PAS 2013-1:2013

Incorporating Corrigendum No. 1

Liquid fire-extinguishing media –

Part 1: Hand-applied units for use on Class F fires (up to 3 L or up to 5 L cooking media) – Specification






ABCB

Callaway's COMMERCIAL INSURANCE

CFOA Chief Fire Officers Association

FIA Fire Industry Association

HouseMark Performance Improvement

IFPO ENITI AD DEFENDERE

uclan University of Central Lancashire

FIRE OUT™

bsi.

Publishing and copyright information

ISBN 978 0 580 87763 6

ICS 13.220.10

The following BSI references relate to the work on this standard:
Draft for comment

Publication history

First published August 2013

Amendments issued since publication

Date	Text affected
30 September 2014	Corrigendum No. 1 to make changes to **6.1**, **E.5.8** and **E.5.13**. See also foreword.

Contents

Foreword

This PAS was sponsored by Fire Out. Its development was facilitated by BSI Standards Limited and published under licence from The British Standards Institution. It came into effect on 31 August 2013.

Acknowledgement is given to Tim Russell, as the technical author, and the following organizations that were involved in the development of this PAS as members of the steering group.

- Association of British Certification Bodies (ABCB)
- Building Research Establishment (BRE)
- Callaways and Sons Insurance Consultants Limited
- Chief Fire Officer's Association (CFOA)
- Fire Brigades Union (FBU)
- Fire Industry Association (FIA)
- Fire Out
- HouseMark Limited
- Institute of Fire Prevention Officers (IFPO)
- University of Central Lancashire (UCLAN)

Acknowledgement is also given to the members of a wider review panel who were consulted in the development of this PAS.

The PAS process enables a specification to be rapidly developed in order to fulfil an immediate need in industry. A PAS can be considered for further development as a British Standard, or constitute part of the UK input into the development of a European or International Standard.

Relationship with other publications

It is envisaged that a further part to PAS 2013 to cover hand-applied units for quantities of cooking media fires greater than 5 L is likely to be developed.

Product certification and testing. Users of this PAS are advised to consider the desirability of third-party certification and testing of product conformity with this PAS. Users seeking assistance in identifying appropriate conformity assessment bodies or schemes may ask BSI to forward their enquiries to the relevant association.

Assessed capability. Users of this PAS are advised to consider the desirability of quality system assessment and registration against the appropriate standard in the BS EN ISO 9000 series by an accredited third-party certification body.

Test laboratory accreditation. Users of this PAS are advised to consider the desirability of selecting test laboratories that are accredited to BS EN ISO/IEC 17025 by a national or international accreditation body.

Information about this document

Text introduced by or altered by Corrigendum No. 1 is indicated in the text by tags [C1⟩ and ⟨C1]. Minor editorial corrections are not tagged.

The figure ≤200 °C has been corrected to ≤300 °C as the piloted ignition temperature of oil is above 300 °C. It is the "fire point" and not the "flashpoint" from *Kirk's fire investigation* [9] that should have originally been referenced.

Hazard warnings

WARNING. This PAS calls for the use of substances and/or procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Use of this document

It has been assumed in the preparation of this PAS that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in italic type, and does not constitute a normative element.

Requirements in this standard are drafted in accordance with *The BSI guide to standardization – Section 2: Rules for the structure, drafting and presentation of British Standards*, subclause **11.3.1**, which states, "Requirements should be expressed using wording such as: 'When tested as described in Annex A, the product shall ...'". This means that only those products that are capable of passing the specified test will be deemed to conform to this standard.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a PAS cannot confer immunity from legal obligations.

Particular attention is drawn to the following specific regulations:

- The Regulatory Reform (Fire Safety) Order 2005 [1];
- The Control of Substances Hazardous to Health (Amendment) Regulations 2004 [2];
- The Control of Substances Hazardous to Health (Amendment) Regulations (Northern Ireland) 2005 [3];
- The REACH Enforcement Regulations 2008 [4];
- The Personal Protective Equipment Regulations 2002 [5].

Introduction

This specification has been sponsored by Fire Out and developed in conjunction with BSI to cover a new type of lightweight fire-extinguishing unit which can be used by a single person to extinguish and cool Class F (cooking media) fires of up to 3 L or of up to 5 L rapidly and simply by placing it in the burning cooking media. Quick application of such a hand-applied unit could help to prevent the escalation of a small fire into a more serious fire. It might also prevent the burns that can result from handling a kitchen pan which has been subjected to fire. The aim of the PAS is to help this area of the fire prevention industry to grow with a series of established benchmarks promoting good practice for manufacturers and for the production of hand-applied units of a consistent and industry-accepted quality. Hand-applied units can be used as part of a wider fire-prevention system. British Standards such as BS EN 1869, BS 7944 and the BS EN 3 series were used to inform the development of PAS 2013-1.

