

Specification for small disposable fire extinguishers of the aerosol type

ICS 13.220.10; 13.220.20

Committees responsible for this British Standard

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Automobile Association
 BRE/LPC Laboratories
 Chief and Assistant Chief Fire Officers Association
 Consumer Policy Committee of BSI
 Home Office
 Society of Motor Manufacturers and Traders Ltd.

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The following BSI references relate to the work on this standard:
 Committee reference FSH/2/9
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Foreword

This British Standard has been prepared under the direction of the Fire Standards Policy Committee and specifies requirements for non-refillable fire extinguishers of the aerosol type. This British Standard supersedes BS 6165:1992, which is withdrawn.

It is recognized that small disposable non-refillable fire extinguishers can be exposed to more severe environmental conditions and are required to maintain their performance for longer periods than are other aerosol dispensers. For example, they can be installed in cars or other vehicles where they can be repeatedly exposed to higher than normal temperatures for up to five years. For these reasons, the requirements of this standard for the strength and pressure resistance of the extinguisher bodies are more stringent than those specified for the otherwise similar Group 1 containers in BS 3914:1991.

This British Standard has been written with the aim of producing a specification for a relatively inexpensive small disposable fire extinguisher with an acceptable minimum level of performance. This type of extinguisher is intended for use only in situations where fires of limited proportions are anticipated because of the nature of some process or activity, where the possibility of fire spreading to other materials is remote, or where people are present at the likely times of risk. The standard therefore is unlikely to meet the requirements of the various specifying authorities for more comprehensive protection. These extinguishers are not intended to supplant the performance of extinguishers that comply with the requirements, which should still be regarded as the principal type to meet the needs of various authorities.

In order to minimize hindrance to developments in design, the general emphasis is on performance requirements rather than on dimensional requirements.

Clean agents for use with small portable extinguishers are not yet proven and are not therefore included in this standard but will be covered by an amendment when necessary.

Attention is drawn to the fact that many countries, including the United Kingdom, have statutory regulations concerning aerosol dispensers with which exporters to these countries have to comply. It is not practicable to give such details in a British Standard, and the user of this standard should, in the UK, seek the advice of the Department of Trade or, outside the UK, the Commercial Attaché or Consulate of the country concerned.

Annex A to Annex H are normative.

Special attention is drawn to EEC Directive 75324 of 20 May 1975, on Approximation of Aerosol Dispensers [1].

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

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 15 and a back cover.

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1 Scope

This British Standard specifies performance requirements for, and the maximum capacity of, small disposable fire extinguishers of the aerosol type, with metal bodies. It covers extinguishers containing powder and water-based media.

Requirements are specified for minimum performance in extinguishing test fires of type B and, optionally, type A classification of BS EN 2.

Annex A gives the conditioning treatment to be applied to extinguishers prior to testing as described in Annex B to Annex H.

NOTE Unless otherwise specified in the text, all pressures are gauge pressures and are expressed in bars.

1 bar = 10^5 N/m² = 10^5 Pa.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this British Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS 3914:1991, *Specification for non-refillable metal aerosol dispensers of 50 ml to 1400 ml capacity and up to 85 mm diameter.*

BS 6002-1, *Sampling procedures for inspection by variables — Specification for single sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection.*

BS EN 2, *Classification of fires.*

BS EN 615, *Fire protection — Fire extinguishing media — Specifications for powders (other than class D powders).*

3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

3.1

aerosol

dispensing container with a valve, holding a product that is kept under greater than atmospheric pressure by means of propellant (liquefied, compressed or dissolved gas or combination of such gases) and that is discharged when the valve is operated

NOTE This definition is that used in the packaging industry (see BS 3130-4:1976) and is in popular usage for consumer products. Scientifically, the term aerosol is defined as "a suspension of solid or liquid particles in a gas". To avoid confusion, this British Standard avoids the use of the term "aerosol" as a noun and uses only the term "fire extinguisher of the aerosol type".

3.2

batch

definite quantity of some commodity or service produced at one time under conditions that are presumed uniform

NOTE The circumstances under which the conditions can be presumed cannot be generally stated; for example, a change in the material or tool used in an interruption in the manufacturing process can give rise to different conditions (see BS ISO 3534-2: 1993).

3.3

body

shell of the extinguisher not fitted with its accessories, such as valves and gauges, but fitted with all its welded/brazed parts

3.4

charge of an extinguisher

mass or volume of the extinguishing medium contained in the extinguisher

3.5

equilibrium pressure

pressure developed within the container when filled with the quantity of solid, liquid and gaseous contents normally specified under production conditions and at a temperature of 55 °C

3.6

extinguishing medium

substance including any admixture such as corrosion inhibitor, freezing point depressant or blowing agent, contained in the extinguisher that causes extinction of a fire

3.7

fire extinguisher

appliance containing an extinguishing medium that can be expelled by the action of internal pressure and be directed on to a fire

3.8

fire extinguisher of the aerosol type

small disposable container incorporating a valve and containing a fire extinguishing medium kept under greater than atmospheric pressure by means of a propellant. The contents are discharged when the valve is operated

NOTE Fire extinguishers of the aerosol type are designed to be discarded after use and not to be refilled.

