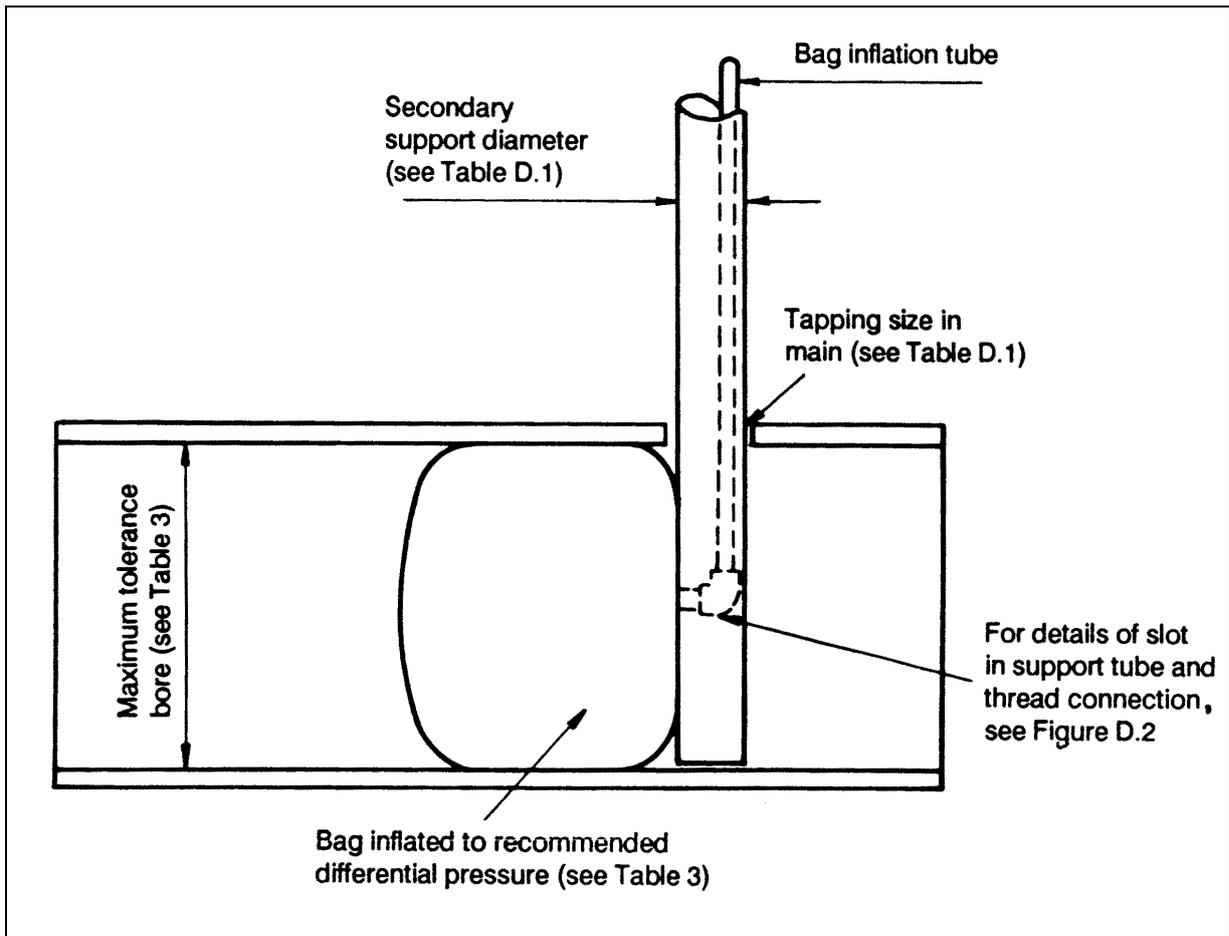


Figure D.1 — Equipment for stop bag insertion test

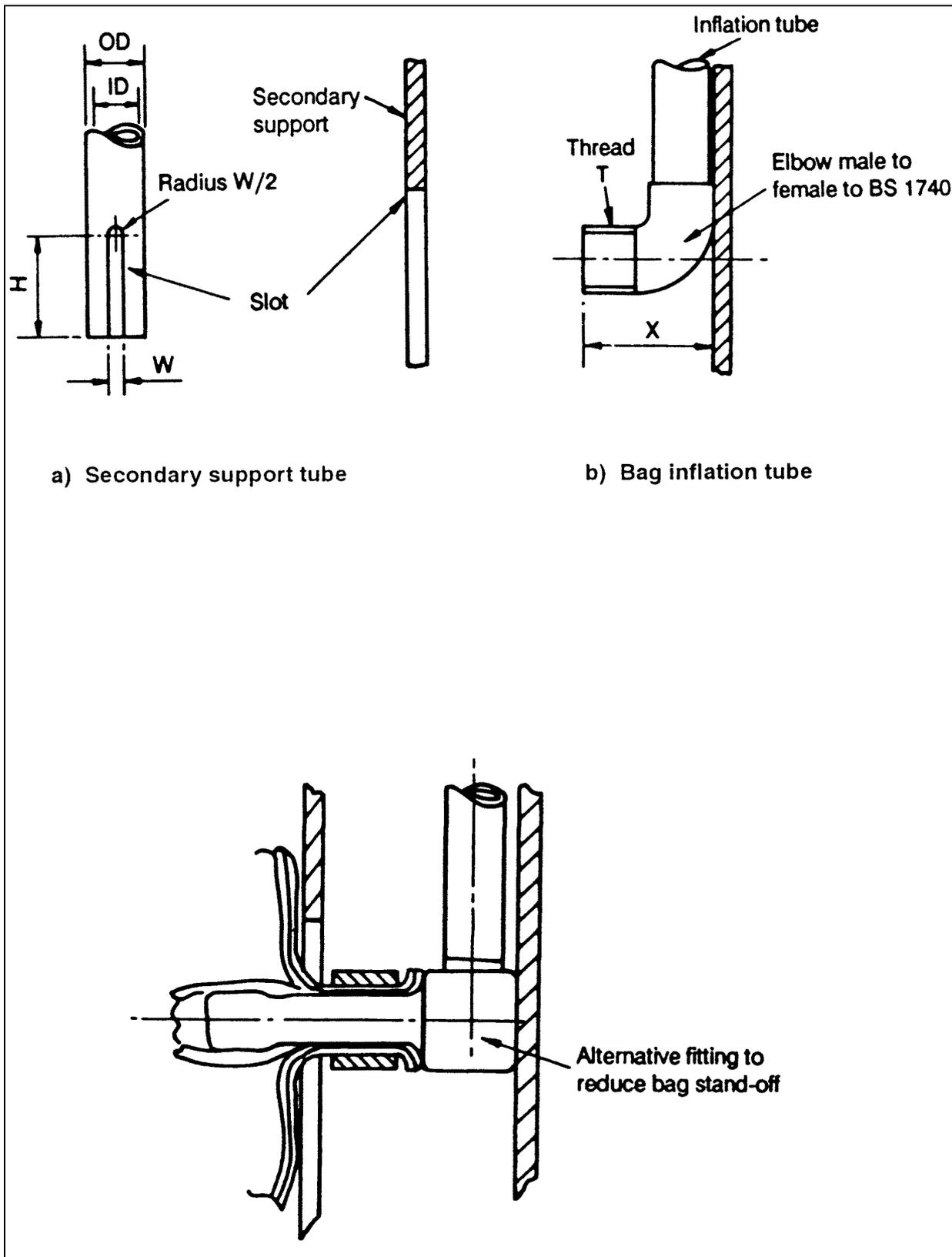


Figure D.2 — Details of secondary support and stop bag inflation connection

Table D.1 — Secondary stop bag support and inflation tube sizes

Pipe nominal size		Tapping size in pipe in BSP	Slot dimensions		Secondary bag supports		Inflation connection	
			H ^{a)} mm	W ^{a)} mm	OD mm	ID mm	X ^{a)} mm	Thread T ^{a)} in BSP
mm	in							
100	4	1 ¼	64	25	38	30	38	¼
150	6	1 ½	89	25	42	34	38	¼
200	8	2	114	25	51	43	38	¼
250	9 and 10	2 ½	140	38	70	57	57	¾ taper
300	12 to 15	3	203	38	83	64	57	¾ taper
400 and 450	16 and 18	4	241	38	108	89	57	¾ taper
500	20 and 21	5	318	38	133	108	57	¾ taper
600 to 1200	24 to 48	6	See Note	38	159	133	57	¾ taper
a) See Figure D.2.								
NOTE For pipe nominal bores 24 in to 48 in, H = (nominal bore/2) + 13 mm.								

Annex E (normative)

Upper pressure test

E.1 Principle

This test is to ensure that the stop bag will remain in position without bursting, seriously distorting at the seams or panels, or being pushed past the support tube.

E.2 Apparatus

E.2.1 *Completed stop bag*, at recommended working inflation pressure.

E.2.2 *Calibrated pressure transducers*, with ranges suitable for measuring the pressures given in Table E.1.

E.2.3 *Two-channel chart recorder*.

