

Loss Prevention Standard

LPS 1261: Issue 1.2

Requirements for testing flexible hoses for sprinkler systems

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Issue 1.2	LOSS PREVENTION STANDARD	LPS 1261
Date: Jan. 2014	Requirements for testing flexible hoses for sprinkler systems	Page 1 of 15

CONTENTS	PAGE
PARTICIPATING ORGANISATIONS	2
REVISION OF LOSS PREVENTION STANDARDS	2
NOTES	3
1. SCOPE	4
2. DEFINITIONS	4
3. INFORMATION TO BE SUPPLIED BY APPLICANT	4
4. SPECIMENS TO BE SUPPLIED FOR TESTING	5
5. TESTING PROTOCOL	5
6. PRE-CONDITIONING	5
7. TEST REQUIREMENTS	7
PUBLICATIONS REFFERED TO	14
Table of amendments issued since publication	15

Issue 1.2	LOSS PREVENTION STANDARD	LPS 1261
Date: Jan. 2014	Requirements for testing flexible hoses for sprinkler systems	Page 2 of 15

PARTICIPATING ORGANISATION

This standard was prepared by Technical Panel C of the Loss Prevention Certification Board. The following organisations participated.

Association of British Insurers	(ABI)
British Automatic Sprinkler Association	(BASA)
Confederation of British Industry	(CBI)
International Fire Sprinkler Association	(IFSA)
Local Governments Association	(LGA)
Loss Prevention Council/Fire Risk Sciences	(LPC/FRS)
National Fire Sprinkler Association	(NFSA)
Risk Engineers Data Exchange Group	(REDEG)

REVISION OF LOSS PREVENTION STANDARDS

Loss Prevention Standards will be revised by issue of revised editions or amendments. Details will be posted on our website at www.redbooklive.com

Technical or other changes which affect the requirements for the approval or certification of the product or service will result in a new issue. Minor or administrative changes (e.g. corrections of spelling and typographical errors, changes to address and copyright details, the addition of notes for clarification etc.) may be made as amendments. (See amendments table on page 15)

The issue number will be given in decimal format with the integer part giving the issue number and the fractional part giving the number of amendments (e.g. Issue 3.2 indicates that the document is at Issue 3 with 2 amendments).

USERS OF LOSS PREVENTION STANDARDS SHOULD ENSURE THAT THEY POSSESS THE LATEST ISSUE AND ALL AMENDMENTS.

Issue 1.2	LOSS PREVENTION STANDARD	LPS 1261
Date: Jan. 2014	Requirements for testing flexible hoses for sprinkler systems	Page 3 of 15

NOTES

Compliance with this LPS does not of itself confer immunity from legal obligations. Users of LPSs should ensure that they possess the latest issue and all amendments.

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Issue 1.2	LOSS PREVENTION STANDARD	LPS 1261
Date: Jan. 2014	Requirements for testing flexible hoses for sprinkler systems	Page 4 of 15

1. SCOPE

This Standard describes tests for the assessment of the suitability of flexible hoses to be used for sprinkler systems. Some installation codes may require these products to be supported or may even prohibit the use of these products.

2. DEFINITIONS

Two types of flexibility are possible, 1 and 2

Type 1: hose of high flexibility. This may be used in applications where differential movement between the two ends is expected. (e.g. Supply to storage racks)

Type 2: hose of moderate flexibility. This may be used in applications where little or no differential movement between the two ends is expected after installation. (e.g. Supply to single sprinklers in suspended ceilings)

3. INFORMATION TO BE SUPPLIED BY APPLICANT

3.1 General

Prior to examination and testing an applicant shall furnish comprehensive information about the product for consideration. All documents shall be dated and given a reference number and issue description. If the applicant is not the manufacturer then an application must be accompanied by written permission for testing from the manufacturer.

3.2 Data

The applicant shall supply the following detailed information relating to the product to be tested.

- a) Manufacturing responsibilities:
 - i) Name of manufacturer.
 - ii) Place of manufacture.
 - iii) Year of manufacture.
 - iv) Relationship of applicant to manufacturer.
 - v) Company responsible for design and quality assurance.
- b) Drawings of the components, including:
 - i) Cross sections.
 - ii) General assembly.

