

Loss Prevention Standard

LPS® 1666 : Issue 1.0

Requirements and test procedures for the LPCB approval of direct low pressure (DLP) application fixed fire suppression systems.

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PARTICIPATING ORGANISATIONS

This standard was approved by the BRE Global Governing Body with input from the BRE Global Standing Panel and Fire Suppression Liaison Group. The following organisations participated in the preparation of this standard:-

Association for Specialist Fire Protection (ASFP)
 Association of Insurance Surveyors
 Association of Tanks and Cistern Manufacturers (ATCM)
 Heathrow plc
 British Automatic Fire Sprinkler Association (BAFSA)
 British Property Federation (BPF)
 Chief Fire Officers' Association (CFOA)
 Construction Industry Council (CIC)
 Construction Products Association
 Fire Industry Association (FIA)
 Home Builders Federation (HBF)
 Homes & Communities Agency
 NHBC
 RICS
 Risktech Ltd
 Sustainability + Architecture
 Sustainable by Design

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REVISION OF LOSS PREVENTION STANDARDS

Loss Prevention Standards (LPSs) 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.

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 LPSs should ensure that they possess the latest issue and all amendments.

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FOREWORD

This Standard identifies the evaluation and / or testing practices undertaken by LPCB for the purposes of approval and listing of products and services. LPCB listing and approval of products and services is based on evidence acceptable to LPCB:-

- that the product or service meets the standard;
- that the manufacturer or service provider has staff, processes and systems in place to ensure that the product or service delivered meets the standard

and on:-

- periodic audits of the manufacturer or service provider including testing as appropriate;
- compliance with the contract for LPCB listing and approval including agreement to rectify faults as appropriate;

The responsibility for ensuring compliance with the technical and managerial process and requirements for the product or service lies with the manufacturer, service provider or supplier.

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.

LPCB welcomes comments of a technical or editorial nature and these should be addressed to “the Technical Director” at enquiries@breglobal.co.uk.

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1 SCOPE

This document specifies the requirements and test procedures for LPCB approval of direct low pressure (DLP) application fixed fire suppression systems, using heat sensitive pneumatic detection tubing, designed for the protection of small unoccupied defined volume enclosures such as electrical switchgear cabinets, server racking and similar installations from small local flaming fire sources. The systems use a single method for detection and delivery of the extinguishing agent to the activation point.

The objective of the approval is to assess the ability of the system to prevent fire spread between units by evaluating the effectiveness and reliability of a system to detect and extinguish the fire at its source. The system shall also be capable of isolating the power to the protected enclosures and generating a signal for an alarm. The evaluation of a system is essentially a verification of the parameters specified in the system manual.

The selection and specification of fire protection equipment should be based on the completion of a suitable risk assessment and local regulatory requirements.

These systems are intended solely to provide enhanced local fire protection. They are not intended for use as whole room or building fire protection systems.

The requirements and test procedures specified herein are those which generally enable a satisfactory evaluation of a system to be made. However, the LPCB reserves the right to apply special considerations dependant on the scope of application of a particular system if it is not adequately dealt with by this standard.

The scheme provides approval for systems with:

- A single container heat detection tube installation protecting a maximum single volume of 2m³.
- Up to 4 heat detection tube runs connected to a single container where no single protected volume exceeds a 2m³ volume.
- A maximum heat detection tube length of 10m from the container outlet to the end of any single detection tube run.

The range of materials and products employed within these enclosed volumes is large and whilst this scheme addresses a number of potential fire scenarios it cannot be considered to address all applications in particular where the electrical power supply is not isolated/removed upon activation of the suppression system and the risk of re-ignition remains high.

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2 DEFINITIONS

2.1 Design concentration

The concentration of extinguishant, including a safety factor, required for system design purposes.

2.2 Small enclosure

Contained enclosure which may contain multiple sub-compartments. The total enclosure volume shall be less than or equal to 2m³ (including the multiple sub-compartments).

2.3 Direct Low Pressure (DLP) systems

A system using a single method of detection and delivery of the extinguishing agent to the activation point.

2.4 Pneumatic heat detection system

A system pressurised with gas which when heated activates releasing the fire extinguishing agent at the point of activation.

2.5 Discharge time

Duration of agent discharge.

2.6 Free vent area

The total open, effective area of air vents and unsealed penetrations.