Cooking-related fires are responsible for a high number of casualties and deaths. In Great Britain in 2011 to 2012 alone, there were 2 600 chip or fat pan fires reported.[1)] These fires caused 1 230 casualties and 12 fatalities. Having a readily accessible method for extinguishing a fire that is appropriate for the type of fire, its location and its severity could significantly reduce the fire risks to occupants as well as reducing fire damage to a property. A publication by the Fire Extinguishing Trades Association (FETA) and the Independent Fire Engineering and Distributors Association (IFEDA), called *Report on a survey into portable fire extinguishers and their use in the United Kingdom and other member countries of Eurofeu* [7], states that the Fire and Rescue Service were not called to 75% of fires in the UK. This could indicate that such fires were successfully tackled by those within its proximity. In instances where people attempt to extinguish a fire themselves, it is safer for them to use an appropriate method.

However, it is important to stress that it is not advisable for someone to attempt to approach a fire to apply a hand-applied unit in situations in which it would be considered unsafe to do so (i.e. in situations in which it would be considered too unsafe to approach the fire to turn off the heat).[2)]

NOTE *Attention is drawn to the Regulatory Reform (Fire Safety) Order 2005 [1] for hand-applied units intended for use in non-domestic premises.*

[1)] DCLG report, *Fire Statistics – Great Britain: 2011 to 2012* [6].

[2)] Further information and guidance specifically regarding household fire safety can be found in the DCLG publication, *Fire safety in the home* [8].

1 Scope

This PAS specifies requirements and test methods for hand-applied units containing a non-toxic liquid medium for use to extinguish and cool Class F fires in open-top cooking appliances (e.g. chip pans, deep fat fryers) that involve cooking media (vegetable or animal oils and fats) up to a volume of 3 L or up to a volume of 5 L. It is for use by manufacturers of such hand-applied units.

This PAS covers non-pressurized hand-applied units that are not reusable and that are intended for use by one person. It covers testing for electric shock, durability and inappropriate use.

This PAS does not cover any fire-fighting apparatus that uses a jet-discharge (e.g. fire extinguishers).

***NOTE** For information and requirements for portable fire extinguishers, see BS EN 3 (all parts).*

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensible for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN 60068-2-78, *Environmental testing – Part 2-78: Tests – Test cab: Damp heat, steady state*

BS EN 60584-1 (IEC 60584-1), *Thermocouples – Part 1: Reference tables*

BS EN ISO 13943 (ISO 13943), *Fire safety – Vocabulary*

BS ISO 24153, *Random sampling and randomization procedures*

3 Terms and definitions

For the purposes of this PAS, the terms and definitions given in BS EN ISO 13943 and the following apply.

3.1 Class F fire

fire involving cooking media in cooking appliances

***NOTE** See also BS EN 2:1992, Clause **2**.*

3.2 cooking media

vegetable or animal oils and fats

3.3 hand-applied unit

product that can be held in one hand and applied to a fire to extinguish it by a single person

4 Testing (type tests)

***NOTE 1** Type tests are tests made before supplying a particular type of item on a general commercial basis, to determine whether the item has satisfactory performance characteristics to be suitable for the intended application.*

***NOTE 2** Users might find it desirable to implement a quality control system such as BS EN ISO 9001, or equivalent.*

4.1 General

Type tests shall be carried out on eight hand-applied unit test specimens. These test specimens shall be selected in accordance with BS ISO 24153 and labelled Specimen 1 to Specimen 8.

Specimen 1 to Specimen 8 shall conform to the relevant clauses in accordance with Table 1.

Where a specimen does not conform to the relevant clauses in accordance with Table 1, the hand-applied unit shall be recorded as a failure.

4.2 Repetition of type tests

Type tests shall be repeated when changes are made to the hand-applied unit's:

a) materials;

b) design; or

c) manufacturing process.

Table 1 – Test schedule

Specimen	Test	Clause
	Construction and design tests	
1	Drop test	**5.2**
2	Electrical resistance test	**5.3**
3	Humidity test	**5.4**
4	Nominal volume test	**5.6**
	Performance tests	
5	Fire extinguishing and cooling test (conditioning at 0 °C to 30 °C)	**6**
6	Fire extinguishing and cooling test (conditioning at approximately 0 °C)	**6**
7	Fire extinguishing and cooling test (conditioning at approximately 60 °C)	**6**
8	Inappropriate use test (conditioning at 0 °C to 30 °C)	**6**

5 Construction, design and disposal of the hand-applied unit

5.1 Flammability

The hand-applied unit shall conform to Clause **6**. The outer material of the hand-applied unit may degrade or even burn on contact with flame.

5.2 Drop test

When tested in accordance with Annex A and Annex B, the hand-applied unit shall not leak, break, swell or distort.

5.3 Electrical resistance

When tested in accordance with Annex A and Annex C, the electrical resistance of the hand-applied unit shall not be less than 1 MΩ across 100 mm, as measured across the surface of the hand-applied unit from the body to the handle.

NOTE 1 *See BS EN 62631-1 for further information regarding electrical resistance.*

NOTE 2 *The "handle" of the test specimen is considered to be the part of the hand-applied unit that is held by the user on application. The "body" of the hand-applied unit is considered to be the part that contains the liquid fire-extinguishing media.*

5.4 Humidity (test for damp heat, steady state)

5.4.1 General

The test specimen shall be tested for its influence by the absorption and diffusion of moisture and moisture vapour in accordance with BS EN 60068-2-78, using the parameters and requirements given in **5.4.2** to **5.4.5**.

The test specimen shall be tested for a duration of 21 days (504 h).