E.2.4 *Secondary support tube*, appropriate for the stop bag being tested, as detailed in Figure C.2.

E.2.5 *Pipe*, of appropriate maximum tolerance bore for the stop bag being tested, as specified in Table 2, including a drilled hole of dimensions specified in Table D.1.

E.2.6 *Air pressure source to provide required test pressure*.

E.3 Procedure

E.3.1 Set up the apparatus as illustrated in Figure E.1.

E.3.2 Record the upstream pressure and bag pressure against time on the chart recorder.

E.3.3 Inflate the stop bag to its maximum working inflation pressure, as given in Table 2.

E.3.4 Raise the upstream pressure until the stop bag slips into position against the support tube.

E.3.5 With the stop bag in position against the support tube, adjust the upstream pressure to give the test differential pressure given in Table E.1. Maintain this differential pressure for the duration of the test allowing a tolerance of +35, -0 mbar.

E.3.6 Increase the upstream and bag pressures, always maintaining the test differential to prevent slip.

E.3.7 When the stop bag pressure is at 80 % of the P_b value given in Table E.1, leave for 5 min.

E.3.8 Raise the bag pressure every 5 min, in increments of 5 % of the value given in Table E.1, until the upper limit is reached; leave pressurized for 5 min.

E.3.9 Reduce pressures slowly, maintaining the differential.

E.4 Result

The stop bag shall withstand the pressures given in Table E.1 without bursting, seriously distorting at seams or panels, or being pushed past the secondary support.

Table E.1 — Upper test pressures

Pipe nominal size		Upstream pressure (P_{us})	Test differential pressure	Bag pressure (P_b)
mm	in.			
100 to 250	4 to 10	6000	1050	7050
300	12	5100	840	5940
	14 and 15	3600	600	4200
400	16	2850	600	3450
450	18	2100	520	2620
500 and 600	20 to 24	2100	420	2520
	27 to 30	600	315	915
900	36	420	210	630
	42	210	150	360
1200	48	105	105	210

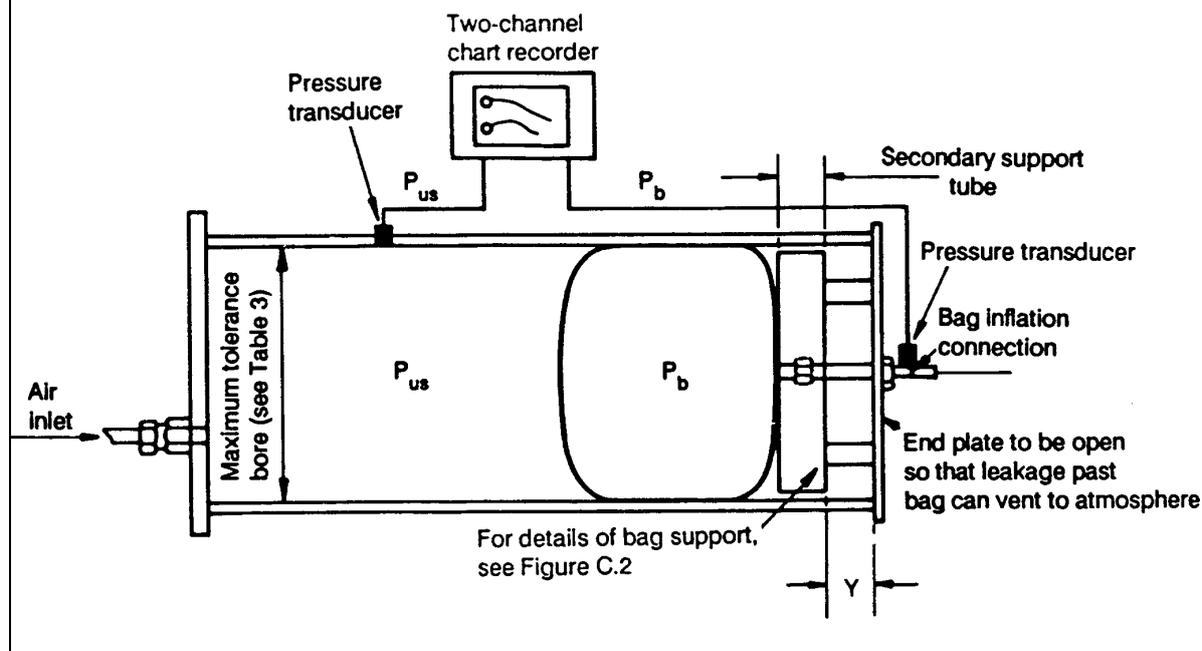


Figure E.1 — Equipment for upper pressure test