Issue 1.2	LOSS PREVENTION STANDARD	LPS 1261
Date: Jan. 2014	Requirements for testing flexible hoses for sprinkler systems	Page 5 of 15

- c) Details of hose (formulation where applicable)
- d) A description of any other materials of construction if not contained on the drawings.
- e) Instructions and specification for installation / use including limitations and recommendations.
- f) Whether the product or hardware are prototypes.

4. SPECIMENS TO BE SUPPLIED FOR TESTING

- a) The applicant shall supply an agreed number of specimens.
- b) When the product incorporates advances or changes in technology, then additional sample pieces, parts or sections may be requested for evaluation prior to the supply of the agreed specimens.
- c) The number and size of specimens to be supplied for test is dependent upon the test schedule specified for the product type, size range and design variations
- d) All specimens shall be supplied complete with specified fixings, seals for installation.

5. TESTING PROTOCOL

General laboratory procedures, confidential handling of specimens, event record requirements and presentation of the test report shall be in accordance with the requirements specified in ISO 17025.

6. PRE-CONDITIONING

A) For Type 1 Flexible Hoses

Prior to each test the product shall be pre-conditioned by bending without pressure for 30,000 cycles in accordance with the following method:

For flexible hose assemblies up to and including DN 100, six samples of each nominal size shall be subjected to a fatigue test (see Figure 1). The test shall be conducted on the hose with the distance between the axis of the end fitting equal to twice the nominal dynamic bend radius given in Table 1.

The hose shall be subjected to repeated flexion at a rate of from 5 cycles/min to 30 cycles/min in a direction parallel with the axis of the hose through a movement of 2x.

Issue 1.2	LOSS PREVENTION STANDARD	LPS 1261
Date: Jan. 2014	Requirements for testing flexible hoses for sprinkler systems	Page 6 of 15

The test shall be conducted using hose assemblies mounted to form a vertical loop as shown in Figure 1. The flexible length of the assembly l , shall be given in the following equation.

$$l = 4r + y$$

where

- r is the nominal dynamic bend radius;
- x is equal to 4 DN or 126mm, whichever is greater;
- DN is the nominal size.

The hose shall not be lubricated prior to or during the test. Where the minimum bend radius specified is less than that stated in Table 1, the minimum bend radius shall be used.

Table 1 – Nominal size and bend radii (radii in millimetres)

Nominal size DN	Nominal static bend radius	Nominal dynamic bend radius	
	Types 1 and 2	Type 1	Type 2
6	25	110	140
8	32	130	165
10	38	150	190
12 ⁽¹⁾	45	165	210
15	58	195	250
20	70	225	265
25	85	260	325
32	105	300	380
40	130	340	430
50	150	390	490
65	200	460	580
80	240	520	660
100	290	600	750
125	For details refer to the manufacturer		
150			
200			
250			
300			
1) Not listed in ISQ 49, which applies to the R10 series			

Issue 1.2	LOSS PREVENTION STANDARD	LPS 1261
Date: Jan. 2014	Requirements for testing flexible hoses for sprinkler systems	Page 7 of 15

B) For Type 2 Flexible Hoses

Prior to each test the product shall be pre-conditioned by bending through 10 cycles without pressure as follows:

For flexible hose assemblies up to and including DN 100, two samples of each nominal size of hose assembly shall be subjected to a bend test in accordance with Figure 2. With one hose end rigidly fixed, the other shall be moved in a circular arc around a former having a radius calculated from the nominal static bend radius as given in Table 1, until the hose assembly is in intimate contact with the full length of the arc of the former.

One stress cycle comprises one bend and the return movement to the straight position. The test shall consist of the assembly being flexed through 10 cycles without pressure as indicated in Figure 2. The test frequency shall be between 10 cycles/min and 30 cycles/min.

Where the minimum bend radius specified is less than that stated in Table 1, the minimum bend radius shall be used.