3.9

overcap

headcap

cover over head of extinguisher

3.10

powder extinguisher

extinguisher containing fire extinguishing powder

3.11

small disposable fire extinguisher

fire extinguisher of the aerosol type with capacity of less than 950 ml

NOTE See 5.3.1.1.

3.12

test fire rating

designation of the largest test fire that an extinguisher extinguishes when tested in accordance with 7.6.1 and 7.6.2

3.13

water-based extinguisher

extinguisher containing water only or water with additive

NOTE This includes foam extinguishers.

4 Contents of the extinguisher

4.1 Extinguishing medium

The extinguishing medium shall be one of the following:

- water-based, including foam (see notes 1 and 2);
- powder conforming to BS EN 615.

NOTE 1 It is recommended that extinguishers containing halons other than halon 1211 and halon 1301 should be removed from service. They should not be discharged. The use of halon 1211 and 1301 will be restricted to the "Critical Uses" listed by Annex VII of EC 3093/94 [2]. This permits no uses of these halons other than for very specific aircraft, defence or police fire extinguishing applications, such as extinguishing fires on the persons of police officers.

NOTE 2 Halon portable fire extinguishers withdrawn from service should be emptied in such a way that the halon is recovered, either for the limited possibility of reuse or for disposal by a non-contaminating method. This may be done by a suitable agency who will not necessarily be the manufacturer of the extinguisher.

4.2 Propellant

Only propellants listed in Table 1 or mixtures thereof shall be used. The maximum water content shall be as specified in Table 1, except when used in stored pressure water-based portable fire extinguishers. Tracers may be added to the propellant to facilitate leakage detection, but the content shall not exceed a mass fraction of 5 % of the propellant content.

Table 1 — Permitted propellants

Propellant	Maximum water content mass fraction, %
Air	0.006
Argon	0.006
Carbon dioxide	0.015
Helium	0.006
Nitrogen	0.006

5 Construction

5.1 Operation

5.1.1 Extinguishers shall be operated by the depression of a valve. The method of operation shall be readily apparent. It shall not be necessary for any movement of the actuating mechanism to be repeated in order to initiate discharge.

NOTE The valve may be protected by an overcap.

5.1.2 Extinguishers shall operate without inversion.

5.1.3 Extinguishers shall incorporate a device to prevent inadvertent operation, which shall be so constructed that any unaided manual attempt to initiate discharge will not deform or break any part in a way that would prevent the subsequent discharge of the extinguisher.

5.1.4 Extinguishers shall have a tamper evident seal, which shall be broken in the removal of the safety device. This seal shall be such that it will not be broken or damaged in normal service and cannot be replaced after operation. A paper seal shall not be used.

5.1.5 Extinguishers shall incorporate a controllable device to enable the discharge to be interrupted.

5.2 Mounting

Extinguishers shall be provided with a means for mounting.

