

BS 5446-3:2015



BSI Standards Publication

Detection and alarm devices for dwellings –

Part 3: Specification for fire alarm
and carbon monoxide alarm systems
for deaf and hard of hearing people

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Foreword

Publishing information

This part of BS 5446 is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 28 February 2015. It was prepared by Subcommittee FSH/12/2, *Fire detectors*, under the authority of Technical Committee FSH/12, *Fire detection and alarm systems*. A list of organizations represented on these committees can be obtained on request to their secretary.

Supersession

This part of BS 5446 supersedes BS 5446-3:2005, which is withdrawn.

Relationship with other publications

BS 5446 is published in the following parts:

- Part 2: *Specification for heat alarms*;
- Part 3: *Specification for fire and carbon monoxide alarm systems for deaf and hard of hearing people*.

Smoke alarms for use in dwellings are specified in BS EN 14604. Carbon monoxide alarms are specified in BS EN 50291-1.

Guidance on the siting, installation and maintenance of smoke alarms for deaf and hard of hearing people in dwellings, and on user actions, is given in BS 5839-6.

Guidance on siting and maintenance of carbon monoxide alarms is given in BS EN 50292 for general use.

Information about this document

This is a full revision of the standard, and introduces the following principal changes:

- inclusion of carbon monoxide alarms;
- change from “kits” to individual components that may be used to form a system appropriate to individual requirements or needs;
- inclusion of references to European standards for visual alarm devices and low frequency sounders;
- removal of requirements specific to LAVs;
- inclusion of guidance on systems suitable for varying levels of hearing loss.

Product certification/inspection/testing. 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.

Use of this document

It has been assumed in the preparation of this British Standard 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 smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. "organization" rather than "organisation").

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 British Standard cannot confer immunity from legal obligations.

Particular attention is drawn to the following specific regulations:

- Consumer Protection Act 1987 [1];
- Batteries and Accumulators (Containing Dangerous Substances) (Amendment) Regulations 2001 [2];
- Electrical Equipment (Safety) Regulations 1994 [3].

Introduction

Fire and carbon monoxide alarms for use in dwellings have been available for many years, and are specified in BS EN 14604 (smoke alarms), BS 5446-2 (heat alarms) and BS EN 50291-1 (carbon monoxide alarms). These devices are intended to warn of the presence of a potentially dangerous condition by emitting a loud piercing sound. However, people with hearing loss might not be able to adequately hear such an alarm sound.

There are recognized methods of alerting deaf and hard of hearing people, including the use of vibratory, visual alarm and low frequency audible devices. To provide a fire or carbon monoxide warning for those who are deaf or hard of hearing, it has become common practice for such devices to be coupled to domestic alarms. For example, vibrating pads can be used to awaken deaf or hard of hearing people, and visual alarms to alert those already awake, in the event of the associated alarm(s) activating. There is therefore an increasing need for standardization of such alarm systems. This part of BS 5446 addresses that need by specifying requirements for fire and carbon monoxide alarm systems that include fire and carbon monoxide alarms and associated warning devices used in dwellings to warn deaf and hard of hearing people. This part of BS 5446 does not claim to provide an exclusive or definitive solution to the problem of providing reliable protection to people with impaired hearing. It is recognized that other techniques or products might be developed which would currently fall outside the scope of this part of BS 5446.

This part of BS 5446 includes tests and requirements for vibratory, visual alarm and low frequency audible devices, for fire and/or carbon monoxide alarms by reference to BS EN 14604, BS 5446-2 and BS EN 50291-1, and for the interconnections of these components. The tests specified in this part of BS 5446 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 the components of alarm systems for deaf and hard of hearing people, they cannot remove the necessity for regular inspection and maintenance, which is essential for reliable operation.

The sound from fire and carbon monoxide alarms is intended to alert people when they are either awake or asleep, but for a person with significant hearing loss, a combination of vibration, flashing light and sound is generally required in order to provide an equivalent level of protection. Some medical conditions might require specialist medical advice as to appropriate alarm equipment.

Since any fire or carbon monoxide alarm that forms part of a system for deaf and hard of hearing people is required to conform to BS EN 14604, BS 5446-2 or BS EN 50291-1, it will incorporate a functioning sounder. BS 5446-3 specifies requirements for the additional vibration and flashing light functions and any low frequency sounders.

To assist in the selection of an alarm system appropriate to an individual's needs, a grade system has been devised for guidance purposes. The grade system is covered in more detail in the Commentary on Clause 4 and Annex A.