5.4.2 Severity

The testing severity parameters shall be as follows:

- temperature: (40 ±2) °C;
- relative humidity: (93 ±3) %rh.

5.4.3 Conditioning

The test specimen shall conform to **A.1.2**. During conditioning, the hand-applied unit shall be repeatedly examined using normal or corrected vision without magnification to detect any leak, break, swelling or distortion. Where a leak, break, swelling or distortion is detected, the specimen shall be recorded as a failure.

5.4.4 Recovery

The recovery period shall be for a minimum duration of 60 min at standard atmospheric conditions for testing.

***NOTE** See BS EN 60068-1:1995, 5.3, regarding standard atmospheric conditions for testing.*

5.4.5 Final measurements

After the recovery period, the hand-applied unit shall be visually examined using normal or corrected vision without magnification and no leak, break, swelling or distortion shall be detected. Where a leak, break, swelling or distortion is detected, the specimen shall be recorded as a failure.

5.5 Disposal

5.5.1 Disposal of the hand-applied unit (unused)

The method(s) of disposal to be specified for the hand-applied unit when intact, or that of its component parts, shall be determined by:

a) the type and properties of the materials used in its construction; and

b) the design of the hand-applied unit.

***NOTE 1** Where practicable, consideration should be given to disposal methods such as recycling, composting and disposal in household waste.*

***NOTE 2** The method(s) of disposal for the hand-applied unit when intact, or that of its component parts, should also be determined within the following scenarios:*

a) when the hand-applied unit for disposal is within its design life (see Annex D); and

b) when the hand-applied unit for disposal is past its design life (see Annex D).

Instructions for disposal of the hand-applied unit shall be documented and included in the product information (see **8.5**).

***NOTE 3** Attention is drawn to the Control of Substances Hazardous to Health (Amendment) Regulations 2004 [2], the Control of Substances Hazardous to Health (Amendment) Regulations (Northern Ireland) 2005 [3] and the REACH Enforcement Regulations 2008 [4].*

5.5.2 Disposal of the hand-applied unit and cooking media residue (used)

The method(s) of disposal for the hand-applied unit and cooking media residue after use in a fire scenario shall be documented and included in the product information (see **8.5**).

***NOTE** Attention is drawn to the Control of Substances Hazardous to Health (Amendment) Regulations 2004 [2], the Control of Substances Hazardous to Health (Amendment) Regulations (Northern Ireland) 2005 [3] and the REACH Enforcement Regulations 2008 [4].*

5.6 Nominal volume

The test specimen and test conditions shall conform to Annex A. The liquid fire-extinguishing media content of the hand applied unit shall be extracted and its volume measured and recorded. When measured, the volume of the liquid fire-extinguishing media shall be within 5% of the nominal volume of the hand-applied unit.

6 Fire extinguishing and cooling performance

6.1 General

When tested in accordance with Annex A and Annex E, the hand-applied unit shall extinguish the Class F fire within 60 s of application and shall cool the cooking media to a temperature of [C1] ≤300 °C [C1] within 15 min of application. There shall be no re-ignition within 20 min.

***NOTE 1** The temperature, [C1] ≤300 °C [C1], is below the piloted ignition temperature for pure edible vegetable oil. Further information can be found in the publication,* Kirk's Fire Investigation*, de Haan and Icove, 2011 [9].*

Application of the hand-applied unit shall not cause enlargement of flame height by more than 10%.

***NOTE 2** Visual recording of the fire tests is carried out to establish conformity with this requirement.*

There shall be no ejection of burning material from the hand-applied unit.

NOTE 3 Burning material refers to physical parts or fragments of the hand-applied unit itself.

When testing Specimen 5, Specimen 6 and Specimen 7, there shall be no ejected cooking media on application of the hand-applied unit.

When testing Specimen 8, any ejected cooking media shall self-extinguish within 10 s and shall not eject onto the person carrying out the test.

Hand-applied units designed for use on up to 3 L or up to 5 L cooking media shall be tested in accordance with **6.2** or **6.3**, as applicable.

6.2 Hand-applied unit (up to 3 L cooking media)

A hand-applied unit for use on Class F fires of up to 3 L cooking media shall conform to **6.1** and be tested in accordance with Annex E using the following variations:

- **E.2.1**a);
- **E.3.1**a); and
- **E.3.2**a).

6.3 Hand-applied unit (up to 5 L cooking media)

A hand-applied unit for use on Class F fires of up to 5 L cooking media shall conform to **6.1** and be tested in accordance with Annex E using the following variations:

- **E.2.1**b);
- **E.3.1**b); and
- **E.3.2**b).

6.4 Inappropriate use test

Hand-applied units for use on either Class F fires of up to 3 L or of up to 5 L cooking media shall conform to **6.1** and be tested in accordance with Annex E using the applicable variations, as given in **6.2** or **6.3**, and the variation **E.5.8**b).

7 Classification for fire applicability

The hand-applied unit shall be classified according to its applicability to Class F fires up to a maximum volume of 3 L or up to a maximum volume of 5 L of cooking media, in accordance with Table 2 and as determined by conformity to Clause **6**. This classification shall be represented in a coded format, i.e. "3F" or "5F".

Table 2 – Fire classifications and cooking media volumes

Classification	Volume of cooking media L
3F	3
5F	5

8 Marking and product information

8.1 General

All markings shall be externally visible and form an integral part of the hand-applied unit.