2.7 System manual

A document or documents provided by the system manufacturer giving full instructions on the design, installation, operation, recharging and maintenance of the system.

2.8 Authorised installer

A person trained and registered with the listed company who is authorised to install, maintain and service the approved system.

2.9 Container

The vessel used to hold the extinguishing media.

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2.10 Maximum Activation Height (MAH)

The maximum installed height of the detector tube above the protected risk.

2.11 Maximum system pressure

The maximum operating pressure of the DLP system at 20°C shall not exceed 20 bar.

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3 REQUIREMENTS

The system shall be designed to detect and extinguish fires within small enclosures using pneumatic heat detection tubing. The system shall be capable of:

- Connection to a fire alarm or other warning device.
- Isolating power supplies and auxiliary equipment such as fan units to the cabinet.

3.1 Design Requirements

- a) The system shall protect the defined enclosure and associated fire risks contained within it, in order to prevent fire spread to adjoining cabinets or enclosures. The design concentrations for the fire suppressing agent shall be specified in the system manual.
- b) The system shall be designed to enable a single container heat detection tube installation run to protect a maximum single volume of 2m³.
- c) Up to 4 heat detection tube runs maybe connected to a single container where no single protected volume exceeds a 2m³ volume.
- d) The maximum heat detection tube length from the container outlet to the end of any single detection tube run shall not exceed 10m.
- e) Upon activation, the system shall be capable of isolating any power supply associated with the protected enclosure. Where this is not implemented, a statement shall be included in the design specification and in the associated 'handover documentation'.
- f) It shall not be possible for the user to isolate any electrical power supply or alarm connections to the DLP system without also isolating the power supply to the enclosure, and/or placing the system into an alarm status. If the end user does not require operational shut down of the enclosure during DLP equipment maintenance this shall be clearly stated in the equipment documentation and training.
- g) The system shall be supplied with labels for fixing to the enclosure, stating that the enclosure is fitted with a local direct application extinguishing system and should include the contact information for the system installer and local site responsible person.
- h) The DLP system shall be capable of connection to a sounder or other alarm activation system. The provision of an alarm which sounds in the event of system operation is required. Implementation may not be necessary where, based on local risk assessments, warning devices may not be required such as remote and/or isolated applications.
- i) The system shall display, monitor and provide a low pressure alarm either as a stand-alone alarm unit or for connection to a fire control panel.

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- j) The system design shall state and provide shut down of the airflow / extract fans, if required as part of the specification.
- k) MSDS details for the extinguishing agents, limitations on applications or locations based on the health and safety and/or environmental impact of discharges shall be included.

3.2 System Manual Requirements

3.2.1 Manual Requirements

The system manual shall address the following points and should be read in conjunction with the requirements for training and monitoring installers (Section 3.3).

Multiple manuals such as design guides, installation requirements and user manuals may be provided to address the following requirements:

- a) Scope of application and system limitations, i.e. the types, numbers and dimensions of equipment that may be protected
- b) Health and Safety requirements; including details such as stored pressure requirements, MSDS data for the extinguishing media, warnings regarding toxicity and environmental issues for personnel (not only those working on the systems for installation or maintenance but also working in the general area) and equipment in the area of potential agent discharge events.
- c) Design principles, methodology and guidelines.
- d) Installation, maintenance, servicing and system reset / recharge procedures.

3.2.2 Design Principles

The methodology and requirements for assessing the placement and routing of the detector tube shall be defined in the design manual and training programmes. This shall also be a requirement for the installation and maintenance training programme (See Section 3.3).

3.2.2.1 Application Limits

The application limitations for the system design shall be stated and shall address, as a minimum:

- a) The types of equipment to be protected within the enclosure, including any application exclusions such as types of materials or risk not covered.
- b) The volume and maximum single dimension of the enclosure.
- c) The maximum free vent area.
- d) The maximum air ventilation rate.

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3.2.2.2 Operating Parameters

The operating parameters for the detection and extinguishing components shall also be stated including:

- a) The operating temperature range for the system.
- b) The detection tube pressure operating range.
- c) The operating pressure range for the system.
- d) The design manual shall define details such as minimum bend radius, maximum number of bends per metre, fixing details, material compatibility of the detection tube.
- e) The manual shall state the proximity requirements in terms of the maximum and minimum distances of the detection tube from the defined risk. These dimensions shall be confirmed as part of the approval protocol, see Clause 4.
- f) The system manual shall adequately describe whether or not it is required that any airflow/extract fans be shutdown upon system actuation.

