

*Incorporating
Amendment Nos. 1
and 2, and
implementing No. 3, not
published separately*

Components of automatic fire alarm systems for residential premises

Part 1. Specification for self-contained smoke alarms and point-type smoke detectors

ICS 13.220.20

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Fire Standards Policy Committee (FSM/-) to Technical Committee FSM/12, upon which the following bodies were represented:

British Cable Makers' Confederation
 British Fire Protection Systems Association Ltd.
 British Fire Services' Association
 British Telecommunications plc
 Chartered Institution of Building Services Engineers
 Chief and Assistant Chief Fire Officers' Association
 Department of Health
 Department of the Environment (Building Research Establishment)
 Department of the Environment (Property Services Agency)
 Department of Transport (Marine Directorate)
 Electrical Contractors' Association
 Electrical Installation Equipment Manufacturers' Association (BEAMA Ltd.)
 Home Office
 Institution of Electrical Engineers
 Institution of Fire Engineers
 Loss Prevention Council
 Ministry of Defence
 National Inspection Council (Quality Assurance Ltd.)
 Royal Institute of British Architects
 Society of Fire Protection Engineers
 Trades Union Congress

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

Electricity Supply Industry in England and Wales
 National Caravan Council Limited

This British Standard, having been prepared under the direction of the Fire Standards Policy Committee, was published under the authority of the Board of BSI and comes into effect on 31 July 1990

© BSI 1997
 First published January 1977
 Second edition July 1990

The following BSI references relate to the work on this standard:
 Committee reference FSM/12
 Draft for comment 89/39453 DC

ISBN 0 580 18699 7

Amendments issued since publication

Amd. No.	Date	Text affected
6863	September 1991	Indicated by a line in the margin
7648	May 1993	Indicated by a line in the margin
9628	August 1997	Indicated by a line in the margin

Contents

	Page
Committees responsible	Inside front cover
Foreword	3
Specification	
Section 1. General	
1 Scope	4
2 Definitions	4
Section 2. Requirements	
3 Marking	5
4 Provision of information	5
5 Constructional requirements	5
Section 3. Tests	
6 Testing	7
7 Measurement of response threshold	8
8 Directional dependence	8
9 Preliminary test and numbering	8
10 Connection and stability test	9
11 Repeatability	9
12 Supply voltage	9
13 Air movement	10
14 Ambient light	10
15 Elevated and depressed temperature	11
16 Humidity	11
17 Corrosion	11
18 Impact	11
19 Vibration	12
20 Fire sensitivity	12
21 Maximum sensitivity	13
22 Final test	14
23 Self-contained smoke alarms	14
Appendices	
A Wind tunnel	18
B Determination of optical density	18
C Smoke density measuring instruments for tunnel tests	19
D Ambient light test apparatus	20
E Temperature test apparatus	20
F Corrosion test apparatus	20
G Assessment and testing to determine the adequacy of personal protection against electric shock and against the effects of excessive temperature; and of protection against fire	20

	Page
Tables	
1 Test schedule	7
2 Equivalent smoke densities	19
Figures	
1 Plan view of test chamber	12
2 Schematic diagram of wood crib	13
3 Battery fault warning test circuit	14
4 A suitable wind tunnel for the measurement of response threshold	18
5 Schematic diagram of optical density meter	19

Foreword

This Part of BS 5446, prepared under the direction of the Fire Standards Policy Committee, is a revision of BS 5446 : Part 1 : 1977, which is withdrawn. It specifies the requirements for self-contained smoke alarms and for point-type smoke detectors intended for use in residential premises where provision is made for people to sleep. Such premises include private dwellings, hotels, boarding houses, nursing homes, homes for the elderly and handicapped, hospitals and other institutional premises.

This revision includes requirements to cover the provision of alarm silence facilities and additional requirements for detectors suitable for installation in touring caravans.

Self-contained smoke alarms are suitable only for installation in single-family dwellings as recommended in appendix H of BS 5839 : Part 1 : 1988. In large private dwellings, for example a country mansion, the use of self-contained smoke alarms (even if interconnected) is not considered to be a suitable method of protection, and reference should be made to BS 5839 : Part 1.

If provided, an alarm silence facility is intended to discourage the user from permanently disabling the smoke alarm (e.g. by removing the battery) when performing actions likely to cause nuisance alarms (e.g. cooking or paint stripping). It is also intended to make smoke alarms more convenient for use in small caravans and similar situations where they cannot normally be adequately separated from the cooking area or bath/shower room, etc.

The detectors for which requirements are specified in this standard are not necessarily suitable for use in situations where they could be subjected to corrosive environments.

Requirements for ceiling and wall mounted detectors for residential premises are specified in this standard and special attention is drawn to the siting of the wall mounted detectors. These detectors may be used in combination with heat detectors specified in BS 5445 : Parts 5 and 8 and should be installed in accordance with BS 5839 : Part 1.