1 Scope

This part of BS 5446 specifies requirements and test methods for components and their means of interconnection (e.g. by electrical wiring or by radio links) intended to be assembled to create fire and/or carbon monoxide alarm systems for deaf and hard of hearing people, for the purpose of life safety in dwellings.

NOTE 1 Although this part of BS 5446 provides the specification for alarm systems for dwellings, it is recognized that these systems, or components thereof, might be used in other situations, where similar requirements could be anticipated.

NOTE 2 Equipment conforming to this part of BS 5446 might not be suitable for use in boats, due to the corrosive atmosphere. It might however be suitable for use in other leisure accommodation vehicles (LAVs).

NOTE 3 The systems specified in this part of BS 5446 are specifically intended to give warning in the event of fire, or carbon monoxide emissions. However, it is recognized that systems might also incorporate devices to alert deaf and hard of hearing people to other events, such as door bell, telephone, alarm clock, baby alarm, etc., that are outside the scope of this part of BS 5446.

This part of BS 5446 does not cover medical vibrating devices as defined in BS EN ISO 9999; these are covered by BS EN 12182.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable 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 5446-2, *Fire detection and fire alarm devices for dwellings – Part 2: Specification for heat alarms*

BS 5839-6, *Fire detection and fire alarm systems for buildings – Part 6: Code of practice for the design, installation, commissioning and maintenance of fire detection and fire alarm systems in domestic premises*

BS EN 54-1, *Fire detection and fire alarm systems – Part 1: Introduction*

BS EN 54-3:2001, *Fire detection and fire alarm systems – Part 3: Fire alarm devices – Sounders*

BS EN 54-23:2010, *Fire detection and fire alarm systems – Part 23: Fire alarm devices – Visual alarm devices*

BS EN 14604, *Smoke alarm devices*

BS EN 50130-4:2011, *Alarm systems – Part 4: Electromagnetic compatibility – Product family standard – Immunity requirements for components of fire, intruder, hold up, CCTV, access control and social alarm systems*

BS EN 50291 (both parts), *Electrical apparatus for the detection of carbon monoxide in domestic premises*

BS EN 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

BS EN 60068-2-6:2008, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

BS EN 60068-2-27:2009, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

BS EN 60068-2-31:2008, *Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens*

BS EN 60068-2-42, *Environmental testing – Part 2-42: Tests – Test Kc: Sulphur dioxide test for contacts and connections*

BS EN 60068-2-75, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

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

BS EN 60529:1992+A2:2013, *Specification for degrees of protection provided by enclosures (IP code)*

BS EN 60950-1, *Information technology equipment – Safety – Part 1: General requirements*

BS EN ISO 13943, *Fire safety – Vocabulary*

3 Terms and definitions

For the purposes of this part of BS 5446, the terms and definitions in BS 5446-2, BS 5839-6, BS EN 54-1, BS EN 14604, BS EN 50291, BS EN ISO 13943 and the following apply.

3.1 control unit

separate self-contained unit that houses components for functions such as supply of power, monitoring of circuits, and control and indication

3.2 deaf or hard of hearing person

person who, as a result of hearing loss (including total hearing loss), is unable to rely on hearing audible alarm signals under typical conditions of use from fire or carbon monoxide alarms

3.3 low frequency sounder

audible device with a frequency in the range 500 Hz to 1 000 Hz

3.4 primary usage plane

plane, parallel to the way a vibrating fire alarm device is normally used or operated

3.5 vibrating pad

device intended for installation underneath a mattress or pillow to rouse a deaf or hard of hearing person from sleep by subjecting the person to vibrations

3.6 vibrating alerter

radio-linked portable device intended to alert a deaf or hard of hearing person, while awake, by subjecting the person to vibrations

3.7 vibrating alarm device

device that provides a tactile sensation sufficient to alert the user to a fire alarm condition whether asleep or awake

NOTE Vibrating fire alarm devices may be fixed, movable or portable.