7. TEST REQUIREMENTS

- 7.1 Examine each component for geometric and dimensional compatibility with the manufacturer's drawings and each other where applicable.
- 7.2 Examine each component type for adequate identification. This shall include: Manufacturer's name, Hose type (1 or 2), size of component, pressure rating, temperature rating and LPCB reference. Normally the marking shall be printed on the product but labels can be used where this is not possible.
- 7.3 Assess the clarity, accuracy and provision of essential component details within the assembly instructions. Ensure that all components fit together.
- 7.4 Check that the components shall maintain structural integrity and shall not leak when subjected to a hydrostatic pressure four times the maximum working pressure ± 1 or 48 bars, whichever is the greater, for 5 minutes $-0, +30$ seconds.
- 7.5 Check that the components shall maintain structural integrity and shall not leak when subjected to the maximum working pressure ± 1 bar or 48 bar, whichever is the greater, for 5 minutes $-0, +30$ seconds, and a temperature of $50^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 90 days. The test is to determine whether jointing materials/adhesives weaken at elevated temperatures.
- 7.6 Check that the components shall maintain structural integrity and shall not leak when subjected to a pressure four times the maximum working pressure ± 1 bar or 48 bar, whichever is the greater, for 1 hour. This test is to determine whether jointing materials/adhesives are weakened by creep.
- 7.7 Check that the components shall maintain structural integrity and shall not leak at a pressure four times the maximum working pressure ± 1 bar or 48 bar, whichever is the greater, for 5 minutes $-0, +30$ seconds after the following conditioning:

Issue 1.2	LOSS PREVENTION STANDARD	LPS 1261
Date: Jan. 2014	Requirements for testing flexible hoses for sprinkler systems	Page 8 of 15

The assembly shall be pressurised with air to 3 bar \pm 0.5 bar to stabilise the assembly and checked for leakage.

The assembly is to be de-pressurised and filled with water to 60% \pm 5% of volume, sealed and placed in an oven and heated to 95°C + 5°C/-0°C for 90 days +5 days/-0 days.

On completion of the ageing period the assembly shall be removed and allowed to cool at an ambient temperature of 25°C \pm 10°C for at least 24hr before being subjected to the pressure test in Clause 7.4

The samples should be weighed before and after the test to determine the degree of moisture absorption.. This Clause shall not be performed on steel or stainless steel pipes unless they incorporate a gasket or other sealing device

- 7.8 Check that the components shall maintain structural integrity and shall not leak at a pressure four times the maximum working pressure \pm 1 bar or 48 bar, whichever is the greater, for 5 minutes –0, +30 seconds, after conditioning at a temperature of –20°C \pm 3°C for 24 hours. This Clause shall not be performed on steel or stainless steel pipes unless they incorporate a gasket or other sealing device.
- 7.9 Record change of state of materials after subjecting the components to clause 8.2 of BS 3506 Appendix A.4. *This Clause shall not be performed on stainless steel pipes, unless they have a plastic cover.*
- 7.10 Check that the components shall maintain structural integrity and shall not leak at a pressure four times the maximum working pressure \pm 1 bar or 48 bar, whichever is the greater, for 5 minutes –0, +30 seconds after conditioning in sulphuric acid in accordance with clause 8.4 of BS 3506/clause 4.2 of BS 4346.
- 7.11 Check that the components shall maintain structural integrity and shall not leak at a pressure four times the maximum working pressure \pm 1 bar or 48 bar, whichever is the greater, for 5 minutes –0, +30 seconds after immersion in bleach for 30 days at 20°C \pm 5°C. There after test to destruction to determine whether the hose or fittings had been weakened. This Clause shall not be performed on stainless steel pipes.
- 7.12 Check that the components shall maintain structural integrity and shall not leak at a pressure four times the maximum working pressure \pm 1 bar or 48 bar, whichever is the greater, for 5 seconds –0, +30 seconds after conditioning in acetone when tested in accordance with clause 8.3 of BS 3506.
- Record any change in state. This Clause shall not be performed on stainless steel pipes.
- 7.13 Check that the components shall maintain structural integrity and shall not leak at a pressure four times the maximum working pressure \pm 1 bar or 48 bar, whichever is the greater, after exposure to normal daylight for 90, 180 and 360 days. *This Clause shall not be performed on stainless steel pipes.*
- 7.14 Record change of state of materials after subjecting the components to impact utilising clause 9.2 of BS 3506. Each diameter/size shall be subjected to this test.
- This Clause shall not be performed on stainless steel pipes.
- 7.15 Check that the components shall maintain structural integrity and shall not leak at a pressure four times the maximum working pressure \pm 1 bar or 48 bar for whichever is the greater, after completion of the crushing test described below:

Issue 1.2	LOSS PREVENTION STANDARD	LPS 1261
Date: Jan. 2014	Requirements for testing flexible hoses for sprinkler systems	Page 9 of 15

The flexible connection with the cover removed shall be subjected to a crushing load of 100kg applied evenly over a length of 50mm for 30s. The connection shall not collapse or show signs of permanent deformation in excess of 5% of any appropriate dimension measured before the test.