The tests are type tests and are not intended as manufacturers' tests to maintain uniformity of quality in production, which is dealt with in BS 5750. While the tests are intended to assess the most important features of the design and construction of detectors and smoke alarms they cannot remove the necessity for regular inspection and maintenance, which is essential for reliable operation.

Product certification. Users of this British Standard are advised to consider the desirability of third party certification of product conformity with this British Standard based on testing and continuing surveillance, which may be coupled with assessment of a supplier's quality systems against the appropriate Part of BS 5750.

Enquiries as to the availability of third party certification schemes will be forwarded by BSI to the Association of Certification Bodies. If a third party certification scheme does not already exist, users should consider approaching an appropriate body from the list of Association members.

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

Section 1. General

1 Scope

This Part of BS 5446 specifies requirements and describes test methods for self-contained smoke alarms and point-type smoke detectors irrespective of operating principle, intended solely for permanent installation, for the protection of life in premises in which regular provision is made for people to sleep. It does not cover requirements for smoke detectors designed for use in ventilation ducts.

NOTE 1. The term 'detector' is used in this standard to cover point-type smoke detectors and self-contained smoke alarms.

NOTE 2. The titles of the publications referred to in this standard are given on the inside back cover.

2 Definitions

For the purposes of this standard the definitions given in BS 4422 apply, together with the following.

2.1 fixed sensitivity detector

A detector, the response threshold of which cannot be varied manually after the completion of the manufacturing process without the breakage of a seal or some equivalent permanent indication of adjustment, and in which any such breakage is clearly visible during servicing.

2.2 self-contained smoke alarm

A detector that contains a unit capable of operating as a complete smoke detection system.

NOTE. This may operate from the mains supply, and may have provision for additional components.

2.3 adjustable sensitivity detector

A detector, the response threshold of which can be varied within specified limits without permanent indication of such variation.

NOTE. Limits are specified in clauses 20 and 21; see also 9.2.

2.4 response threshold

The smoke concentration at which the detector changes to its alarm condition.

NOTE. For the purposes of this standard, response threshold is determined as described in clause 7.

2.5 energized condition

The state in which the detector is supplied with power.

2.6 normal condition

The condition in which the detector is energized but not giving either a fire alarm signal or a fault warning, although able to give such signals if the occasion arises.

2.7 alarm condition

The condition in which the detector is giving a signal specified by the manufacturer's requirements as indicating the existence of a fire.

2.8 fault warning

A signal indicating an actual or incipient fault that might inhibit the emitting of a fire alarm signal, whether or not such a fault exists.

2.9 manufacturer's requirements

Requirements specified by the manufacturer and/or supplier.

NOTE. See clause 4.

2.10 alarm silence facility

A means of temporarily disabling or desensitizing a self-contained smoke alarm.

Section 2. Requirements

3 Marking

NOTE. Marking and safety information may be required by legislation. Concerning detectors containing radioactive material, advice should be sought from the National Radiological Protection Board, Chilton, Didcot, Oxfordshire OX11 0RQ.

Each detector shall be indelibly marked with the following:

- a) the number and date of this British Standard, i.e. BS 5446 : Part 1 : 1990¹⁾;
- b) the name or trade mark of the manufacturer or supplier;
- c) the type of detector;
- d) the date of manufacture, or the batch number;
- e) on detectors intended for installation in domestic premises: the address of an organization capable of being responsible for servicing or repair.
- f) the manufacturer's recommended date for replacement, subject to normal, regular maintenance.

Self-contained smoke alarms incorporating user replacement batteries shall be marked with the type or numbers of batteries recommended by the manufacturer and an instruction to the user: 'Test the alarm for correct operation using the test facility whenever the battery is replaced'. This marking shall be visible during the operation of changing the batteries;

Self-contained smoke alarms incorporating non-replaceable batteries shall be marked: 'WARNING - BATTERY NOT REPLACEABLE - SEE INSTRUCTION MANUAL' and this shall be visible during normal use.

Conformity shall be checked by visual inspection. The indelibility of the marking shall be checked by establishing that it cannot be removed when rubbed lightly with a piece of cloth soaked with petroleum spirit or water.

4 Provision of information

4.1 Point-type smoke detectors

Information supplied on or with the detector shall be sufficient to allow the detector to be operated in accordance with this standard. This information shall include:

- a) either the specific types of associated equipment with which the detector may be used or the requirements of the detector with respect to such equipment including, for example, the maximum and minimum voltages over which the detector is designed to operate;

b) any requirements for a time delay after energizing or resetting in order to allow the detector to stabilize;

c) where a specific type of control equipment is required under (a), the maximum and minimum numbers of detectors that may be used in one zone;

d) any necessary parameters of the interconnecting cables, such as resistance, capacitance or leakage.

4.2 Self-contained smoke alarms

Information supplied on or with smoke alarms shall include instructions on siting, installation and maintenance which follow the guidance given in BS 5839 : Part 6 : 1995.