3.2.3 System Installation

The manual shall state that all installation, servicing and maintenance activities shall only be undertaken by installers authorised and trained by the LPCB approved company approved under this scheme. In addition the manual shall contain details, where applicable, of:

- a) Applicable working practice and training requirements.
- b) Details of any specialised tools or equipment.
- c) Fitting requirements such as tightening torques etc.
- d) Health and safety details and practices.
- e) Operating temperature ranges.
- f) Fitting details for containers including provisions for transportation and installation safety systems.

3.2.4 Commissioning

In addition to the training requirements in section 3.3, the manual shall include a check list and operational details for the commissioning of the installation and for re-instatement of the system following maintenance or system reset. This shall cover as a minimum:

- a) Pressure and system leak test.
- b) Clear tube runs, no burrs, kinks or excessive curvatures.
- c) Operation of fault alarms and power cut outs.
- d) Safety warning notifications and hand over documentation.

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3.2.5 Servicing and Maintenance

The manual and associated end user guides shall state:

- a) That only authorised installers shall work on the system.
- b) The service periods and required service activities, including replacement of components, review of protected equipment etc. Servicing with approved spare parts, to include:
 - i. Checks on switches, pressure switches, gauges, detection tube (condition and location), system pressure testing, material compatibility.
 - ii. Risk assessment – has the designated risk changed from the original installation?
- c) Guidance to end user regarding cleaning or maintenance activities and change of use of any protected equipment or risk.
- d) Handover and support to end users, this should include the training and documentation provided to end users, to ensure the on-going operation of the system and should include any regular system testing requirements and service intervals. Details of activities following system reset and recharge, requirements for both authorised installers and end users following system operation or fault.

3.2.6 Details of Components and Auxiliary Equipment

The manual shall include details of all components and auxiliary equipment used for the installation and maintenance of the systems (including spares and consumable products):

- a) Full description; including part numbers and schematics of each component,
- b) Operating parameters such as temperature and pressure ranges,
- c) Material compatibility with the working environment.

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3.3 Training Requirements

The manufacturer or supplier is responsible for the design and installation of an approved system.

The training programme provided to the installer by the manufacturer or supplier, shall be provided in document form to LPCB.

Copies of the training records and certificates shall be maintained by the manufacturer or supplier for those successfully completing the training course.

The manufacturer or supplier shall keep their trained installers informed of product updates and critical issues. The methodology for update programmes and the frequency of refresher courses shall be documented and evidence of attendance at such courses shall be made available as part of the LPCB audit requirements.

The design and installation of systems shall be controlled by the listed manufacturer or supplier. Only trained installers authorised and controlled by the listed manufacturer or supplier shall undertake the installation and maintenance of the systems.

A record of all approved installations shall be maintained for review as part of the audit programme.

Reports of complaints shall be maintained and reviewed as part of the audit programme. Any failures of the units in service shall be notified to LPCB immediately.

3.3.1 Site Audits

Audits of installed systems will be carried out at a frequency and at locations to be determined by LPCB.

The installation audit will include a review of training records, design requirements and component examination.

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4 FIRE EXTINGUISHMENT TESTS

The fire extinguishment tests are designed to benchmark the performance of the system under a range of conditions to determine the detection, discharge and extinguishing characteristics of the system.

LPCB reserve the right to require additional fire extinguishment tests to cover the scope of approval such as force ventilated applications.

The fire test programme consists of three scenarios:

1. Detection Tube Activation Height (see section 4.1)
2. Agent Extinguishing Test (see section 4.2)
3. Cabinet Perimeter Protection (see section 4.3)

4.1 Detection Tube Activation Test

The maximum activation height (MAH) of the detector tube above the protected risk, as specified in the design manual, shall be determined.

The test shall be carried out on both aged (following conditioning to clause 6.5) and unaged samples for all tube variants.

4.1.1 Test Sample

Suitable lengths of both aged and unaged detection tube shall be conditioned at $23 \pm 2^{\circ}\text{C}$ for a minimum of 24 hours prior to testing.