5.3 Body and closure

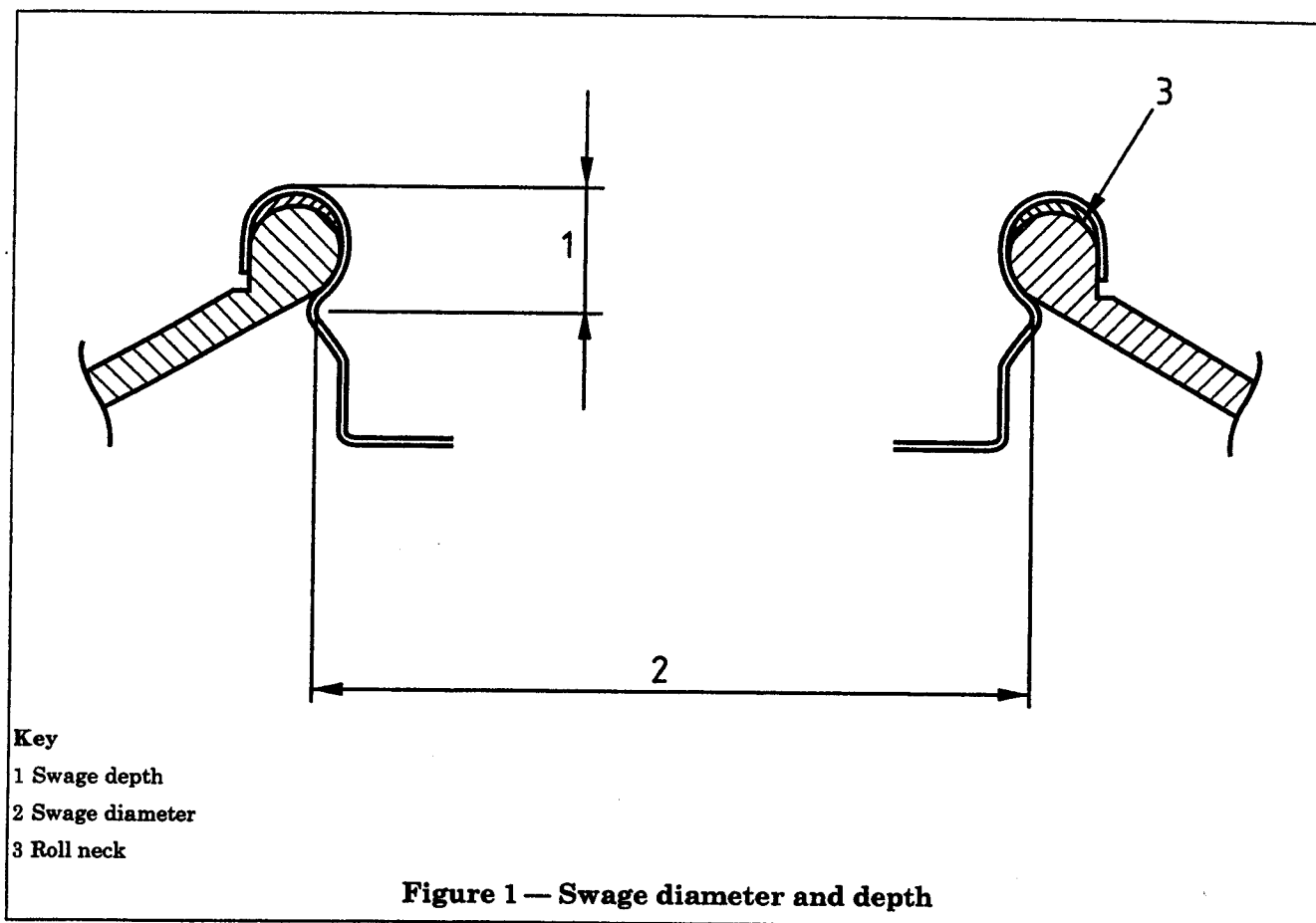
5.3.1 Body

5.3.1.1 The body shall have a brimful capacity not exceeding 950 ml and an internal diameter not exceeding 75 mm and shall be made from metal as specified in BS 3914:1991, clause 3.

5.3.1.2 The body shall be cylindrical with axially symmetrical concave or convex ends, and shall be of seamless construction or of seamed construction with seams that shall be welded or brazed or double seamed or swaged.

5.3.2 Closure

The closure shall be swaged under the neck ring of the body. The swage diameter and the actual swage depth shall not differ by more than ± 0.25 mm from the manufacturer's specified nominal values.



5.4 Nozzle cap

Any protective cap fitted to the nozzle shall be removed or ruptured by the discharge of the contents when the extinguisher is operated.

NOTE It is not necessary to carry out special tests; this requirement can be assessed in conjunction with the tests carried out to assess the performance requirements of 7.1, 7.2, 7.3, 7.5 and 7.6.

5.5 Corrosion resistance

After storage in accordance with Annex B, an extinguisher shall not show signs of corrosion or other chemical degradation other than staining or discolouration, and the extinguisher shall operate as intended.

5.6 Impact resistance

The extinguisher (with overcap if used) correctly charged and equipped with all the fittings that are subject to internal pressure in normal operation shall not release pressure in a potentially dangerous manner when tested in accordance with Annex C.

5.7 Resistance to shock and mechanical damage

The extinguisher shall show no perceptible leakage permitting loss of pressure when tested in accordance with Annex D.

5.8 Resistance to internal pressure

The body shall withstand an internal pressure equal to the equilibrium pressure +1.4 bar, or to 10.0 bar, whichever is the greater, without visible permanent deformation when tested in accordance with E.1.

5.9 Minimum burst pressure

The burst pressure of the body, fitted with all pressure retaining parts, shall be not less than twice the equilibrium pressure or 18 bar, whichever is the greater, when tested in accordance with E.2. The body shall not fragment or throw any parts in a dangerous manner.

5.10 Pressure indicator

A pressure indicator, where fitted, shall have a green zone (working zone), covering the equilibrium pressure at 55 °C and 75 % of the working pressure at 20 °C with a tolerance of ${}_{0}^{+1}$ bar.

6 Production requirements

6.1 Cleanliness

6.1.1 General

Bodies and valves of all extinguishers shall be clean at the time of filling.

6.1.2 Powder extinguishers

Bodies and valves of powder extinguishers shall be dry at the time of filling.

6.2 Filling tolerance

The filling tolerance shall be ± 5 % for powder extinguishers and ${}_{-5}^{0}$ % for water-based extinguishers.

7 Performance

7.1 Delay on operation

Not more than 2 s shall elapse between the depression of the valve and the commencement of discharge when tested in accordance with F.1 (continuous discharge).

7.2 Duration of discharge

The duration of effective discharge shall be not less than 6 s when tested in accordance with F.1 (continuous discharge).

7.3 Minimum discharge of contents

The extinguisher when operated in its normal working position shall discharge not less than 85 % (m/m) of the nominal charge when tested in accordance with F.1 (continuous discharge).

