

Fire detection and fire alarm devices for dwellings —

Part 2: Specification for heat alarms

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Committees responsible for this British Standard

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- BRE/LPC Laboratories
- BSI Testing — Product Certification
- Building Research Establishment
- Consumer Policy Committee of BSI
- Department of Health — NHS Estates
- Electricity Association
- Energy Industries Council
- London Fire and Emergency Planning Authority
- Maritime and Coastguard Agency
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- National Caravan Council Limited
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Foreword

This part of BS 5446 has been prepared by Subcommittee FSH/12/2 under the direction of Technical Committee FSH/12.

It is an addition to the BS 5446 series and specifies requirements and test methods for heat alarms intended for use in dwellings. (See BS 5839-6.)

The tests are type tests and are not intended as manufacturers' tests to maintain uniformity of quality in production, which is dealt with in the BS EN ISO 9000 series. While the tests are intended to assess the most important features of the design and construction of heat 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. Appropriate conformity attestation arrangements are described in the appropriate part of the BS EN ISO 9000 series. Users seeking assistance in identifying appropriate conformity assessment bodies or schemes may ask BSI to forward their enquiries to the relevant association.

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

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 29 and a back cover.

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1 Scope

This part of BS 5446 specifies requirements and type test methods for heat alarms. It is applicable to heat alarms intended solely for permanent installation on ceilings or walls of dwellings, and to heat alarms suitable for use in leisure accommodation vehicles (LAVs).

NOTE 1 Equipment conforming to this part of BS 5446 might not be suitable for use in boats due to the corrosive atmosphere.

NOTE 2 Although not covered by this part of BS 5446, equipment is available for use with heat alarms in order to provide a suitable warning system for use by the deaf and hearing impaired.

NOTE 3 This part of BS 5446 does not include point type detectors.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 2011 (IEC 60068) (all parts), *Environmental testing*.

BS 4422 (all parts), *Glossary of terms associated with fire*.

BS 5839-6:1995, *Fire detection and alarm systems for buildings — Part 6: Code of practice for the design and installation of fire detection and alarm systems in dwellings*.

BS EN 54-5, *Fire detection and fire alarm systems — Part 5: Heat detectors — Point detectors*.

BS EN 60065:2002, *Audio, video and similar electronic apparatus — Safety requirements*.

BS EN 60068 (IEC 60068) (all parts), *Environmental testing*.

BS EN 60651, *Specification for sound level meters*.

BS EN 60950-1:2002, *Information technology equipment — Safety — Part 1: General requirements*.

ISO 209-1:1989, *Wrought aluminium and aluminium alloys — Chemical composition and forms of products — Part 1: Chemical composition*.

3 Terms and definitions

For the purposes of this part of BS 5446 the terms and definitions given in BS 4422, BS 5839-6, BS EN 54-5 and the following apply.

3.1

alarm condition

condition in which a heat alarm is giving a signal as specified by the manufacturer

3.2 application temperatures

3.2.1

maximum application temperature

maximum temperature that an installed heat alarm can be expected to experience, even for short periods of time, in the absence of a fire condition

NOTE This temperature is deemed to be 4 °C below the minimum static response temperature for the appropriate class marked on the heat alarm, as specified in Table 1.

3.2.2

typical application temperature

temperature that an installed heat alarm can be expected to experience for long periods of time in the absence of a fire condition

NOTE This temperature is deemed to be 29 °C below the minimum static response temperature for the appropriate class marked on the heat alarm, as specified in Table 1.

3.3

fault warning

signal intended to indicate an actual or incipient fault that might prevent the emitting of a heat alarm signal

3.4

heat alarm

device containing within one housing all the components, except possibly the energy source, necessary for detecting heat and for giving an audible alarm

3.5

normal condition

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

3.6

static response temperature

temperature at which a heat alarm would produce an alarm signal if subjected to a vanishingly small rate of rise of temperature

4 Constructional requirements

4.1 Visual indication of operation

Mains-powered apparatus shall include a power supply indicator. This shall be coloured green and shall be continuously illuminated when mains power is present.

If an alarm indicator is fitted, it shall be red and shall be separate from the mains power supply indicator. The alarm indicator shall be illuminated when an alarm condition is present.

NOTE 1 The fitting of alarm indicators is optional.

NOTE 2 It is usual for an alarm indicator to be continuously illuminated, or flashing at least once per second, when an alarm condition is present.

When the failure of an alarm indicator or a power supply indicator is simulated by open circuit or short-circuit, there shall be no failure of the fire alarm signal.

NOTE 3 This is to ensure that the failure of an indicator lamp does not prevent the emitting of a fire alarm signal.