Any text and markings appearing on the surface area of the hand-applied unit shall be in a colour that contrasts with the background colour.

NOTE 1 See Annex F for recommendations for the colour of hand-applied units.

NOTE 2 See BS ISO 3864-1 for further information regarding contrasting colours.

The hand-applied unit shall be marked with the following:

a) the words, "Fire extinguishing unit" in letters of height not less than 7 mm;

b) the words, "For up to 3 L Class F fires only" or "For up to 5 L Class F fires only", as applicable, in letters of height not less than 3 mm;

c) the method of operation in words with letters of height not less than 3 mm.

NOTE 3 For example: "Turn off heat source; place in burning pan; leave to cool for X min, discard after use".

8.2 Pictograms

In order to reduce the time required to understand instructions and to avoid the confusion that can occur from language barriers, instructions for use shall be provided in the form of pictograms on the surface of the hand-applied unit.

***NOTE** See BS ISO 3864-1 for further information regarding the design principles for safety colours and safety signs of graphical symbols.*

8.3 Required marking

Each hand-applied unit shall be indelibly marked with the following:

a) the number and year of this PAS, i.e. PAS 2013-1:2013 [3)];

b) the appropriate classification(s) in accordance with Clause **7**;

c) the name and/or identification mark of the manufacturer;

d) the week or month and year of manufacture (coded or not coded);

e) the product's applicability to Class F fires, for use on cooking media;

f) markings relating to the intended application and use;

g) the date of expiry of the product;

h) the temperature range at which the hand-applied unit is expected to operate (e.g. 0 °C to 60 °C);

i) critical warnings, e.g. "Do not throw hand-applied unit into the pan. Release hand-applied unit immediately on application. Do not put hand within 100 mm of the burning pan, or stay within 100 mm of the burning pan for more than 4 seconds".

***NOTE** Critical warnings should be written such that they are clear for the intended user group(s).*

8.4 Optional marking

Each hand-applied unit may also be marked with the following:

1) the mark of a certification body, where applicable;

2) the product identification (name and/or catalogue number);

3) the mass of the hand-applied unit in kg.

***NOTE** Attention is drawn to the Control of Substances Hazardous to Health (Amendment) Regulations 2004 [2] and the Control of Substances Hazardous to Health (Amendment) Regulations (Northern Ireland) 2005 [3] which might contain further relevant marking requirements.*

8.5 Product information

Information shall be provided with the hand-applied unit in accordance with Annex G.

[3)] Marking PAS 2013-1:2013 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 PAS. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

Annex A (normative)
Test specimens and test conditions

A.1 Test specimens

A.1.1 General

Each test specimen shall comprise a single hand-applied unit for extinguishing Class F fires. Each test specimen shall be tested separately.

Each test specimen shall be provided with the properties and/or material safety data sheet(s) (MSDS) for all component parts.

NOTE 1 *Attention is drawn to the REACH Enforcement Regulations 2008 [4].*

NOTE 2 *Any other information that could be deemed relevant regarding the proposed application of the test specimen should also accompany the test specimen.*

NOTE 3 *When the specimens are tested, the individual carrying out the testing should not wear reflective clothing as this can reflect the heat of the fire and affect the test results.*

NOTE 4 *Attention is drawn to the Personal Protective Equipment Regulations 2002 [5].*

A.1.2 Conditioning

The test specimen shall be conditioned for 24 h prior to testing. Testing shall be conducted on the test specimen within 30 s of being removed from the conditioning environment.

Specimen 1, Specimen 2, Specimen 3, Specimen 4, Specimen 5 and Specimen 8, shall be conditioned at a temperature of between 0 °C and 30 °C.

NOTE *Ideally conditioning should be undertaken at approximately 20 °C.*

Specimen 6 shall be conditioned at (0 ±5) °C.

Specimen 7 shall be conditioned at (60 ±5) °C.

A.2 Test conditions

A.2.1 General

Tests shall be carried out at a temperature of between 0 °C and 30 °C, unless otherwise indicated within the test parameters.

NOTE 1 *Ideally testing should be undertaken at approximately 20 °C.*

NOTE 2 *See Table 1 for the test schedule.*

A.2.2 Fire extinguishing and cooling test conditions

The location in which the fire extinguishing and cooking media cooling tests are conducted shall be indoors in an environment which is free from draughts and ventilated.

NOTE 1 *Draughts can put out or prevent a test fire from burning effectively. Sufficient ventilation allows the test fire to burn freely and also to remove the products of combustion.*

NOTE 2 *A shipping container may be regarded as an indoor environment.*

Annex B (normative)
Drop test

B.1 Principle

A test specimen is dropped from a height at a horizontal body axis onto a flat concrete surface. The specimen is then dropped again from the same height, but at a vertical body axis. The specimen is subsequently visually examined for leakage, breakage, swelling or distortion.

B.2 Apparatus

B.2.1 *Distance-measuring implement*, capable of measuring a minimum distance of 1.5 m horizontally within an accuracy of ±0.05 m.

NOTE *For example, a tape measure.*

B.2.2 *Flat concrete floor*, measuring dimensions of at least 50% larger than the greatest length of the test specimen and of a minimum thickness of 76 mm.