7.4 Leakage rate

The rate of leakage before and after storage in accordance with Annex B shall not exceed a rate of loss of pressure equivalent to 5 % of the working pressure per annum.

7.5 Retention of charge following partial discharge

The second pressure shall be not less than 80 % of the first when the extinguisher is tested in accordance with Annex G.

7.6 Fire extinguishing performance rating

7.6.1 Class B rating

The extinguisher shall have a class B test fire rating which shall be determined by the test method described in H.5.

7.6.2 Class A rating

If appropriate, the class A rating of the extinguisher shall be determined by the test method described in H.4.

8 Production testing requirements

8.1 General

In addition to any other scheme of quality control, extinguishers shall be produced according to the production testing scheme of this subclause.

NOTE When carrying out production tests, it might be desirable or convenient to exceed the conditions of test given in this standard.

8.2 Bodies

From each batch of unfilled bodies, samples shall be tested in accordance with Annex E for conformity to 5.8 and 5.9. Batches showing an AQL worse than 2.5 % (inspection level S3) in accordance with BS 6002-1 shall be rejected.

8.3 Extinguishers

8.3.1 Swaged closures

8.3.1.1 During production, the first extinguisher produced from each batch of valves or bodies, and the first extinguisher produced from each swaging head each day, shall be checked for conformity to 5.3.2.

If this sample does not conform, a further sample, produced after any appropriate adjustments, shall be tested.

Production shall not be commenced until a sample conforming to 5.3 has been tested.

8.3.1.2 If more than 10 000 extinguishers are produced in a day from a swaging head, one extinguisher in every 10 000 produced shall subsequently be tested; if one fails to conform to 5.3, then checks to identify all faulty extinguishers shall be made. All that do not conform to 5.3 shall be rejected, and the procedure specified in 8.3.1.1 shall be repeated.

A record of the measured dimensions shall be kept.

8.3.2 Discharge test

One extinguisher per batch shall be discharged and the discharge duration and percentage discharge shall be recorded. If this extinguisher does not meet the requirements of 7.2 and 7.3, a further 10 extinguishers shall be tested and, if there are more failures, the batch shall be rejected.

8.3.3 Leak test

All extinguishers shall be submitted to a leak test capable of detecting a leakage rate equivalent to a loss of pressure of 5 % per annum. Products with a leakage rate greater than 5 % per annum shall be rejected.

NOTE Mass spectrometry is an acceptable method.

9 Colour and marking of extinguishers

NOTE 1 It is recommended that extinguishers should be coloured predominantly signal red (BS 381C:1996 reference 537, equivalent to BS 5252:1976 reference 04E53) and a zone of colour with an area of up to 10 % of the surface area of the extinguisher body to be used to identify the extinguishing agent and located in accordance with BS 7863:1996.

NOTE 2 The method of marking should be such that the marking will remain clear and legible throughout the expected life of the extinguisher.

NOTE 3 It is recommended that, on the extinguisher body or on a separate leaflet accompanying the extinguisher, advice on siting and fixing the extinguisher together with basic fire-fighting techniques be given.

9.1 Primary information

9.1.1 The extinguisher shall be marked with the following:

- a) the words "Fire extinguisher" in letters of height not less than 7 mm;
- b) the words "For small fires only" in letters of height not less than 3 mm;

NOTE For class B fires "small" means fires of area up to 0.1 m² (for extinguishers rated 13B), 0.15 m² (for extinguishers rated 21B) or 0.25 m² (for extinguishers rated 34B), or for fuel volumes up to 1.3 l (for extinguishers rated 13B), 2.1 l (for extinguishers rated 21B) or 3.4 l (for extinguishers rated 34B). Appropriate information can be marked on the extinguisher or given in an accompanying leaflet.

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

NOTE In addition, pictograms may be used.

d) the types of fire for which the extinguisher is suitable;

NOTE The following wording as appropriate is recommended, in letters of height not less than 3 mm:

1) powder extinguishers with class A and B ratings:

"FOR WOOD, PAPER, TEXTILE AND SIMILAR CLASS A FIRES AND FOR LIQUID AND ELECTRICAL EQUIPMENT FIRES";

2) powder extinguishers with class B rating only:

"FOR LIQUID AND ELECTRICAL EQUIPMENT FIRES";

3) water-based extinguishers with class A and B ratings:

"FOR WOOD, PAPER, TEXTILE AND SIMILAR CLASS A FIRES AND FOR LIQUID FUEL FIRES";

4) water-based extinguishers with class B rating only:

"FOR LIQUID FUEL FIRES".

e) the types of fire for which the extinguisher is not suitable, including the words:

"THIS EXTINGUISHER IS NOT SUITABLE FOR USE ON DEEP FAT FIRES";

For water-based extinguishers:

"THIS EXTINGUISHER IS NOT SUITABLE FOR USE ON ELECTRICAL EQUIPMENT FIRES";

f) an instruction to discard the extinguisher if the tamper evident indicator is broken or missing, after use and after the expiry date marked on the extinguisher.