4.2 Terminals for external conductors

The alarm 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 mm² and 1.5 mm².

Terminals shall be designed such that:

- a) it is not possible to disconnect the conductors, or access the conductors for disconnection, without the use of a tool;
- b) they clamp the conductor between metal surfaces without rotation of those surfaces but with sufficient contact pressure and without damage to the conductor.

4.3 Alignment of alarms

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

4.4 Failure of components

If a component is fitted that has a mean time before failure of less than 5 years, the heat alarm shall be designed in such a way that a fault warning is given on the failure of that component. Any such warning shall be readily distinguishable from the alarm signal.

NOTE It is usual to fit components that have a mean time before failure of more than 5 years.

4.5 Battery removal indication

The heat alarm shall be designed in such a way that removal of any user-replaceable battery used to power, or provide back-up power for, the heat detection circuit/sounder, from a battery or mains-powered d.c.-backed heat alarm, results 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.

4.6 Position of heat-sensitive elements

The heat alarm shall be constructed such that at least part of its heat-sensitive element(s), except elements with auxiliary functions (e.g. characteristic correctors), is ≤ 15 mm from the mounting surface of the heat alarm.

4.7 Routine testing facility

Provision shall be made in the construction of the heat alarm, and in the manufacturer's instructions (see Clause 7), for testing by the domestic user. Such testing shall include the whole of the operating system of the heat alarm, including the integrity of the heat-sensing thermistor.

NOTE This testing is normally carried out by the use of a test switch mounted in the heat alarm cover. Failure of the thermistor (e.g. due to physical damage or corrosion of the leads) is critical to the heat alarm's operation.

4.8 Battery connections

For heat alarms intended for use in LAVs, any leads connecting the terminal connectors of batteries in heat alarms to the heat alarm circuit board shall be provided with strain-relieving devices adjacent to both battery terminal connectors and the heat alarm circuit board so that when the leads are subjected to a pull of 20 N without jerks for 1 min in any direction allowed by the design, the pull is not transmitted to the joints between the leads and the battery terminal connectors or between the leads and the heat alarm circuit board.

4.9 Monitoring of back-up power source

NOTE See also 5.24.2.

A means shall be provided for monitoring the back-up power source for fault conditions, including low back-up, open circuit and short-circuit failure.

5 Operational requirements

5.1 General

When tested in accordance with the appropriate method specified in Annex A, using the test schedule specified in Annex B, heat alarms shall conform to the requirements specified in 5.3 to 5.20. Heat alarms shall also conform to the requirements specified in 5.21, 5.22, 5.23 and 5.24, as appropriate.

Where response times are to be measured, the specimen shall be mounted in a heat tunnel as specified in Annex C.

NOTE Further information regarding the construction of the heat tunnel is given in Annex D.

The general procedures specified in A.1 shall be carried out for all tests.

5.2 Classification

Heat alarms shall conform to class A1, A2 or B, as specified in Table 1.

Table 1 — Heat alarm classification temperatures

Heat alarm class	Typical application temperature °C	Maximum application temperature °C	Minimum static response temperature °C	Maximum static response temperature °C
A1	25	50	54	65
A2	25	50	54	70
B	40	65	69	85

5.3 Directional dependence

When tested in accordance with A.2, class A1 heat alarms shall respond between 1 min 0 s and 4 min 20 s at all eight orientations, and class A2 and B heat alarms shall respond between 2 min 0 s and 5 min 30 s at all eight orientations.

5.4 Static response temperature

When tested in accordance with A.3, the response temperatures shall lie between the minimum and maximum static response temperatures specified in Table 1 for the appropriate alarm class.

5.5 Response times from typical application temperature

When tested in accordance with A.4, the response times shall lie between the lower and upper response time limits specified in Table 2 for the appropriate alarm class.

Table 2 — Response time limits from typical application temperature

Rate of rise of air temperature °C/min	Class A1 heat alarms				Class A2, B heat alarms			
	Lower limit of response time		Upper limit of response time		Lower limit of response time		Upper limit of response time	
	min	s	min	s	min	s	min	s
1	29	0	40	20	29	0	46	0
3	7	13	13	40	7	13	16	0
5	4	9	8	20	4	9	10	0
10	1	0	4	20	2	0	5	30
20	—	30	2	20	1	0	3	13
30	—	20	1	40	—	40	2	25

NOTE Information concerning the derivation of the limits in Table 2 is given in Annex E.

5.6 Response times from 25 °C

NOTE This requirement is applicable only to class B heat alarms.

When tested in accordance with A.5, the response time at 3 °C/min shall exceed 7 min 13 s, and the response time at 20 °C/min shall exceed 1 min 0 s.