4.1.2 Test Method

The test method shall use the equipment and methodology specified in the relevant clauses of sections 4, 5, 6 and 7 of EN ISO 11925-2 (vertical mount position only). Each tube shall be pressurised to the minimum system working pressure and fitted horizontally into the test frame, so that the height of the lower edge of the detection tube is set at a specified height above the tip of the ignition source.

The MAH, at a flame application time of 30 sec, shall be determined by reducing the distance between the tube and flame tip in 10mm steps until activation is achieved.

4.1.3 Requirements

Three consecutive operations at the MAH are required to confirm the result for both aged and unaged samples.

The variation between the aged and unaged sample shall be no more than $\pm 20\%$. The MAH declared in the design manual, shall be less than or equal to the lowest activation height determined.

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4.2 Agent Extinguishing Tests

The extinguishing discharge tests are intended to investigate efficient delivery of the agent into the chamber.

The test shall be based on Annex A1 of DOT/FAA/AR-01/37.

For each system configuration the test shall be conducted up to five times to determine extinguishing averages. The variables considered shall be:

- container size (based on a maximum 2m³ volume)
- fill pressure (for the given container size – minimum and maximum)
- extinguishing agent
- airflow (still air and maximum airflow)
- free vent area (enclosed box or open vents)

4.2.1 Test Equipment

The test equipment shall consist of a 2m x 0.5m x 2m high box fitted with clear panels to the front face to enable viewing of the fire sources during test, as detailed in Clause A.1.4 of DOT/FAA/AR-01/37.

4.2.2 Fire Source

20 cups shall each be filled with 10ml of water and 5ml of commercial grade heptane floated on the surface of the water.

4.2.3 Instrumentation

The temperature at the centre of the cabinet prior to the start of each test shall be recorded.

A video record shall be taken for each test.

4.2.4 Test Procedure

Test containers shall be conditioned at $20 \pm 5^\circ\text{C}$ for a minimum period of 24 hours prior to testing.

The temperature measured within the centre of the test chamber shall be $25 \pm 5^\circ\text{C}$ at the start of each test.

The mass of the discharged agent shall be recorded by weighing the container before and after discharge.

The system shall be mounted in a suitable location close to the test chamber. A 10m length of tube shall be pressurised to normal system working pressure. A point 200mm from the closed end of the tube shall be activated using a pilot flame source.

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The fixing of the previously activated detection tube shall be fixed such that the discharge point of the system is level and centred left to right with the system inlet port (the tube will be 'open' and unpressurised at the start of each test). See Figure A-6 and A-7 in the DOT/FAA/AR-01/37 standard.

The fire cups are ignited, cabinet doors closed and the cups are allowed to burn for 30 seconds before the systems are activated.

The following records are taken during the test:

- Time for system discharge.
- Mass of agent released during test (container weight before and after test).
- Number of cups extinguished 2 minutes from the start of discharge.

Once the system has discharged the box is cleared of the extinguishing agent and any remaining flaming in the cups are extinguished.

4.2.5 Requirements

The test shall be conducted up to five times for each scenario. The pass/fail criteria shall be applied as follows:

- For each test the number of cups extinguished 2 minutes from the start of discharge shall be determined. A minimum of 5 cups shall be extinguished in any test.
- For each scenario, the average number of cups extinguished over the series shall be greater than or equal to 9.

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4.3 Perimeter Fire Test

The perimeter fire test shall verify the system design arrangements to protect the cabinet from potential secondary fire sources located around the perimeter of the cabinet.

Internal perimeter protection of the cabinet to be protected shall be assessed by placing a fire source in the centre of the test chamber and verifying successful system activation and extinguishment. System control arrangements, including ventilation shut down and signal outputs to enable event annunciation will also be confirmed in the test.

Where the system design allows for air flow and/or ventilation through the cabinet during operation the test shall be repeated, as required, at the maximum permissible airflow rates and with the maximum available free vent areas to confirm system operation.

4.3.1 Test Enclosure Equipment

The test chamber shall comprise a steel enclosure, with a vision panel and openings to enable air vents or mechanical fan arrangements to be installed as required. The dimensions of the test enclosure shall be 1m x 0.5m x 2m high.

4.3.2 System Design

The arrangement of the detection and extinguishment delivery system shall be based on the system manual.

The system design to be tested shall be verified for the design parameters suitable for the proposed approval listing and as specified in the design manual.