The information provided with smoke alarms incorporating user-replaceable batteries shall include specific guidance on changing the batteries. This guidance shall include any advice which is necessary to ensure that the battery is properly connected. It shall also include a recommendation that the operation of the alarm is tested with the test facility whenever the batteries are replaced.

NOTE. It is recommended that the guidance should also state that if the alarm fails to operate correctly, the advice of the manufacturer should be sought.

For smoke alarms incorporating non-replaceable batteries, information shall be given on the action to be taken if a battery fault warning is emitted.

Information for interconnectable smoke alarms shall state the maximum number that may be interconnected, and details of suitable cables shall be given.

Information for smoke alarms intended for connection to mains supplies shall include a warning that draws attention to the hazards associated with mains voltages and recommends that the smoke alarm, together with any associated supply and interconnect wiring, be installed in accordance with the Regulations for Electrical Installations²⁾, published by the Institution of Electrical Engineers.

Information for smoke alarms provided with an alarm silence facility shall include a warning that if there is any question as to the cause of an alarm it should be assumed that the alarm is due to an actual fire and the dwelling should be evacuated immediately.

If it is claimed that the smoke alarm is also suitable for use in touring caravans then this shall be clearly stated in the information supplied on or with the smoke alarm (see also 23.10).

¹⁾ Marking BS 5446 : Part 1 : 1990 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of such a claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

²⁾ 'Regulations for Electrical Installations' (IEE Wiring Regulations). Available from Station House, Nightingale Road, London SE16 5PU.

5 Constructional requirements

5.1 Visual indication of operation

When visual indication of operation is included in the detector, the presence or absence of the indication shall be clearly visible from a distance of 5 m in normal conditions of use. The failure of any indicator lamp shall not prevent the emitting of a fire alarm signal.

NOTE. Good installation practice may require indication of the operation of individual detectors in all systems other than those containing only small numbers of detectors.

5.2 Terminals for external conductors

The detector or base, as appropriate, if intended to have external connections, shall be provided with terminals for the connection of conductors by means of screws, nuts or equally effective devices. Terminals shall allow the connection of conductors having nominal cross-sectional areas of between 0.4 mm^2 and 1.5 mm^2 . Disconnection of the conductors shall not be possible without the use of a tool. Terminals shall be so designed that they clamp the conductor between metal surfaces without rotation of those surfaces but with sufficient contact pressure and without damage to the conductor.

5.3 Alignment of detectors

Where separate bases are used, a means to prevent incorrect alignment of the detector in the base shall be provided.

5.4 Failure of components

For any component, failure of which would cause the detector not to emit a fire alarm signal, and which has a 'mean time before failure' of less than 5 years, failure of the component shall give a fault warning.

5.5 Battery removal indication

The removal of any user-replaceable battery used to power, or provide back-up power for, the smoke detection circuit/sounder, from a battery or mains powered d.c. backed smoke alarm, shall result in a visual, mechanical or audible warning that the battery has been removed. The visual warning shall not depend upon a power source.

NOTE. Conformity may be achieved by, but is not restricted to, one of the following examples:

- (a) a warning flag that will be exposed with the battery removed and the cover closed;
- (b) a hinged cover or battery compartment that cannot be closed when the battery is removed;
- (c) a unit that cannot be replaced upon its mounting with the battery removed.

Section 3. Tests

6 Testing

6.1 Test specimens

Eleven point-type smoke detectors shall be provided for use in the tests described in clauses 8 to 22.

Thirteen self-contained smoke alarms shall be provided for use in the tests described in clauses 8 to 23.

6.2 Test schedule

The detectors shall be numbered as specified in clause 9. The tests on each detector indicated in table 1 shall be carried out in the order in which they are listed.

The battery installation test shall be conducted on alarms selected in accordance with 23.14.2 from amongst the 13 samples provided for test.

Table 1. Test schedule															
Test	Clause	Detector number													
		1	2	3	4	5	6	7	8	9	10	11	12	13	
Directional dependence	8	One detector selected at random													
Preliminary test	9	x	x	x	x	x	x	x	x	x	x	x	x	x	
Connection and stability	10		x								x				
Repeatability	11	x										x			
Supply voltage	12	x										x			
Air movement	13	x										x			
Ambient light	14	x										x			
Temperature	15	x										x			
Humidity	16			x						x					
Corrosion	17				x				x						
Impact	18					x		x							
Vibration	19						x								
Fire sensitivity	20	x	x								x	x			
Maximum sensitivity	21	x	x												
Final test	22	x	x								x	x			
Battery fault warning	23.2												x		
Sound output	23.4													x	
Tests on interconnectable smoke alarms	23.6												x		
Tests of alarm silence facility	23.7												x		
Battery reversal	23.9													x	
Additional tests for detectors suitable for installation in touring caravans															
Vibration	23.10.2						x								
Temperature cycle	23.10.3			x											
NOTE. Attention is drawn to the fitting of wind shields to appropriate detectors (see 13.1.4).															

NOTE. Attention is drawn to the fitting of wind shields to appropriate detectors (see 13.1.4).