B.3 Test specimens and test conditions

The test specimens and test conditions used shall conform to **4.1** and Annex A.

B.4 Procedure

B.4.1 Using the distance-measuring implement (**B.2.1**), measure a height of (1.5 ±0.05) m from the flat concrete floor (**B.2.2**).

B.4.2 Position the test specimen at the measured height on a horizontal body axis.

NOTE *The "body" of the test specimen is considered to be the part of the hand-applied unit that contains the liquid fire-extinguishing media.*

B.4.3 Drop the test specimen from the measured height.

B.4.4 Visually examine the test specimen for leakage, breakage, swelling or distortion between 5 min and 6 min after impact, using normal or corrected vision without magnification. Record the results.

B.4.5 Repeat **B.4.1**, and position the test specimen at the measured height on a vertical body axis.

B.4.6 Repeat **B.4.3** and **B.4.4**.

Annex C (normative) Electrical resistance test

C.1 Principle

The electrical resistance of the hand-applied unit is measured between a negative electrode probe and a positive electrode probe.

C.2 Apparatus

C.2.1 *Electrical isolation brackets*, capable of securing the hand-applied unit to the test table

C.2.2 *Megohmmeter*, having a test voltage of 500 V d.c.

C.2.3 *Negative electrode probe*

C.2.4 *Positive electrode probe*

C.2.5 *Test table*, consisting of a horizontal steel or aluminium test surface (1 800 ±10) mm in width and (1 800 ±10) mm in length, and which is (800 ±10) mm in height

C.3 Procedure

Arrange the apparatus as shown in Figure C.1. Secure the test specimen within the electrical isolation brackets (**C.2.1**) above and parallel to the test table (**C.2.5**). Affix the negative electrode probe (**C.2.3**) to the handle of the test specimen and affix the positive electrode probe (**C.2.4**) at a distance of 100 mm on the body of the test specimen (see Figure C.1, key 4 and key 6).

NOTE *The "handle" of the test specimen is considered to be the part of the hand-applied unit that is held by the user on application. The "body" of the hand-applied unit is considered to be the part that contains the liquid fire-extinguishing media.*

Operate the megohmmeter (**C.2.2**) in accordance with the manufacturer's instructions. Obtain and record the results in mega ohms.

Annex D (informative) Design life

The hand-applied unit should have a design life of a minimum of 5 years. This should be determined by:

a) the type and properties of the materials used in the construction;

b) the design of the hand-applied unit;

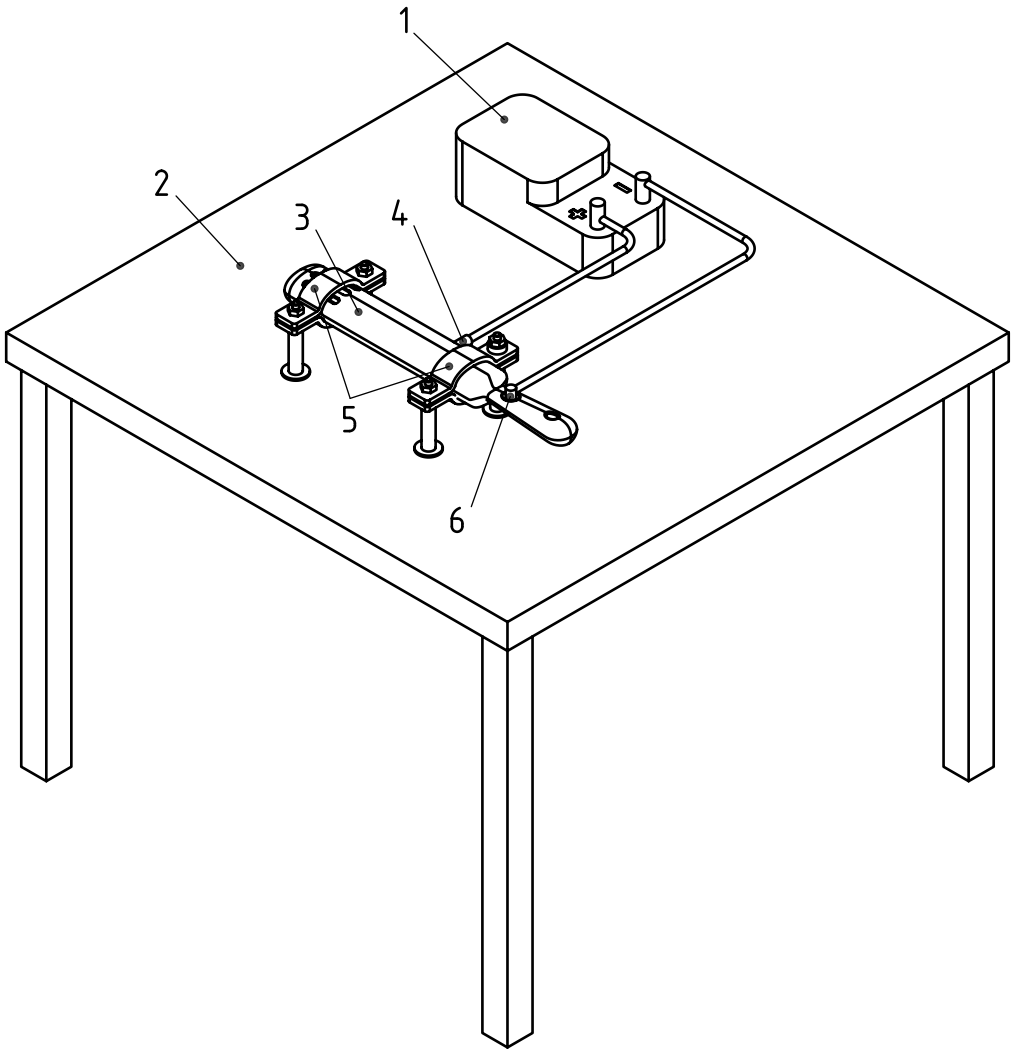
c) the manufacturer-defined conditions of storage; and