9.1.2 All the markings specified in 9.1.1 shall be visible when the extinguisher is correctly mounted, as recommended by the manufacturer, in its means for mounting.

NOTE All instructions concerning safety, i.e. items a), c), e) and f) of 9.1.1 should be in a prominent position and in lettering that stands out by reason either of its size or of its colour.

9.2 Secondary information

9.2.1 The extinguisher shall be marked with the following:

a) the manufacturer's or vendor's name and address;

b) instructions to check the pressure indicator, where fitted, regularly for operational serviceability including an instruction to dispose of the extinguisher [see 9.2.1h)] if its pressure at 20 °C falls below the pressure corresponding to the pressure outside the green zone;

NOTE The pressure is dependent on temperature. A temperature drop of 27 °C for powder extinguishers will cause a reversible 10 % reduction of pressure.

c) the service expiry date which shall be not later than the end of the fifth year after filling;

d) the number and date of this British Standard, i.e. BS 6165:2002¹⁾;

e) the class of fire and fire rating achieved;

f) the nominal mass and type of extinguishing medium (e.g. "1 kg powder");

g) the instruction "Keep out of reach of young children";

h) instructions for the correct method of disposal once the expiry date is reached or if the extinguisher is partly discharged; in the case of halon extinguishers, the instruction shall include the words "Return to manufacturer for halon recovery";

i) the instruction "Not to be refilled";

j) the instruction "Pressurized container: protect from sunlight and other sources of heat and do not expose to temperatures exceeding 60 °C. Do not pierce or burn, even after use".

The letter height shall be not less than 1.2 mm and the markings specified in g), h), i) and j) shall have a letter height greater than that used for the markings specified in a), b), c), d), e) and f).

9.2.2 The markings specified in 9.2.1 shall be marked on a part of the extinguisher separate from that bearing the markings specified in 9.1.1.

¹⁾ Marking BS 6165:2002 on or in relationship to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility, such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

Annex A (normative)
Test conditions

A.1 General

Except where stated otherwise in the text, use correctly filled and charged extinguishers for testing. Where there is no pressure indicator, the extinguisher should be submitted for testing fitted with a suitable pressure connection to the body to allow the internal pressure to be measured. For the tests described in Annex F, Annex G and Annex H, first condition all powder extinguishers as follows.

Hold the extinguisher in the vertical position and drop it vertically 500 times from a height of (16 ± 1) mm at a frequency of (1 ± 0.02) Hz onto a rigid steel plate, of dimensions (300 ± 5) mm square and (60 ± 1) mm thick. Store the extinguisher at a temperature of (22 ± 8) °C for not less than 24 h.

A.2 Storing and temperature

Unless otherwise stated, store extinguishers for not less than 24 h at a temperature of (22 ± 8) °C before tests are carried out, and maintain them within this temperature range until tested. Unless stated otherwise, the ambient temperature for carrying out the tests is -5 °C to 30 °C.

For the discharge performance tests of Annex F and Annex G and the fire performance tests of Annex H use extinguishers fitted with a nozzle cap, if normally fitted.

NOTE See 5.4.

Annex B (normative)
Storage and corrosion test

NOTE See 5.5 and 7.4.

Prepare 12 extinguishers as described in Annex A, and examine for leakage.

Store in two groups, each of 6 extinguishers, for 8 cycles of the duration and conditions given in Table B.1.

Table B.1 — Storage conditions for extinguisher tests

Duration h	Storage temperature for extinguishers
	Group 1 store upright and Group 2 store horizontal °C
24 ± 1	-20 ± 2
24 ± 1	$+20 \pm 2$
24 ± 1	$+60 \pm 2$

NOTE 1 Store water-based extinguishers at (5 ± 2) °C.
 NOTE 2 Also 95 % r.h. at $+60$ °C.
 NOTE 3 After removal from the test cabinet, store extinguishers at (20 ± 2) °C for (24 ± 1) h.

After storage, examine the extinguishers for leakage (see 7.4) and then test the extinguishers as follows:

- a) two from each group for conformity to 7.5 (see Annex G); and
- b) two from each group for conformity to 7.2 (see F.1);

before visually examining all 12 extinguishers internally for conformity to 5.5.

Annex C (normative)

Impact test

NOTE See 5.6.

Condition the extinguisher, prepared as described in Annex A, for $24 \begin{smallmatrix} +2 \\ 0 \end{smallmatrix}$ h at a temperature of $(-15 \pm 5) ^\circ\text{C}$ for powder extinguishers and $(5 \pm 1) ^\circ\text{C}$ for water-based extinguishers.

Maintain at this temperature during the test.

Mount a steel cylindrical hammer of diameter (75 ± 2) mm, mass $4 \begin{smallmatrix} +0.025 \\ 0 \end{smallmatrix}$ kg, with flat faces, in loose guides so that it will drop vertically and freely through a height $(H \pm 5)$ mm given by the following equation:

$$H = 50M$$

where

M is the total extinguisher mass (in kg);

H is the nominal height (in mm).