- 7.16 At least one flexible hose of each product range shall be subjected to salt spray conditioning in accordance with BS EN 60068-2-52:1996 Test K6 Salt Mist Cyclic (Severity 1).

On completion of the salt spray conditioning, the assemblies shall be subjected to the hydrostatic pressure test of 7.4. No leakage shall occur. The conditioned assemblies shall be dismantled and examined for the effects of the corrosion.

- 7.17 Check that the components shall maintain structural integrity and shall not leak at a pressure four times the maximum working pressure ± 1 bar or 48 bar, whichever is the greater, for 5 minutes $-0, +30$ seconds after completion of the SO₂ conditioning below:

The test equipment shall consist of a 10 litre vessel* made of heat-resistant glass, with a corrosion-resistant lid of such a shape as to prevent condensation dripping on the hose. The vessel shall be electrically heated through the base, and provided with a cooling coil around the side walls. A thermostat placed 45 ± 5 mm above the bottom of the vessel, shall regulate the heating so that the temperature inside the glass vessel is $45 \pm 3^\circ\text{C}$.

During operation when the heating is switched on, water shall flow through the cooling coil at sufficient rate to keep the discharge temperature below 30°C .

*Other sizes of vessel may be used with proportionate quantities of chemicals.

The hose to be tested shall be suspended under the lid inside the vessel and subjected to a corrosive sulphur dioxide atmosphere for 16 days. The corrosive atmosphere shall be obtained by introducing a solution made up by dissolving 40g of sodium thiosulphate crystals in 1 litre of water.

The test shall last two periods of 8 days. Each day 40ml of dilute sulphuric acid consisting of 156ml of normal H₂SO₄ per litre of water shall be added at a constant rate. After 8 days the hose shall be removed from the container, and the container emptied and cleaned. The procedure described above shall then be repeated for the second period of 8 days. After 16 days the hose shall be removed from the container and allowed to dry for 24 hours at a temperature not exceeding 35°C with a relative humidity not greater than 70%.

7.18 Dry Pipe Fire Test

- 7.18.1 The test is to be carried out indoors. A flexible hose assembly shall be configured as in Fig. 1. The flexible hose assembly shall be pressurised with air to 3 bar $+0.5$ bar/ -0 bar for 3 minutes. The flexible hose assembly shall then be subjected to a fire test. The air pressure shall be kept constant by venting.

Within 60 seconds of initiation of the test a temperature of $800^\circ\text{C} \pm 50^\circ\text{C}$ shall be achieved 13mm-15mm from the surface of the flexible hose. An average temperature of 800°C shall be maintained around the flexible hose for a period of at least 6 minutes.