- *Fixed equipment is equipment fastened to a support or otherwise secured in a specific location, or equipment not provided with a carrying handle and having such a mass that it cannot easily be moved (e.g. a fire alarm system control panel screwed to the wall).*
- *Moveable equipment is equipment which is not fixed equipment and which is not normally in operation while the location is changed (e.g. a local unit or controller which is placed on a Table top and operates a vibrating pad in a bed).*

- *Portable equipment is equipment designed to be in operation while being carried (e.g. radio pager or other system using radio communication).*

3.8 visual alarm device

device which generates a flashing light to signal to the user that an alarm condition exists

4 General requirements for alarm systems

COMMENTARY ON CLAUSE 4

An alarm system comprises one or more detectors and one or more actuators from the following list, together with additional items as appropriate:

- a) *detectors:*
 - 1) *smoke alarm (6.1.1);*
 - 2) *heat alarm (6.1.2) [interconnected to smoke alarm(s) on the escape route];*
 - 3) *carbon monoxide alarm (6.1.3);*
- b) *actuators:*
 - 1) *control unit (6.2), which may be a self-contained unit or may be made up of several parts, each of which may be integrated with another component of the system;*
 - 2) *visual alarm device (6.3);*
 - 3) *vibrating pad (6.4);*
 - 4) *vibrating alerter (6.5);*
 - 5) *low frequency sounder (6.6);*
- c) *additional items:*
 - 1) *power supply, which may be self-contained or may form a part or parts of other system components, e.g. control unit and smoke alarm (specific requirements for power supplies for control units are given in 6.2);*
 - 2) *appropriate interconnecting cables (Clause 5);*
 - 3) *set of instructions for creating a system from these components, and for operation of the system (Clause 8).*

Individual components may be combined to form different grades of systems which are graded according to the minimum items needed to alert a deaf or hard of hearing person, while asleep or awake. The grading system is given in Annex A.

It is strongly recommended that a fire or carbon monoxide alarm signal has priority over the signal from any other device that might be incorporated into the system.

When a vibrating alerter is included in the system, the associated radio transmission equipment (6.5 and 6.7) shall be supplied.

For any other radio-linked components, radio transmitter and receiver units shall be supplied as required (6.7).

NOTE 1 *Specific requirements for power supplies for radio-linked systems are given in 6.7.6.*

NOTE 2 *For those who are unable to hear audible alarm signals even with the use of a hearing aid or cochlear implant, it might be necessary to provide additional visual alarm devices (6.3) and/or vibrating alarm devices (6.4 and 6.5).*

5 Constructional and electrical requirements

5.1 Electrical safety

All components of a system, including flexible mains supply cord/cable, shall conform to the appropriate requirements of BS EN 60950-1.

NOTE 1 Fixing holes in a component should be positioned where they are easily accessible and such that damage will not be caused to internal parts when tightening/loosening fixing screws.

NOTE 2 No part of the system should be held in position by, or rely on support from, any attached interconnecting wiring.

5.2 Component interconnections

When tested in accordance with the appropriate cable product standard, cables for interconnecting components shall meet the minimum requirements specified in the appropriate cable product standard for the relevant currents and voltages.

Connecting arrangements for fire and carbon monoxide alarms shall be in accordance with BS EN 14604, BS 5446-2 or BS EN 50291 as appropriate. Every other connection between system components shall be via a mechanically latching connector that cannot be incorrectly connected.

NOTE Wired components may be powered via other components. All components should require clear and deliberate action by users to disable them.

5.3 Connecting terminals

Terminals shall hold conductors by means of screws, nuts or other equally effective means.

Terminals shall allow the connection of conductors having a nominal cross-sectional area in the range 0.4 mm² to 1.5 mm².

NOTE 1 Terminals for connection of external cables and wires should be easily accessible and clearly marked.

NOTE 2 Each terminal should be so designed that it clamps the conductor between metal surfaces without rotation of those surfaces, but with sufficient contact pressure, and without damage to the conductor.

5.4 Battery connectors

Battery connectors for flexible leads shall be protected by strain-relieving devices conforming to the requirements for battery connections specified in BS EN 14604.

5.5 Electromagnetic compatibility

Each component shall conform to the appropriate requirements specified in BS EN 50130-4:2011, Clause 8, Clause 9, Clause 10, Clause 11, Clause 12 and Clause 13.

5.6 Power supplies

5.6.1 General

Any control unit, low frequency sounder, vibrating pad or visual alarm device may be powered:

- a) from a 230 V a.c. mains supply (see 5.6.2), in which case a standby supply conforming to 5.6.3 shall be provided; or

- b) from a primary battery supply (see 5.6.4), for which a standby supply may be provided. If a standby supply is provided it shall conform to 5.6.5.

The mains connecting cable supplying power to the component shall be either permanently wired into the component or provided with a means of securing the cable to the component to prevent accidental disconnection.

Power supplies shall be marked in accordance with Clause 7.