5.7 Response times from high ambient temperature (dry heat operational)

When tested in accordance with A.6, no alarm or fault signal shall be given during the period when the temperature is increasing to the stabilization temperature or during the stabilization period, and the response times shall lie between the lower and upper response time limits specified in Table 3 for the appropriate alarm class.

Table 3 — Response time limits from maximum application temperature

Rate of rise of air temperature °C/min	Class A1 heat alarms				Class A2, B heat alarms			
	Lower limit of response time		Upper limit of response time		Lower limit of response time		Upper limit of response time	
	min	s	min	s	min	s	min	s
3	1	20	13	40	1	20	16	0
20	—	12	2	20	—	12	3	13

NOTE Information concerning the derivation of the limits in Table 3 is given in Annex E.

5.8 Supply voltage

When tested in accordance with A.7, the response times shall lie between the lower and upper response time limits specified in Table 2 for the appropriate heat alarm class.

5.9 Reproducibility

When tested in accordance with A.8, the response times shall lie between the lower and upper response time limits specified in Table 2 for the appropriate heat alarm class.

5.10 Operation at low temperature

When tested in accordance with A.9:

- a) no alarm or fault signal shall be given during the transition to the conditioning temperature or during the period at the conditioning temperature;
- b) the response time of the heat alarm at 3 °C/min shall be not less than 7 min 13 s and any change in the response time compared with the time obtained in A.8 shall not exceed 2 min 40 s;
- c) the response time of the heat alarm at 20 °C/min shall be not less than 30 s for class A1 detectors, 1 min 0 s for all other classes, and any change in the response time compared with the time obtained in A.8 shall not exceed 30 s.

5.11 Humidity

When tested in accordance with A.10, the response times shall lie between the lower and upper response time limits specified in Table 2 for the appropriate heat alarm class.

5.12 Corrosion

When tested in accordance with A.11:

- a) no fault signal, attributable to the endurance conditioning, shall be given on reconnection of the specimen;
- b) the response time at 3 °C/min shall be not less than 7 min 13 s and any change in the response time compared with the time obtained in A.8 shall not exceed 2 min 40 s;
- c) the response time at 20 °C/min shall be not less than 30 s for class A1 heat alarms, 1 min 0 s for all other classes, and any change in the response time compared with the time obtained in A.8 shall not exceed 30 s.

5.13 Impact

When tested in accordance with A.12:

- a) the response time at 3 °C/min shall be not less than 7 min 13 s and any change in the response time compared with the time obtained in A.8 shall not exceed 2 min 40 s;
- b) the response time at 20 °C/min shall be not less than 30 s for class A1 heat alarms, 1 min 0 s for all other classes, and any change in the response time compared with the time obtained in A.8 shall not exceed 30 s, unless, within 30 s of the impact, the heat alarm gives a fault warning that cannot be reset;
- c) the impact shall not detach the heat alarm from its mounting.

NOTE An example of a typical test rig for the impact test is described in Annex F.

5.14 Vibration

When tested in accordance with **A.13**:

- a) no fire alarm signal or fault warning shall be given during the vibration;
- b) no defect that might lead to subsequent failure shall be observed after the vibration;
- c) the response time at 3 °C/min shall be not less than 7 min 13 s and any change in the response time compared with the time obtained in **A.8** shall not exceed 2 min 40 s;
- d) the response time at 20 °C/min shall be not less than 30 s for class A1 heat alarms, 1 min 0 s for all other classes, and any change in the response time compared with the time obtained in **A.8** shall not exceed 30 s.

5.15 Battery fault warning

NOTE This requirement is applicable only to heat alarms incorporating a battery.

When tested in accordance with **A.14**:

- a) the response time at 3 °C/min shall be not less than 7 min 13 s and any change in the response time compared with the time obtained in **A.8** shall not exceed 2 min 40 s;
- b) the response time at 20 °C/min shall be not less than 30 s for class A1 heat alarms, 1 min 0 s for all other classes, and any change in the response time compared with the time obtained in **A.8** shall not exceed 30 s.

5.16 Sound output

When tested in accordance with **A.15**:

- a) for mains-powered alarms, the sound output shall be not less than 85 dBA after 4 min of alarm operation;
- b) for battery-operated alarms, the sound output shall be not less than 85 dBA after 1 min of alarm operation and not less than 82 dBA after 4 min of alarm operation.

5.17 Interconnection of heat alarms

NOTE See also 5.24.

5.17.1 When tested in accordance with **A.16.2**, **A.16.3** and **A.16.4**, and with **A.16.1** if appropriate, all the interconnected heat alarms shall give an audible alarm signal.