4.3.3 Test Procedure

The ignition source shall be formed from 50g of soft wood fibres (as specified in DD CEN/TS1187 Method 1) laid as a single layer in the base of the enclosure. The time to activation of the system and the time to extinguish the ignition source shall be recorded.

The activation distance of the detection tube above the wood fibres shall be determined to the nearest 25mm for each relevant design parameter (such as with and without ventilation and/or forced airflow) and shall be repeated to confirm the finding.

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4.3.4 Requirements

The following requirements shall be met in each test:-

- a) The fire shall be effectively extinguished within the system discharge time. One minute after the end of the agent discharge there shall be no residual flames burning in any part of the test cabinet.
- b) No burning fuel shall be dispersed from the test fires as a result of agent discharge.
- c) Actuation of the system shall cause shut-down of the power source, if required, and provide annunciation signal.
- d) The declared perimeter activation height in the design manual shall be less than or equal to the lowest perimeter activation height determined.

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5 SYSTEM DISCHARGE TESTS

For each extinguishing agent type and container size the system discharge characteristics shall be determined.

5.1 Minimum Flow Conditions Test

The minimum flow conditions shall be determined for each extinguishing agent at the minimum specified design temperature.

The system shall be based on the design manual requirements, according to the following criteria:

- a) The system shall use the maximum specified length of detection tube (10m or less).
- b) The tube shall be activated within 200mm of the end of the tube, i.e. the furthest distance from the extinguisher container.

5.2 Maximum Flow Conditions Test

The maximum flow conditions shall be determined for each extinguishing agent at the maximum specified design temperature.

The system shall be based on the design manual requirements, according to the following criteria:

- a) The system shall use a 1 metre length of detection tube.
- b) The tube shall be activated within 200mm of the container start of the tube, i.e. the closest distance to the extinguisher container.

5.3 Test Procedure

The system (including the pressurised container, valve and detection tube) shall be conditioned prior to test for the appropriate operating temperature.

For each configuration the system will be tested as follows:

- The mass of the system configuration (container, tube and any ancillary devices) will be recorded before and after activation. The difference in mass shall be recorded.
- The system shall be activated by heating the detection tube at the specified location using a pilot flame source. The time taken for the system to fully discharge following activation will be recorded.

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5.4 Requirements

The system shall function normally during discharge. No deformation, rupture, cracking or splitting of any components shall occur during testing. No leakage or seizure of components during discharge shall occur.

5.4.1 Minimum Flow Conditions

- The discharge shall commence within 10 seconds of activation of the detection tube.
- The discharge time shall be not more than twice the value established at a temperature of 20°C.
- The residual charge shall be not more than 10% of the nominal charge.

5.4.2 Maximum Flow Conditions

- The discharge shall commence within 10 seconds of activation of the detection tube.
- The discharge time shall be not more than the value established at a temperature of 20°C.

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6 COMPONENT EXAMINATION AND TESTS

Set out below are those test methods which are applicable in assessing the reliability and suitability for use of the major components in a system. Table 1 identifies the typical component test requirements for a system. However, the test programme required for a particular system will depend on the design and method of operation as described in the system manual. The precise nature of the test programme shall therefore be decided by the LPCB in each case.

Table 1: Component Test Programme

Test component	Examination	Pressure strength	Leakage	Corrosion	Ageing
Container	6.1	6.2	6.3	6.4	
Container Valve	6.1	6.2	6.3	6.4	
Pressure Gauges	6.1	6.2	6.3	6.4	
Fittings – Metallic	6.1	6.2	6.3	6.4	
Fittings – Non- Metallic	6.1	6.2	6.3		
Detector Tube	6.1	6.2	6.3		6.5

6.1 Examination

Components submitted for test shall be examined visually on the following points prior to test:-

- a) Finished assembly identification markings, pressure strength and fill ratio (where applicable) shall be recorded.
- b) Comparison of specimens with manufacturer's drawings for general form, completeness, capacities and designated markings.

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6.2 Pressure Strength Tests

6.2.1 Containers

Containers shall conform to the requirements of BS EN 3-8 Clause 6.3.2 (burst test) as appropriate.

6.2.2 Control Valve

Control valves shall conform to the requirements of BS EN 3-8 Clause 6.3.2.3 (burst test fittings) as appropriate.

6.2.3 Tube And Ancillary Fitting

The burst or fitting failure pressure for the system shall be determined by hydraulically pressure testing a 10m length of tube containing one in-line connector at the midpoint of the tube and an end of line fitting.