5.6.2 Mains power supply

The connection to the mains power supply shall comprise a plug suitable for connection to a standard domestic 13A socket (or a mains adaptor if the supply to the system is at a lower voltage than 230 V a.c.). The plug/adaptor shall be marked with white lettering on a red background with the text "Alarm system – DO NOT REMOVE OR SWITCH OFF".

When tested in accordance with Annex B, the mains power supply shall be capable of supplying all the power for the system, with the standby power supply (battery) disconnected for 72 h, followed by 4 min in alarm condition, or, in the absence of an alarm condition, a fault warning in accordance with 6.2.6.1f) for at least 24 h.

5.6.3 Standby power supply for mains-powered units

NOTE The standby battery should be of a type that has an expected life of at least 4 years under the conditions likely to be experienced in normal use. Information should be provided to indicate the period beyond which they should be replaced.

When tested in accordance with Annex B, the standby power supply shall be capable of supplying all the power for the system with the mains supply disconnected for a period of at least 72 h, followed by 4 min in alarm condition.

When tested in accordance with Annex B, the battery voltage at the end of the 4 min in alarm condition shall be greater than or equal to the minimum battery voltage specified by the battery manufacturer.

5.6.4 Primary battery power supply

Any control box, sounder or visual alarm device may be powered by primary batteries provided the following requirements are met.

- The battery or batteries shall be capable of supplying the quiescent load of the device together with the additional load resulting from a routine weekly 10 s test for at least 1 year or the duration specified by the manufacturer, whichever is longer, before the battery fault warning is given.
- At the point when the battery fault warning commences, the battery or batteries shall have sufficient capacity to give an alarm condition when tested in accordance with Annex B for at least 4 min in the event of activation by a fire or carbon monoxide alarm, or, in the absence of an alarm condition, a battery fault warning for at least 30 days.
- If the system relies upon a radio frequency signal for communication between the smoke or carbon monoxide alarm and the control box, sounder or visual alarm device, the requirements at a) and b) shall also be met for any battery or batteries solely used to power the radio frequency signal at the control box, sounder and visual alarm device.

NOTE As it is not practicable to run a system and battery combination for a real-time test period of 1 year, the test house may accept data detailing the control box, sounder, visual alarm device loads and the battery characteristics to determine whether the requirements can be met. The load calculations should be undertaken for the maximum number of devices that can be connected together in any one system.

5.6.5 Standby power supply for battery-powered units

If a standby battery power supply is provided, it shall conform to the following requirements.

- a) The standby battery shall be of a type that has an expected life of at least 4 years. The manufacturer shall supply data to confirm this expectation.
- b) When tested in accordance with Annex B, the standby power supply shall be capable of supplying all the power for the system with the primary battery source disconnected for the period of at least 72 h, followed by 4 min in the alarm condition.
- c) When tested in accordance with Annex B, the standby battery voltage at the end of the 4 min in alarm condition shall be greater than or equal to the minimum specified battery voltage [see Annex C, C.4.2d)].
- d) Batteries shall be identified by some means as to which are the primary and secondary supplies.

5.7 Operation

When a fire or carbon monoxide alarm condition is triggered:

- a) the alarm outputs shall be given within 3 s on the sensing device and within 30 s on all interconnected devices;
- b) the alarm outputs shall continue until the alarm condition ceases.

5.8 Integrity

If a component is fitted with an off switch, or a switch to disable the alarm signal, the design of the switch shall be such as to avoid inadvertent operation.

The off switch may be a physical device or an option, selected from a menu.

- a) A physical switch shall be of a type and location such that two separate operations are necessary to operate it.
- b) A menu-selectable switch shall not be located on the component's main menu and shall require two distinct menu selections in order to operate it.

6 Requirements for components

NOTE The components of a system should be suitable for use indoors in a domestic environment.

6.1 Alarms

6.1.1 Smoke alarms

Smoke alarms shall conform to BS EN 14604 and to any additional requirements specified in this part of BS 5446.

NOTE Additional requirements given in this part of BS 5446 include requirements for connections and monitoring that are not needed for standard smoke alarms.

Every smoke alarm forming part of a system shall be provided with the information specified in Clause 8.

6.1.2 Heat alarms

Heat alarms forming part of a system shall conform to BS 5446-2 and to any additional requirements specified in this part of BS 5446.

NOTE Additional requirements given in this part of BS 5446 include requirements for connections and monitoring that are not needed for standard heat alarms.

Heat alarms forming part of a system shall be provided with the information specified in Clause 8.