d) the conditions of use.

NOTE 1 *Users of this PAS are advised to consider the desirability of demonstrating the design life through compliance with a quality management standard, such as those in the BS EN ISO 9000 series, or equivalent.*

NOTE 2 *It might be advisable to carry out weathering and/or aging tests to determine the expected life of the hand-applied unit.*

Figure C.1 – Apparatus set-up for electrical resistance test



Key

1	Megohmmeter	4	Positive electrode probe
2	Test table	5	Electrical isolation brackets
3	Hand-applied unit [A)]	6	Negative electrode probe

[A)] The hand-applied unit illustrated is only an example to indicate the placement of the hand-applied unit within the apparatus set-up. Hand-applied unit designs might differ. In the illustrated example, the main body of the hand-applied unit containing the liquid fire-extinguishing media is that to which the clamps are affixed. The smaller part protruding is, in this design, a handle with which the hand-applied unit can be applied to a Class F fire.

Annex E (normative)
Fire extinguishing and cooking media cooling test

E.1 Principle

A thermocouple is inserted into the centre of the fuel in the centre of the fuel tray containing cooking media which is set up over a gas burner. The temperature of the cooking media is measured and recorded. The fuel is heated until it reaches auto-ignition and the heat source is subsequently removed. The fire burns for approximately 2 min (120 s) before the test specimen is placed into the fuel tray. The period that the fire takes to be extinguished from the time the test specimen is placed into the fuel is monitored and recorded. The temperature of the resulting residue is measured using the thermocouple to measure the temperature of the residue within a 15 min period from application of the test specimen.

E.2 Materials and reagents

E.2.1 *Fuel*, consisting of an edible cooking media, having an auto-ignition temperature of between 330 °C and 380 °C. The fuel shall be either:

a) $3\ ^{+0.1}_{-0.0}$ L in volume; or

b) $5\ ^{+0.1}_{-0.0}$ L in volume.

NOTE *Examples of edible cooking media that may be used include: soya bean oil conforming to CODEX STAN 20-1981 [10], sunflower seed oil conforming to CODEX STAN 24-1981 [11] and rape seed oil conforming to CODEX STAN 19-1981 [12]. See the Codex Alimentarius international food standards website for further information: http://www.codexalimentarius.org/standards/list-of-standards.*

E.3 Apparatus

E.3.1 *Fuel tray*. The fuel tray shall be constructed of welded sheet steel, (2 ±0.25) mm in thickness. It shall be free from any residue from previous tests. It shall have either:

a) an internal diameter of (345 ±5) mm and a depth of (100 ±5) mm; or

b) an internal diameter of (300 ±5) mm and a depth of (170 ±5) mm.

E.3.2 *Fuel tray stand*. The fuel tray stand shall have a length of (240 ±5) mm and a width of (240 ±5) mm, have four supporting legs and be made of 25 mm x 25 mm metal angle. It shall be either:

a) (140 ±5) mm in height; or

b) (150 ±5) mm in height.

E.3.3 *Heat source*, such as a gas burner, which is capable of heating the fuel to the required temperature.

E.3.4 *Implement, or function, for measuring the height of the flame and increases in flame height*, to within an accuracy of ±0.01 m.

NOTE *This could be in the form of a physical measuring implement (such as a measuring stick) or a digital measure within the screen of a digital camera frame.*

E.3.5 *Test table*, consisting of a horizontal steel test surface (1 800 ±10) mm in width and (1 800 ±10) mm in length, and which is (800 ±10) mm in height.

E.3.6 *Timing device*, capable of timing a minimum of 180 min within an accuracy of ±0.02 min.

E.3.7 *Type K thermocouple*, conforming to BS EN 60584-1.

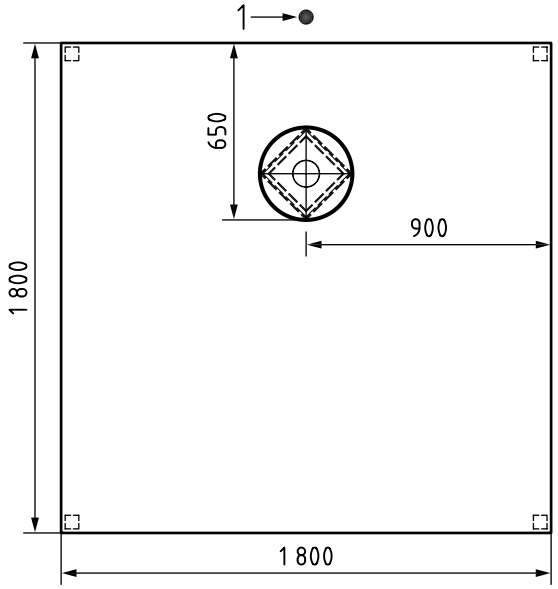
E.3.8 *Liquid measuring equipment*, capable of measuring a minimum volume of 6 L to within an accuracy of ±0.01 L.