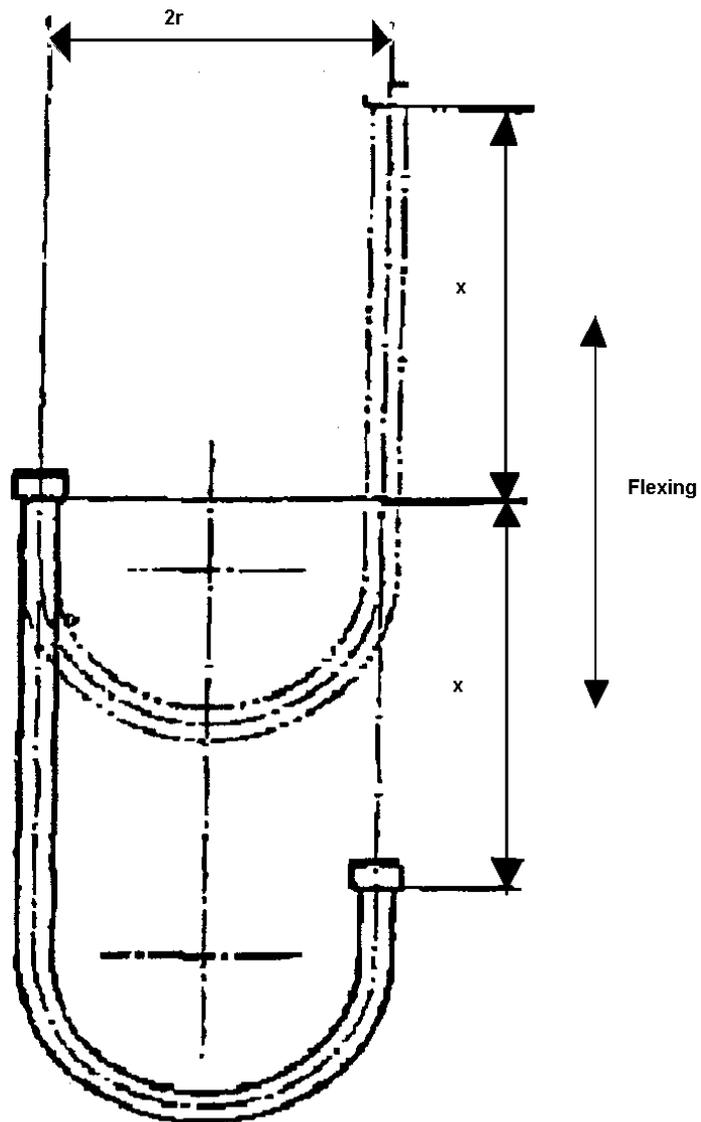
- 7.18.2 7 min $+30\text{s}/-0\text{s}$ after the start of the test the fire tray shall be removed and the assembly shall be filled with cold water and pressurised to 8 bar ± 1 bar for 2 min $\pm 30\text{s}/-0\text{s}$.

Issue 1.2	LOSS PREVENTION STANDARD	LPS 1261
Date: Jan. 2014	Requirements for testing flexible hoses for sprinkler systems	Page 10 of 15

- 7.18.3 After the water pressure test the assembly shall be disassembled and visually examined for evidence of fire damage and/or distortion that may affect the integrity of the assembly.
- 7.18.4 The flexible hose shall satisfy the following requirements:
- a) The flexible hose must maintain the integrity of the pipework throughout the test but the seals can leak.
 - b) There shall be no visual evidence (excluding heat and smoke discolouration) of fire damage and/or distortion of those flexible hose components, which assist in maintaining the integrity of the pipework.
- 7.19 Assess the effect of reaction forces on a typical pipe work installation upon activation of a sprinkler head. Install an appropriate water supply and connect a flexible hose terminating in a sprinkler in a suspended ceiling. The longest flexible hose under test with the maximum number of bends allowed by the manufacturer shall be installed in accordance with the manufacturers instructions. Where the product is designed to connect up to a sprinkler in a suspended ceiling, the suspended ceiling shall consist of one fire rated tile 600mm x 600mm.
- Then subject the installation to an internal standing pressure of $12\text{bar} \pm 0.5\text{bar}$, and operate the sprinkler. Maintaining a running pressure of $11\text{bar} \pm 0.5\text{bar}$ for 2 min and record observations of the effect of the discharge. The sprinkler head must remain in position.
- The pressure loss through each length of hose with the maximum number of bends shall be determined and the equivalent length of steel pipe calculated by the manufacturer and supplied to the test house.