5.17.2 When tested in accordance with **A.16.5**, with **A.16.1** if appropriate, and, for battery-operated heat alarms, with **A.16.6**:

- a) the response time at 3 °C/min shall be not less than 7 min 13 s and any change in the response time compared with the time obtained in **A.8** shall not exceed 2 min 40 s;
- b) the response time at 20 °C/min shall be not less than 30 s for class A1 heat alarms, 1 min 0 s for all other classes, and any change in the response time compared with the time obtained in **A.8** shall not exceed 30 s.

5.17.3 When tested in accordance with **A.16.7**, and with **A.16.1** if appropriate, the sound output for mains-powered alarms shall be not less than 85 dBA after 4 min of alarm operation.

5.17.4 When tested in accordance with **A.16.7** and **A.16.8**, and with **A.16.1** if appropriate, the sound output for battery-operated alarms shall be not less than 85 dBA after 1 min of alarm operation and not less than 82 dBA after 4 min of alarm operation.

5.18 Battery reversal

When tested in accordance with **A.17**:

- a) the response time of the heat alarm measured at 3 °C/min shall be not less than 7 min 13 s and any change in the response time compared with the time obtained in **A.8** shall not exceed 2 min 40 s;
- b) the response time of the heat alarms measured at 20 °C/min shall be not less than 30 s for class A1 heat alarms, 1 min 0 s for all other classes, and any change in the response time compared with the time obtained in **A.8** shall not exceed 30 s.

5.19 Additional requirements for alarms suitable for installation in LAVs

NOTE The requirements specified in 5.19.1 and 5.19.2 are applicable only to heat alarms that are intended to be suitable for installation in LAVs.

5.19.1 *Vibration (additional)*

When tested in accordance with A.18.1:

- a) the response time at 3 °C/min shall be not less than 7 min 13 s and any change in the response time compared with the time obtained in A.8 shall not exceed 2 min 40 s;
- b) the response time at 20 °C/min shall be not less than 30 s for class A1 heat alarms, 1 min 0 s for all other classes, and any change in the response time compared with the time obtained in A.8 shall not exceed 30 s.

5.19.2 *Temperature cycle*

When tested in accordance with A.18.2:

- a) the response time at 3 °C/min shall be not less than 7 min 13 s and any change in the response time compared with the time obtained in A.8 shall not exceed 2 min 40 s;
- b) the response time at 20 °C/min shall be not less than 30 s for class A1 heat alarms, 1 min 0 s for all other classes, and any change in the response time compared with the time obtained in A.8 shall not exceed 30 s;
- c) the specimen shall not emit an alarm signal during the conditioning at –10 °C.

5.20 Battery installation

When tested in accordance with A.19, all 25 combinations of batteries and alarms shall operate correctly.

5.21 Safety

5.21.1 Heat alarms shall be protected against electric shock, either in accordance with BS EN 60065:2002, Clause 8, or by operation from a supply not greater than 34 V (peak or d.c.), which is either independent of the supply mains, or isolated from it by double or reinforced insulation.

5.21.2 For mains-powered equipment, the rated supply voltage shall be 230 V a.c., 50 Hz. If a range of supply voltages is specified, the range shall include 230 V a.c., 50 Hz.

5.21.3 When tested in accordance with the test methods specified in the appropriate part of BS EN 60065:2002, heat alarms shall conform to the appropriate part of BS EN 60065:2002, as specified in Annex G. All safety tests shall be carried out both under normal operating conditions as specified in BS EN 60065:2002, 4.2, and under fault conditions as specified in BS EN 60065:2002, 4.3.

5.22 Heat alarms with additional facilities, and heat alarms incorporated into other equipment

Heat alarms with additional facilities, and heat alarms incorporated into other equipment, shall conform to the same requirements as standard heat alarms and shall have a separate power supply to any facilities requiring power (e.g. escape lights).

5.23 Battery capacity

Heat alarms, whether used individually or interconnected, shall only use batteries that can be shown to have the following characteristics:

- a) they are capable of supplying the quiescent load of the heat alarm(s) together with the additional load resulting from routine weekly testing, for at least 1 year before the battery fault warning is given;
- b) at the point when the battery fault warning commences, they have sufficient capacity to give an alarm signal as specified in 5.16 for at least 4 min in the event of fire, or, in the absence of fire, a battery fault warning for at least 30 days.

NOTE As it is not practicable to run a unit and battery combination for a period of 1 year real-time testing, the test house may accept data concerning the heat alarm loads and the battery characteristics to determine whether these requirements can be met. For interconnected heat alarms, this includes the load introduced by interconnecting the maximum permitted number of heat alarms.