Remove the extinguisher from the low temperature environment and place the extinguisher on a rigid flat surface in each of the following two positions in turn:

- a) in the normal upright position, with the longitudinal axis of the hammer coincident with the longitudinal axis of the head cap; and
- b) lying on its side and with the head cap resting on a rigidly fixed steel block, with the longitudinal axis of the hammer intersecting the longitudinal axis of the head cap at right angles.

In each of the above, and within 1 min of removal from the low temperature environment, subject the headcap of the extinguisher to an impact by allowing the steel hammer to fall vertically onto it from the height H . Record any potentially dangerous release of pressure.

NOTE Precautions should be taken to protect personnel from the effects of any pressure release.

Annex D (normative)

Mechanical drop test

NOTE See 5.7.

Prepare the extinguisher as described in Annex A.

Drop the extinguisher, correctly charged and equipped with its normal fittings, from a height of $2.00 \begin{smallmatrix} +0.15 \\ 0 \end{smallmatrix}$ m onto hard concrete twice; firstly with the body axis horizontal and with no protrusion downward, and secondly with the body axis vertical and the head up.

It is essential that impact takes place with the body axis substantially horizontal or vertical as appropriate.

Visually examine the extinguisher for leakage.

Annex E (normative) Pressure and leakage tests for bodies

E.1 Test for resistance to pressure

NOTE See 5.8 and 8.2.

Pressurize the body hydraulically, raising the pressure from zero to a pressure not less than and not more than 0.5 bar above the appropriate test pressure specified in 5.8, at an approximately constant rate over a period of 0.5 min to 3 min, disregarding any temporary changes in rate due to the effective deformation, and retain that pressure for $30^{+0.5}_0$ s, before allowing the pressure to fall to zero. Visually check the body for permanent distortion or leakage, disregarding any temporary deformation under pressure.

E.2 Minimum burst pressure test

NOTE See 5.9 and 8.2.

Pressurize the body hydraulically, raising the pressure from zero to a pressure not less than and not more than 0.5 bar above the appropriate test pressure specified in 5.9, at an approximately constant rate over a period of 0.5 min to 3 min, disregarding any temporary changes in deformation and retain that pressure for 30^{+2}_0 s. Then increase the pressure, with the same settings as above, until the extinguisher bursts.

Record the burst pressure and mode of failure.

Annex F (normative) Discharge tests

NOTE Extinguishers used for the test described in Annex B may be used for these tests.

F.1 Duration of discharge and minimum discharge of contents

NOTE See 7.1, 7.2 and 7.3.

Prepare the extinguisher as described in Annex A.

Do not remove any nozzle cap.

Weigh the extinguisher. Discharge the extinguisher in its normal working position (i.e. vertical), recording the times at the following:

- a) commencement of discharge;
- b) the end of the effective discharge, i.e. when propellant gas suddenly appears or its proportion suddenly increases, as indicated by a marked change in the character of the discharge.

Discharge the extinguisher to exhaustion. Weigh the extinguisher plus a nozzle cap if originally fitted.

Record the effective discharge time, and calculate the proportion of the contents discharged.

F.2 Intermittent discharge and minimum discharge of contents

NOTE See 7.1 and 7.3

Prepare the extinguisher as described in Annex A.

Do not remove any nozzle cap.

Weigh the extinguisher. Discharge the extinguisher in its normal working position (i.e. vertical), recording any delay in operation as in F.1. Three seconds after the commencement of discharge close the valve for 10 s, then open the valve for 3 s and repeat the cycle to the end of effective discharge (see F.1). Close the valve and weigh the extinguisher plus a nozzle cap if originally fitted. Discharge the extinguisher to exhaustion and weigh again, with the nozzle cap if appropriate. Calculate the proportion of the contents discharged.

Annex G (normative)

Test for retention of charge after partial discharge

NOTE 1 Extinguishers used for the test of Annex B may be used for these tests.

NOTE 2 See 7.5.

Prepare an extinguisher as described in Annex A.

Do not remove the nozzle cap.

Discharge the extinguisher for a period equal to half the effective discharge time (see F.1) and close the control valve. Measure the internal pressure (or the mass of contents as appropriate), allow 5 min to elapse with the valve remaining closed and measure it again.

Express the difference between the two measurements as a percentage of the first.

Annex H (normative)

Fire extinguishing performance tests

NOTE 1 Extinguishers used for the tests described in Annex B may be used for these tests.

NOTE 2 See 7.6.

H.1 Operator's clothing

To carry out these tests the operator shall wear suitable working clothes, which may include helmet and face visor. Highly reflective clothing, e.g. aluminized clothing, shall not be worn. It shall be possible to extinguish the rated test fire without respiratory protection and if necessary additional tests shall be made to confirm this.

NOTE 1 Attention is drawn to the necessity for taking precautions to safeguard the health of personnel conducting the tests against the risk of fire and inhalation of smoke and any toxic products of combustion.

NOTE 2 Respiratory protection may be worn to protect the operator from effects of the repeated testing over a period of time. Such protection is not intended to permit an otherwise intolerable exposure to any fumes and or smoke from a single fire.