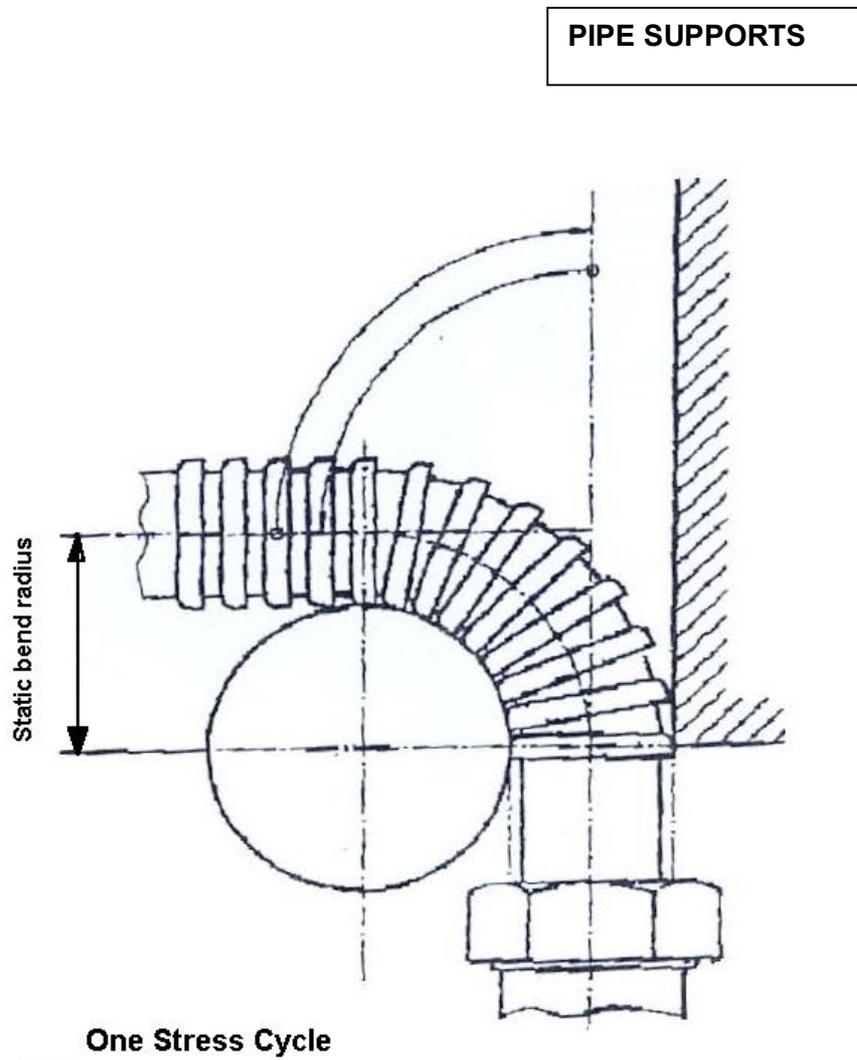
Issue 1.2	LOSS PREVENTION STANDARD	LPS 1261
Date: Jan. 2014	Requirements for testing flexible hoses for sprinkler systems	Page 11 of 15

Figure 1: Pre-conditioning test



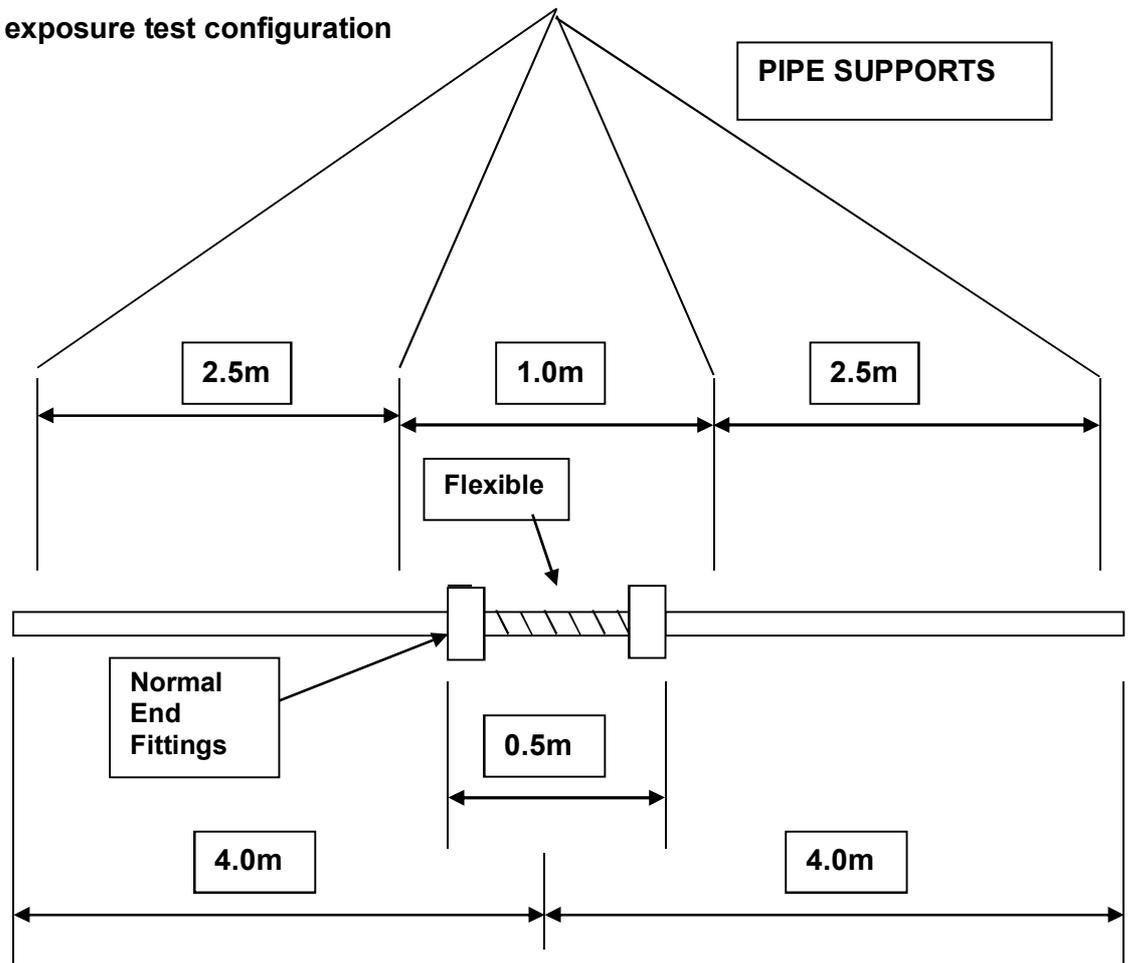
Issue 1.2	LOSS PREVENTION STANDARD	LPS 1261
Date: Jan. 2014	Requirements for testing flexible hoses for sprinkler systems	Page 12 of 15

