

Fire detection and fire alarm systems for buildings —

Part 6: Code of practice for the design, installation and maintenance of fire detection and fire alarm systems in dwellings

ICS 13.220.20; 13.320

Committees responsible for this British Standard

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- British Fire Consortium
- British Fire Protection Systems Association
- British Research Laboratories
- Chartered Institution of Building Services Engineers
- Co-opted Members
- Department of Health — NHS Estates
- Electrical Contractors Association
- Energy Institute
- Energy Industries Council
- Engineering Industries Association
- Institute of Fire Safety
- Institute of Electrical Engineers
- LPCB/BRE Laboratories
- Maritime and Coastguard Agency
- Ministry of Defence — UK Defence Standardization
- National Inspection Council for Electrical Installation
- Office of the Deputy Prime Minister
- Professional Lighting and Sound Association
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Foreword

This part of BS 5839 has been prepared by Technical Committee FSH/12/1. It supersedes BS 5839-6:1995, which is withdrawn. Whereas BS 5839-1 provides recommendations for fire detection and fire alarm systems in buildings, other than dwellings, this part of BS 5839 provides guidance on fire detection and fire alarm systems in dwellings.

This new edition of BS 5839-6 takes into account changes in technology, custom and practice, and changes in guidance that supports national building regulations, since the publication of BS 5839-6:1995, and introduces some significant changes.

The principal changes made within the revision are as follows:

- a) the minimum standard of protection recommended for new dwellings has been increased. Whereas the previous version of this standard recommended only that smoke alarms be provided within the circulation areas of most new single-family dwellings and small houses in multiple occupation, this standard now recommends that, in addition to these smoke alarms, heat alarms be provided in the kitchen and principal habitable room;
- b) whereas the previous version of this standard accepted mains powered smoke alarms within new single-family dwellings and small houses in multiple occupation (HMOs), this standard now recommends that smoke alarms and heat alarms installed within new single-family dwellings and small HMOs should be mains powered with, in addition, a standby power supply in the form of a battery or capacitor;
- c) the code of practice has been simplified by incorporating commentary on relevant principles, followed by short, succinct recommendations. This is intended to make the code of practice less ambiguous, simpler for the non-specialist to apply and compliance of installations more straightforward to audit;
- d) an approach to risk assessment in dwellings, as a basis for determining appropriate system design criteria, has been removed from the body of the code of practice and set out in an informative annex;
- e) the term “Category” (of system) is now used instead of “type” in the description of system objective/area of coverage (e.g. a comprehensive system installed throughout all circulation spaces, rooms and areas in which fire might start, other than toilets, bathrooms and shower rooms, was previously described as type LD1, but is now described as Category LD1); this is to distinguish this term from the less precise use of the term “type” to describe the principles of operation of the system (e.g. purely smoke alarms, mixture of smoke alarms and heat alarms, etc.);
- f) carbon monoxide fire detectors are now recognized as a form of fire detection that may be used in certain parts of certain dwellings;
- g) greater emphasis is placed on the need to limit the potential for false alarms;
- h) recommendations for fire warning systems for deaf and hard of hearing people have been included;
- i) the term “deviation” has been replaced with the term “variation”, to avoid any negative connotation associated with the term used to describe an aspect of system design that, for sound reasons, does not comply with the recommendations of this standard;
- j) the single certificate of installation has, in the case of Grade A systems, been extended to define separately responsibilities for design, installation and commissioning.

In the United Kingdom, around 80 % of all fire deaths and injuries occur in dwellings, a total of 450 to 500 deaths and around 14 000 injuries per annum. Many of those who die are the most vulnerable in the community, namely elderly and socially deprived people. The installation of a fire detection and fire alarm system in a dwelling can substantially reduce the risk of death or serious injury from fire. Indeed, the overall downward trend in annual fire deaths in dwellings since smoke alarms in dwellings were first given recognition in BS 5839-1 in 1988 is almost certainly attributable in part to the increasing use of smoke alarms.

The level of deaths and injuries remains, however, above a level that society regards as acceptable. It has been estimated that, in dwellings without smoke detectors, a substantial proportion of the fatalities from fire could be avoided if smoke detectors were installed. The fatality rate in dwelling fires where there is no working smoke detector is between two and three times the fatality rate in dwelling fires where a smoke detector is present and functions correctly.

The installation of automatic fire detectors is, effectively, required in new dwelling houses, flats and maisonettes in order to satisfy building regulations. In existing houses in multiple occupation, the installation of an automatic fire detection and fire alarm system is normally required by the relevant enforcing authorities. This gives rise to the need for a suitable code of practice, as BS 5839-1 does not contain recommendations on domestic smoke alarms, nor does it address the special design requirements for fire detection and fire alarm systems in dwellings.

The guidance in this standard is intended for architects and other building professionals, enforcing authorities, designers and installers of fire alarm systems and others responsible for implementing fire precautions in dwellings. It has been assumed in the drafting of this part of BS 5839 that the execution of its provisions will be entrusted to appropriately qualified and competent people.