NOTE 3 Suitable working clothes should not be liable to ignite or melt during the fire-fighting process.

H.2 Requirements for extinction

Test fires shall be regarded as extinguished if:

- a) in class A fires: all flames are extinguished and there is no recurrence of flaming during the 3 min following complete discharge of extinguisher;
- b) in class B fires: all flames are extinguished and there is a minimum of 3 mm depth of fuel left in the tray.

If the class A crib collapses during the test, consider it void and carry out a replacement test as part of the set of three tests.

H.3 Test schedule and criteria

Carry out tests using "F" and "L" extinguishers and charges, prepared as described in Annex A, where:

- a) "F" extinguishers are extinguishers containing the full quantity of medium and propellant (i.e. as described in A.1);
- b) "L" extinguishers are extinguishers containing a lower than normal quantity of propellant so that the internal pressure corresponds to the minimum pressure at 20 °C specified by the manufacturer [see 9.1.2b)].

The basic schedule of testing to determine the test fire rating comprises a set of three test fires and a rating is achieved by extinguishing at least two of the three. The extinguishers for a set of test fires are either:

- 1) type "F" and "L" extinguishers, success to be achieved with one "F" and one "L" extinguisher; or
- 2) three "F" extinguishers, success to be achieved with two of these extinguishers, in which case additional tests are to be carried out to show that an "L" extinguisher is capable of extinguishing the rated test fire.

Do not include void tests (see H.2) in a set.

There is no restriction on the number of sets that may be carried out, but a set comprises fires consecutively carried out and the result of any particular test fire is not to be disregarded. Each set is to be completed before another is started.

Each set is completed either when all three test fires are carried out or when the first two test fires are either both successful or both unsuccessful. Use the extinguisher according to the manufacturer's operating instructions but do not remove any nozzle cap.

H.4 Class A fire performance

H.4.1 Apparatus

H.4.1.1 Metal frame support, (250 ± 10) mm high, (900 ± 10) mm wide and of a length equal to that of the test fire. The steel frame (see Figure 1) is constructed of 50 mm \times 50 mm angle sections.

H.4.1.2 Wooden sticks, of *Pinus silvestris* containing 12.5 % to 17.5 % of moisture by mass, and of square section of side (39 ± 2) mm.

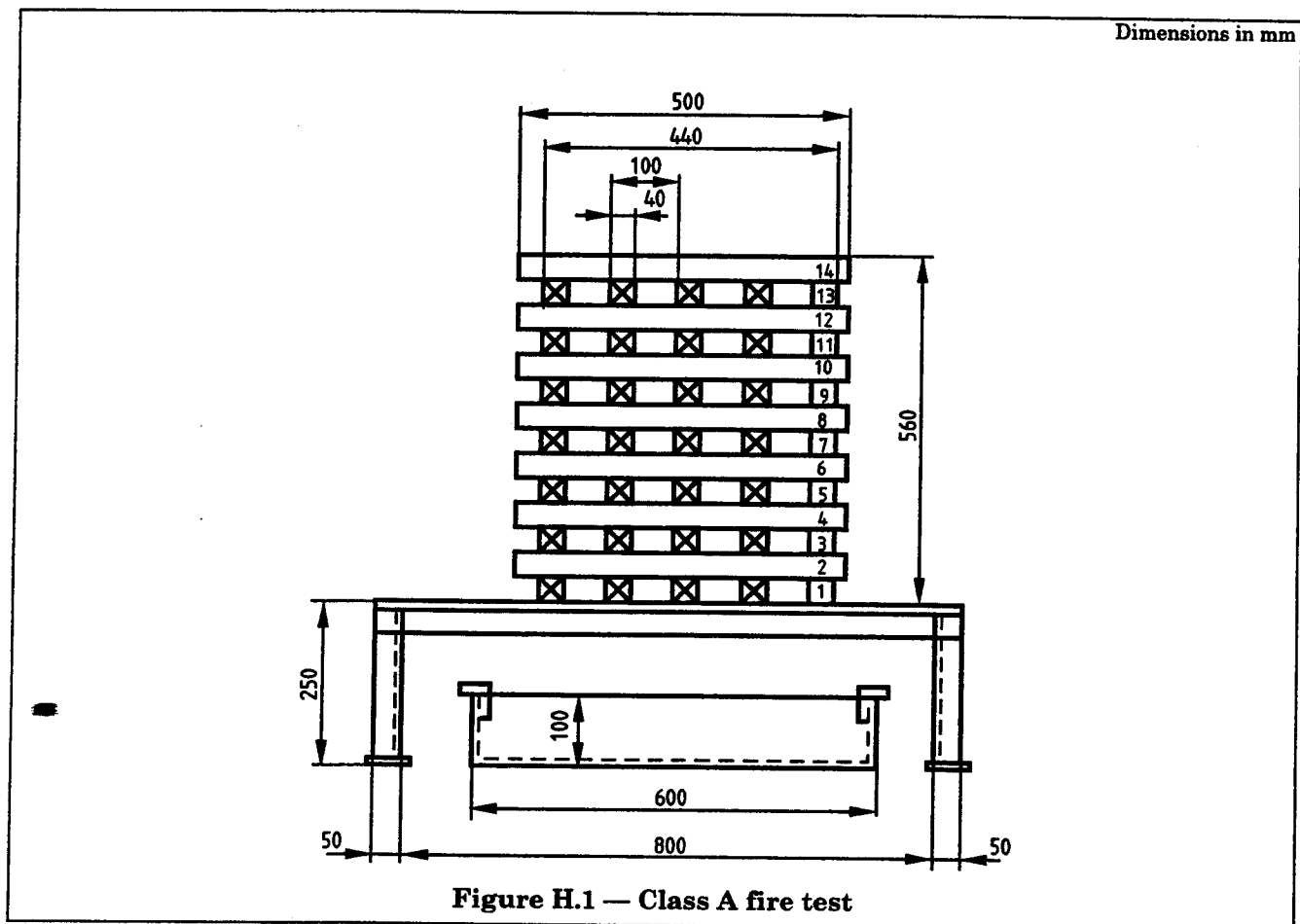
Determine the moisture content of the sticks using commercially available instruments, which measure electrical conductivity between two needle probes pushed into the sticks.