6.1.3 Carbon monoxide alarms

Carbon monoxide alarms forming part of a system shall conform to BS EN 50291-1 and to any additional requirements specified in this part of BS 5446.

NOTE Additional requirements given in this part of BS 5446 include requirements for connections and monitoring that are not needed for standard carbon monoxide alarms.

Carbon monoxide alarms forming part of a system shall be provided with the information specified in Clause 8.

6.2 Control and indicating functions

6.2.1 General

NOTE When the control and indicating functions are contained within a separate self-contained unit, this is defined as a control unit (see 3.1). Alternatively, the control and indicating functions may be combined with another component, or may have its functions spread over more than one component of the system.

When a control unit is tested in accordance with the general procedures specified in Annex C it shall meet the requirements specified in 6.2.2 to 6.2.6. When a control unit is tested in accordance with the general procedures specified in Annex C and the appropriate method specified in Annex D, in accordance with the test schedule given in D.1, it shall meet the requirements specified in 6.2.7.1a).

Control units shall be marked in accordance with Clause 7 and shall be provided with the information specified in Clause 8.

Devices, other than control units, that incorporate control and indicating functions, shall meet the general requirements specified in 6.2.2 to 6.2.6 and the appropriate component-specific requirements specified in 6.2.7.1b) to 6.2.7.1e).

For all devices the mandatory indicators shall be visible from a distance of 3 m from the mounting surface of the device, in an ambient light intensity up to 500 lx.

6.2.2 Fire alarm indicator

There shall be a dedicated red light emitting fire alarm indicator.

When the fire alarm is tested by pressing the test button, when a fire alarm signal is received, the light shall either be on continuously or pulsing at a minimum rate of 1 Hz, and no fault indication shall be given.

6.2.3 Carbon monoxide alarm indicator

There shall be a dedicated red light emitting carbon monoxide alarm indicator.

When the carbon monoxide alarm is tested by pressing the test button, when a carbon monoxide alarm signal is received, the light shall either be on continuously or pulsing at a minimum rate of 1 Hz, and no fault indication shall be given.

6.2.4 Power supply indicators

6.2.4.1 Mains power supply indicator

Any device intended to be connected to the a.c. mains (or transformed to d.c. from the mains supply) shall be provided with a continuous mains-on indicator to indicate that the device is receiving power. The indicator shall be green and clearly labelled to distinguish it from any other indications that might be provided (see 6.2.5).

6.2.4.2 Battery power supply indicator

Any device intended to be solely powered from a primary battery supply shall be provided with a power-on indicator to indicate that the device is receiving a power supply. The indicator shall be green and clearly labelled to distinguish it from any other indications that might be provided (see 6.2.5). The indicator shall either be on continuously or shall pulse at least once every 30 s.

6.2.5 Additional indicators

Additional indicators shall not be coloured red or green.

Indicators used to indicate faults shall be coloured amber or yellow.

6.2.6 Indications of faults in the system

6.2.6.1 When system components are tested as follows, a visual indication shall be given within 300 s by illuminating an amber or yellow light either continuously or at a flash rate of not less than 0.2 Hz:

- a) short circuit in a connection between a control unit and each externally hardwired connected alarm device;
- b) open circuit in a connection between a control unit and each externally hardwired connected alarm device;
- c) short circuit between a control unit and a hardwired smoke alarm or carbon monoxide alarm;
- d) open circuit between a control unit and a hardwired smoke alarm or carbon monoxide alarm;
- e) low battery condition of the smoke alarm or carbon monoxide alarm;
NOTE 1 The low battery condition can be indicated by an amber or yellow light flashing on the carbon monoxide alarm or the smoke alarm. On smoke alarms without an amber light the low battery can be indicated with a unique red LED slow flash pattern once a minute and/or when the test button is pressed
- f) failure or disconnection of a standby supply to any part of the system other than a remote alerter;
- g) when the system is radio-linked and uses one or more primary batteries as a power supply, the low power condition of that supply.

Failure or disconnection of the primary mains supply shall result in the green light turning off.

Failure or disconnection of a unit powered by a primary battery shall result in the extinguishment of the periodic power light flash.

NOTE 2 This is not applicable to a remote alerter.

6.2.6.2 When tested in accordance with Annex E, **E.4**, the integrity of the radio link between the radio-linked alarm devices shall meet the following requirements.

- a) For mains-powered devices, the amber fault light shall indicate a fault within 4 h.
- b) For primary battery-powered devices, the fault shall be indicated within 12 h.