E.3.9 *Visual recording equipment*, in the form of a digital, or film, camera system capable of clearly recording the behaviour of the fire. Camera systems shall be operated at a minimum of 30 frames per second and be capable of producing correctly exposed[4] results in indoor test lighting conditions without resorting to the use of electronic gain or non-standard film processing to correct the exposure. The camera shall be fitted with lenses of a flat field type in order to minimize any distortion of the image; these lenses shall be of a (photographic) quality capable of achieving the optimum sensor, or film, resolution of the camera. The set up of the camera shall be such that the height of the fuel flame at its greatest (prior to hand-applied unit insertion) plus a 15% flame increase is visible within the camera frame.

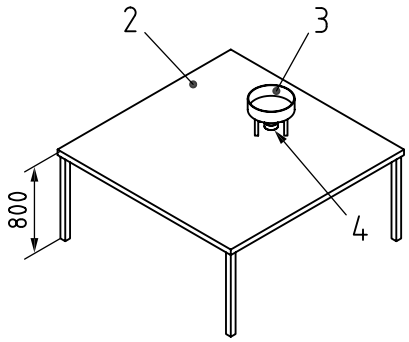
[4] Results are considered to have been correctly exposed when the brightness range of the area of interest has been captured in its entirety. This is achieved through understanding (and utilization) of the camera variables (i.e. aperture, shutter speed, frame rate, sensor/film sensitivity).

Figure E.1 – Apparatus arrangement for fire extinguishing and cooking media cooling test

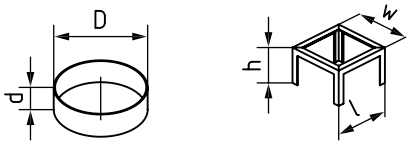
Dimensions in millimetres



a) Overhead view of test apparatus



b) Arrangement (angled view)



c) Fuel tray and fuel tray stand

Key

1	Approach position of person carrying out test
2	Test table
3	Fuel tray and fuel tray stand
4	Heat source

D	Internal diameter of fuel tray
d	Internal depth of fuel tray
w	Width of fuel tray stand
h	Height of fuel tray stand
l	Length of fuel tray stand

NOTE *The dimensions for the fire extinguishing and cooking media cooling 3 L and 5 L tests are given as follows:*

For the 3 L test:

Internal diameter of fuel tray: (345 ±5) mm;
Internal depth of fuel tray: (100 ±5) mm;
Width of fuel tray stand: (240 ±5) mm;
Height of fuel tray stand: (140 ±5) mm;
Length of fuel tray stand: (240 ±5) mm;
Fuel tray support, angled metal: 25 mm × 25 mm.

For the 5 L test:

Internal diameter of fuel tray: (300 ±5) mm;
Internal depth of fuel tray: (170 ±5) mm;
Width of fuel tray stand: (240 ±5) mm;
Height of fuel tray stand: (150 ±5) mm;
Length of fuel tray stand: (240 ±5) mm;
Fuel tray support, angled metal: 25 mm × 25 mm.

E.4 Test specimens and test conditions

The test specimens used shall conform to **4.1** and Annex A.

E.5 Procedure

WARNING. Individuals carrying out testing are advised of the importance of following health and safety procedures while testing. Risks include burning from fire, hot cooking media spillage and inhalation of smoke or toxic products.

E.5.1 Arrange the apparatus in accordance with Figure E.1. Place the fuel tray stand (**E.3.2**) on the test table (**E.3.5**) and the fuel tray (**E.3.1**) on the fuel tray stand. Position or set-up the implement, or function, for measuring the height of the flame, as applicable. Position the visual recording equipment (**E.3.9**) such that:

a) the behaviour and extent of the fire is clearly visible;

b) the performance of the visual recording equipment and the quality of the resulting footage is not affected by the fire itself; and

c) the visual recording equipment does not interrupt the test procedure.

E.5.2 Position the fuel tray so that its innermost edge is between (650 ±5) mm from the front edge of the test table and equidistant from the test table's two sides (see Figure E.1). Place the heat source (**E.3.3**) centrally below the fuel tray.

E.5.3 Using the liquid measuring equipment (**E.3.8**), measure and record the fuel to be poured into the fuel tray.

E.5.4 Pour the fuel in the fuel tray and insert the thermocouple (**E.3.7**) centrally in the fuel.

E.5.5 Measure and record the temperature of the fuel using the thermocouple.

E.5.6 Ignite or switch on the heat source and start the timing device (**E.3.6**). Begin the visual recording equipment (**E.3.9**). When the fuel reaches auto-ignition, record the time taken to auto-ignite, turn off the heat supply and re-start the timing device from zero.

E.5.7 Where the fuel does not reach auto-ignition between 25 min and 35 min, stop the test and repeat the procedure.