6.3 Leakage Tests

Assemblies (including a suitable tube length) shall conform to the requirements of BS EN 3-7 Clause 8.2 by weight.

6.4 Corrosion Tests

The system shall conform to the applicable requirements of EN 3-7 Clause 14.

For EN 3-7 Clause 14.1 the applicable requirements are:

- a) After operation, the pressure gauge, shall operate by subsequently indicating zero pressure.
- b) Any pressure switches shall operate and signal at the set pressure limits.
- c) Any additional metallic components such as tube joints or t-sections shall be checked for pressure leakage after testing.
- d) There shall be no corrosion of the metal of the system likely to impair its operation or safety.

For EN 3-7 Clause 14.2 the applicable requirements are:

- a) There shall be no visible signs of corrosion of the metal, nor detachment, cracking or bubbling of any protective coating of the body.

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6.5 Pneumatic Heat Detector Ageing Tests

6.5.1 Sample Preparation

A 40m length of pneumatic heat detector tube shall be divided equally into two groups and identified as Group (a) and Group (b), each group shall be 20m in length.

6.5.2 Heat Ageing Sample – Group (a)

Group (a) tube shall be pressurised to 15 bar (or the maximum system working pressure @ 20°C if higher) with Nitrogen, and placed in an oven at $130 \pm 3^\circ\text{C}$ for a period of 90 days.

If a material cannot withstand $130 \pm 3^\circ\text{C}$ without excessive softening, distortion, or deterioration, a lower temperature for a longer period of time may be applied.

The duration of exposure shall be calculated from:

$$D = 737000 e^{-0,0693t}$$

where:

D is the test duration in days;

t is the test temperature in °C.

Note: This equation is based on the approximate 10°C rule; i.e. for every 10°C rise, the rate of chemical reaction is doubled.

6.5.3 Control Sample – Group (b)

The Group (b) detector tube shall be stored at $20 \pm 5^\circ\text{C}$ for 90 days.

6.5.4 Post Ageing Testing

After ageing, 2 lengths of tube from each group shall be operated by placing them in a wind tunnel, in general accordance with BS EN 54-5 at a tube pressure of 15 bar (or the maximum system working pressure @ 20°C if higher) with Nitrogen.

The time and temperature of each tube shall be recorded.

6.5.5 Requirement

- The heat detection tube shall operate satisfactorily after being subjected to the ageing test.
- The operating temperature of the detectors in group (a), when measured, shall be within $\pm 15\%$ of the results for the detectors in group (b).

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7 MARKING, LABELLING AND PACKAGING

The manufacturer shall provide appropriate marking, labelling and packaging for the safe transport and subsequent use of the product as well as clear details of the manufacturer, their contact address, the product model identification and any other safety requirements. See section PN103 – Use of the BRE Global Certification Marks for further details of requirements for LPCB certification.

Each installation shall be fitted with a permanent label providing the following details:

- The model and manufacturer identification
- The LPCB reference marking in accordance with PN103.
- The date of installation
- The date of the next service
- The contact details of the authorised installer.
- Warning not to alter or modify the installation without reference to the authorised installer or manufacturer.

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8 REFERENCES

Publication	Title
BS EN 3-7:2004+A1:2007	Portable fire extinguishers. Characteristics, performance requirements and test methods
BS EN 3-8:2006	Portable fire extinguishers. Additional requirements to EN 3-7 for the construction, resistance to pressure and mechanical tests for extinguishers with a maximum allowable pressure equal to or lower than 30 bar
BS EN 3-9:2006	Portable fire extinguishers. Additional requirements to EN 3-7 for pressure resistance of CO2 extinguishers
BS EN 54-5:2001	Fire detection and fire alarm systems. Heat detectors. Point detectors
BS 6266:2011	Fire protection for electronic equipment installations. Code of practice
BS EN ISO 11925-2:2010	Reaction to fire tests. Ignitability of products subjected to direct impingement of flame. Single-flame source test
DD CEN/TS 1187:2012	Test methods for external fire exposure to roofs
DOT/FAA/AR-01/37 [August 2002]	Development of a Minimum Performance Standard for Hand-Held Extinguishers as a Replacement for Halon 1211 on Civilian Transport Category Aircraft
PN103	Use of the BRE Global Certification Marks

For undated references please refer to the latest published issue.