NOTE Some variation of reading can be obtained due to structural variation of the timber and the direction of the grain. This type of instrument should therefore be calibrated in case of doubt by drying samples of the sticks at (103 ± 2) °C, cut to convenient length and to constant mass, and by weighing them at 24 h intervals.

The moisture content expressed as a percentage is given by the following equation:

$$\text{Percentage moisture} = \frac{\text{Initial mass} - \text{Dry mass}}{\text{Dry mass}} \times 100$$

Stack the wooden sticks in 14 layers on the metal frame(s), spaced at nominal 100 mm centres with nominal 61 mm gaps between the sticks as shown in Figure 1.



Use sticks of length (500 ± 10) mm laid (layers 2, 4, 6, 8, 10, 12 and 14) and sticks of lengths equal to the test fire length as shown in Table H.1 laid longitudinally (layers 1, 3, 5, 7, 9, 11 and 13).

Table H.1 — Dimensions of the class A test fire

Designation of test fire	Number of 500 mm wooden sticks in each transverse layer	Length of test fire mm
3A	3	300 ± 10
5A	5	500 ± 10
8A	8	800 ± 10
13A	13	$1\ 300 \pm 10$

NOTE Each test fire is designated by a number in a series in which each term is equal to the sum of two preceding terms i.e. the series is equivalent to a geometric progression having a common ratio of 1.62. The designation of the test fire represents the following.

- The nominal length of the test fire in decimetres, i.e. the nominal length of the wooden sticks arranged in the longitudinal direction of the test fire.
- The number of 500 mm wooden sticks for each layer arranged in the transverse direction of the test fire.

H.4.1.3 Lighting fuel, consisting of an aliphatic hydrocarbon having an initial boiling point of not less than $88\text{ }^{\circ}\text{C}$ and a final boiling point of not more than $105\text{ }^{\circ}\text{C}$.

NOTE Typical fuels meeting this requirement are certain heptane and solvent fractions sometimes referred to as commercial heptane.

H.4.1.4 Lighting tray, (100 ± 10) mm longer than the nominal length of the test fire, of width (600 ± 10) mm and depth (100 ± 10) mm.

H.4.2 Test fire location

Locate the test fire indoors and sheltered from draughts in a test chamber that does not impede the natural development of the test fire or effective fire-fighting.

H.4.3 Procedure

The procedure shall be as follows.

- Pour water into the lighting tray(s) to form a layer at least 3 mm deep over the whole base of the tray. Then add sufficient lighting fuel to burn for at least 2 min.
- Ignite the fuel.
- 120^{+10}_0 s after fuel ignition, withdraw the lighting tray(s) from the crib.
- Permit the crib to burn for a further 6 min, making a total pre-burn time of 8 min.
- Operate the extinguisher, without removing any nozzle cap, and apply it to the test fire. Extinguishers may be discharged continuously or in successive bursts.

NOTE The operator may move around the fire in order to obtain the best results.

H.5 Class B fire performance

H.5.1 Apparatus

H.5.1.1 Test fire trays, made of welded sheet steel and of circular cylindrical shape with dimensions as given in Table H.2. The sides are vertical. The bases of the trays are set horizontal above, or level with, the surrounding ground.

NOTE Reinforcement of the base of the larger test fire trays will be necessary to minimize distortion. In such cases, it will be necessary to ensure that the undersides of the trays are not exposed to the atmosphere.

H.5.1.2 Lighting fuel, consisting of an aliphatic hydrocarbon having an initial boiling point of not less than $88\text{ }^{\circ}\text{C}$ and a final boiling point of not more than $105\text{ }^{\circ}\text{C}$.

NOTE Typical fuels meeting this requirement are certain heptane and solvent fractions sometimes referred to as commercial heptane.