NOTE *It is also important to check that where a gas burner is used the flames from the gas burner do not reach the top edge of the fuel tray, as this can cause piloted ignition. Fuel might be cooler at piloted ignition temperature than at auto-ignition temperature and therefore be easier to extinguish.*

E.5.8 After the fuel has been burning for a period of 120 $^{+10}_{-0}$ s, use the implement, or function, for measuring the height of the flame (**E.3.4**) to measure and record the height of the flame. Apply the test specimen to the fuel tray within 10 s [C1] *Text deleted* [C1], using one of the following methods:

a) place the test specimen into the burning fuel tray by applying it as indicated in the product specification; or

b) (for the inappropriate use test) throw the test specimen using an under-arm motion. The force used to throw the test specimen shall be such that it drops into the pan at a height of (250 ±25) mm, as measured from the upper [C1] edge of the tray. [C1]

E.5.9 In the case of **E.5.8**a), at the point of the test specimen application, the hand of the individual carrying out the test shall be no nearer than a distance of (100 ±10) mm to the fuel tray, when measured from the point on the circumference of the fuel tray which is the closest part to the individual carrying out the test. The individual shall not encroach on this distance while the fuel is burning.

NOTE *To reduce the risk of burns, the individual carrying out the testing should only come within (100 ±10) mm of the fuel tray for a maximum of 4 s. For further information regarding the time taken for skin to blister or burn, refer to the* Principles of fire behavior, *Quintiere, 1997 [13].*

E.5.10 In the case of **E.5.8**b), at the point of the test specimen departure from the hand of the individual carrying out the test, the hand shall be no nearer than a distance of (300 ±10) mm, as measured from the point on the circumference of the fuel tray which is the closest part to the individual carrying out the test. The individual shall not encroach on this distance while the fuel is burning.

NOTE *To reduce the risk of burns, the individual carrying out the testing should only come within (300 ±10) mm of the fuel tray for a maximum of 4 s. For further information regarding the time taken for skin to blister or burn, refer to the* Principles of fire behavior, *Quintiere, 1997 [13].*

E.5.11 Use the implement, or function, for measuring the height of the flame to measure and record the height of the flame.

E.5.12 Measure and record the time it takes from placement or application of the hand-applied unit to the fire becoming extinguished.

NOTE *The fire is considered to be extinguished when there are no flames visible.*

E.5.13 Continue to measure and record the temperature of the fuel and liquid fire-extinguishing media mixture until the mixture cools to [C1] ≤300 °C [C1]. Stop the visual recording equipment.

E.5.14 Where the hand-applied unit is specified to work when placed in the fire on more than one of its faces, repeat the test procedure (**E.5**) for each face for which it is applicable.

Annex F (informative)
Guidance for the colour of hand-applied units

F.1 Colour

It is recommended that hand-applied units should be coloured predominantly signal red (RAL 3000, or colour reference 537 as specified in BS 381C:1996).

Hand-applied units that include wet chemical fire-extinguishing media may also have a zone of colour in canary yellow (RAL 1023 as specified in BS 7863:2009, Clause **4**) covering an area of up to 10% and no less than 3% of the surface area of the hand-applied unit body.

NOTE 1 *Canary yellow is the colour recommended in BS 7863:2009 to indicate wet chemical fire-extinguishing media.*

Any other colours used on the surface area of the hand-applied unit should be of such an area and intensity that it does not detract from or diminish the impact of the signal red and the canary yellow.

NOTE 2 *As different colours are used to indicate different fire-extinguishing media, there is the possibility for confusion over the purpose of the hand-applied unit if it is not clear which colour is being used as a designation. See BS 7863 for further information regarding colours recommended for fire-extinguishing media.*

F.2 Location

The colour zone should appear on the front of the hand-applied unit.

Annex G (normative) Product information

***NOTE 1** The manufacturer may also choose to provide the product information electronically.*

The manufacturer shall provide the following information with the hand-applied unit:

a) model/type/number of the hand-applied unit;

b) PAS 2013-1:2013 [5)];

c) volume of the hand-applied unit;

d) environmental conditions in which to keep the hand-applied unit;

e) storage of the hand-applied unit;

***NOTE 2** This may include instructions and advice regarding the placement, accessibility, siting and fixing (if applicable) of the hand-applied unit in relation to the likely fire source. For example, it might be advised that the hand-applied unit is stored so that it can be removed from its place of storage and used in a fire situation within a period of 4 s.*

f) user guide and instructions;

g) instructions/information regarding the:

1) maintenance;

2) servicing (if applicable); and

3) disposal of the used hand-applied unit and its residue;

h) any hazard warnings;

i) electrical test results;

j) manufacturer's name and address; and

k) supplier's name and address.

***NOTE 3** It might also be desirable to provide instructions and guidance on basic fire-fighting techniques. This could include:*

i) not taking any risks;

ii) not breathing in fumes;

iii) not throwing water on the fire;

iv) if safe to do so:

a) applying the hand-applied unit;

b) turning off the heat;

v) if unsafe:

a) leaving the fire situation immediately;

b) calling 999.

Reference could also be made to the DCLG publication, Fire safety in the home *[8].*

[5)] Marking PAS 2013-1:2013 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 PAS. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity.

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