6.2.7 Environmental requirements

6.2.7.1 General

Devices that incorporate control and indicating functions shall meet the following requirements.

- a) Control units shall conform to the requirements specified in **6.2.7.2** to **6.2.7.6**.
- b) Devices, other than control units, incorporating a visual alarm device shall conform to the requirements specified in **6.3.5.1** to **6.3.5.8**.
- c) Devices, other than control units, incorporating a vibrating pad shall conform to the requirements specified in **6.4.5.1** to **6.4.5.8**.
- d) Devices, other than control units, incorporating a vibrating alerter shall conform to the requirements specified in **6.5.8.1** to **6.5.8.9**.
- e) Devices, other than control units, incorporating a low frequency sounder shall conform to the requirements specified in **6.6.5.1** to **6.6.5.8**.

6.2.7.2 Resistance to damp heat

When the control unit is tested in accordance with **D.2**:

- a) when the functional testing is carried out during the last 30 min of conditioning (**D.2.3**), a visual indication of power supply shall be given as specified in **6.2.4** upon connection of the control unit, and a visual indication of alarm shall be given as specified in **6.2.2** or **6.2.3** as appropriate upon triggering of the alarm condition;
- b) when the functional testing is carried out after the recovery period (**D.2.4**):
 - 1) a visual indication of power supply shall be given as specified in **6.2.4** upon connection of the control unit;
 - 2) a visual indication of alarm shall be given as specified in **6.2.2** upon triggering of a fire alarm condition;
 - 3) a visual indication of alarm shall be given as specified in **6.2.3** upon triggering of a carbon monoxide condition.

6.2.7.3 Resistance to cold

When the control unit is tested in accordance with **D.3**:

- a) when the functional test (**6.2.6.1**) is performed during the last 30 min of conditioning (**D.3.3**), a visual indication of power supply shall be given as specified in **6.2.4** upon connection of the control unit, and a visual indication of alarm shall be given as specified in **6.2.2** or **6.2.3** as appropriate upon triggering of the alarm condition;
- b) when the functional test (**6.2.6.1**) is performed after the recovery period (**D.3.4**), visual indications of power supply and alarm condition shall be given as specified in **6.2.7.2b**).

6.2.7.4 Resistance to corrosion

When the control unit is tested in accordance with **D.4**, when the functional test (6.2.6.1) is performed after the recovery period (**D.4.2**), visual indications of power supply and alarm condition shall be given as specified in 6.2.7.2b).

6.2.7.5 Resistance to impact

NOTE This requirement is applicable only to control units that are intended for mounting on walls.

When the control unit is tested in accordance with **D.5**, visual indications of power supply and alarm condition shall be given as specified in 6.2.7.2b).

6.2.7.6 Resistance to dropping

NOTE This requirement is applicable only to control units that are intended to be free-standing (e.g. on a bedside table).

When the control unit is tested in accordance with **D.6**, visual indications of power supply and alarm condition shall be given as specified in 6.2.7.2b).

6.3 Visual alarm device

6.3.1 General

NOTE Examples of typical visual alarm devices include:

- *flashing xenon beacon;*
- *continuously powered incandescent lamp with a rotating reflector;*
- *incandescent lamp powered to flash on and off;*
- *ultra-bright LED array.*

A visual alarm device (see 3.8) may form an integral part of one of the elements of the alarm system, e.g. a control box or receiver unit, or it may be a completely separate device connected only by cables, or by a radio signal, to other elements of the alarm system.

When the visual alarm device is tested in accordance with the general procedures specified in Annex C and the appropriate methods specified in 6.3.2 to 6.3.5 and in accordance with the test schedule given in Annex F, **F.1**, visual alarm devices shall meet the requirements specified in 6.3.2 to 6.3.5.

Visual alarm devices shall be marked in accordance with Clause 7 and shall be provided with the information specified in Clause 8.

6.3.2 Colour and coverage volume

6.3.2.1 Colour

The flashing light from the visual alarm device shall be either white or red.

6.3.2.2 Coverage volume

When tested in accordance with BS EN 54-23:2010, **4.3.1** and **5.3.1**, the visual alarm device shall meet the minimum coverage volume of either C-3-4 or W-2.4-1.8, or a larger coverage volume if specified by the manufacturer. An ambient light level in the range 300 lx to 400 lx shall be assumed.

The visual alarm device shall meet a minimum illumination of 0.4 lx on surfaces perpendicular to the direction of the light emitted from the device at the edges of the coverage volume.