Figure 2: Pre-conditioning test



Issue 1.2	LOSS PREVENTION STANDARD	LPS 1261
Date: Jan. 2014	Requirements for testing flexible hoses for sprinkler systems	Page 13 of 15

Figure 3: Fire exposure test configuration



- Note 1. Flexible length is 0.5m or minimum possible whichever is the greater.
- Note 2. Pipe shall be grooved or screwed at one end and, as appropriate, shall have a pressure / leak tight blank at the other end or a suitable fitting which can be adapted to ISO 7/1-Rp 1.
- Note 3. Provision shall be made for:
- Pressure charging connection.
 - Pressuring monitoring.
 - Vent valve.
 - Drainage.
- Note 4. The flexible assembly shall be supported as shown. The flexible shall be positioned over the centre of the fire test tray.
- Note 5. For temperature monitoring, four thermocouples shall be placed at various places within 13mm to 15mm of the flexible assembly, level with the horizontal centre line.
- Note 6. For wet pipe test a band should be placed around the fire test tray to contain fire overspill and safety precautions observed.

Issue 1.2	LOSS PREVENTION STANDARD	LPS 1261
Date: Jan. 2014	Requirements for testing flexible hoses for sprinkler systems	Page 14 of 15

PUBLICATIONS REFERRED TO

ISO10380	Corrugated flexible metallic hose and hose assemblies
ISO 17025	General requirements for the competence of testing and calibration laboratories
LPS1039 : Issue 5	Requirements and Testing Methods for Automatic Sprinklers
BS 3506: 1969	Specification for unplasticized PVC pipe for industrial uses
BS 4346: Part 3: 1982	Joint Fittings for use with unplasticized PVC Pressure Pipes
BS EN 3-1: 1996	Portable Fire Extinguishers Part 1 Description, Duration of Operation, Class A and B Fire Tests
BS 669: Part 2: 1997	Flexible hoses, end fittings and sockets for gas burning appliances
BS 2011 Pt.2 1Kb: 1987	Basic environment testing procedures. Salt Mist, Cyclic (Sodium Chloride solution)
BS EN 60068-2-52 : 1996	Environmental testing. Test methods. Tests. Test Kb. Salt mist cyclic (sodium chloride solution).

Issue 1.2	LOSS PREVENTION STANDARD	LPS 1261
Date: Jan. 2014	Requirements for testing flexible hoses for sprinkler systems	Page 15 of 15

Amendments Issued Since Publication

DOCUMENT NO.	AMENDMENT DETAILS	SIGNATURE	DATE
LPS 1261-1.2	<ol style="list-style-type: none"> 1. New front cover 2. Title added to header 3. Contents page moved to Page 1 4. Added Revision of Loss Prevention Standards on Page 2 5. Notes added on Page 3 6. Repagination 7. Update to copyright information 	DC	Jan. 2014