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Clauses are arranged in two parts, namely commentary and recommendations. It is envisaged that, when fire detection and fire alarm systems in dwellings are audited (e.g. by enforcing authorities or third-party certification bodies), only the recommendations will form the basis for the audit, while the commentary is intended to provide an explanatory background to the recommendations, particularly if the recommendations might appear to be arbitrary.

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. In particular, attention is drawn to building regulations and, in the case of houses in multiple occupation, to the relevant housing legislation. Guidance on building regulations is given in Approved Document B in England and Wales, the Technical Standards that support the relevant building regulations in Scotland, and in Technical Booklet E in Northern Ireland.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 69 and a back cover.

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1 Scope

This part of BS 5839 gives recommendations for the planning, design and installation of fire detection and fire alarm systems in dwellings and dwelling units that are designed to accommodate a single family, and in houses in multiple occupation that comprise a number of self-contained units each designed to accommodate a single family. The recommendations apply to both new dwellings and existing dwellings. Recommendations for routine attention are also given.

The systems covered in this part of BS 5839 range from those comprising a single self-contained smoke alarm to systems of the type described in BS 5839-1. The recommendations of this part of BS 5839 may also be applied to the fire detection components of combined domestic fire and intruder alarm systems or fire and social alarm systems.

This part of BS 5839 applies to forms of dwelling including bungalows, multi-storey houses, individual flats and maisonettes, mobile homes, sheltered houses, housing providing NHS supported living in the community (as defined in Health Technical Memorandum 88 [1]), mansions, and houses divided into several self-contained single-family dwelling units. It does not apply to hostels, caravans or boats (other than permanently moored boats used solely as residential premises), or to the communal parts of purpose-built sheltered housing and blocks of flats or maisonettes. It does not apply to any premises used for purposes other than as a dwelling (e.g. small shops, factories or similar premises used solely as places of work).

This part of BS 5839 is intended for use by architects and other building professionals, enforcing authorities, contractors and others responsible for implementing fire precautions in dwellings. It is not intended for occupiers, for whom advice is published by the Government¹⁾. However, recommendations are given for simple systems that may be installed by non-specialists.

The recommendations refer principally to fire detection and fire alarm systems installed for the purpose of life safety. However, recommendations are given for systems that are also intended to protect property.

2 Normative references

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

BS 476 (relevant parts), *Fire tests on building materials and structures*.

BS 3955:1986, *Specification for electrical controls for household and similar general purposes*.

BS 5446-1:2000, *Fire detection and fire alarm devices for dwellings — Part 1: Specification for smoke alarms*.

BS 5446-2, *Fire detection and fire alarm devices for dwellings — Part 2: Specification for heat alarms*.

BS 5446-3, *Fire detection and fire alarm devices for dwellings — Part 3: Specification for smoke alarms for deaf and hard of hearing people*.

BS 5588-1:1990, *Fire precautions in the design, construction and use of buildings — Part 1: Code of practice for residential buildings*.

BS 5839-1:2002, *Fire detection and fire alarm systems for building — Part 1: Code of practice for system design, installation, commissioning and maintenance*.

BS 5979, *Code of practice for remote centres receiving signals from security systems*.

BS 7671, *Requirements for electrical installations — IEE Wiring Regulations — Sixteenth edition*.

BS EN 54-2, *Fire detection and fire alarm systems — Part 2: Control and indicating equipment*.

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

BS EN 54-4, *Fire detection and fire alarm systems — Part 4: Power supply equipment*.

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

¹⁾ The Office of the Deputy Prime Minister (in England and Wales), the Scottish Executive and the Department of Health, Social Services and Public Safety (Northern Ireland).

BS EN 54-7, *Fire detection and fire alarm systems — Part 7: Smoke detectors — Point detectors using scattered light, transmitted light or ionization.*

BS EN 54-11, *Fire detection and fire alarm systems — Part 11: Manual call points.*

BS EN 54-12, *Fire detection and fire alarm systems — Part 12: Smoke detectors — Optical beam detectors.*

BS EN ISO 13943, *Fire safety — Vocabulary.*

LPS 1265: Issue 1.0, *Requirements and testing procedures for the LPCB approval and listing of carbon monoxide fire detectors using electrochemical cells.* Garston: Building Research Establishment, 2004.

3 Terms and definitions

For the purposes of this part of BS 5839, the terms and definitions in BS EN ISO 13943 and the following apply.

3.1

access room

room through which passes the only escape route from an inner room

3.2

addressable system

system in which signals from detectors, manual call points, or any other devices are individually identified at the control and indicating equipment

NOTE Most addressable systems are of the analogue type, in which a signal from each detector representing the value of the sensed phenomenon is individually processed, usually at the control equipment, with a view to enabling more than two output states to be given, representing normal, fire and at least one other abnormal condition. The purpose of analysis of the signal from each detector is often identification of conditions that are not representative of fire but that can result in a false alarm from a simple non-analogue (“two state”) system.

3.3

circulation area; circulation space

area or space (including a stairway) used mainly as a means of access between a room and an exit from the building or compartment

3.4

control and indicating equipment

CIE

component or components of a fire detection and fire alarm system through which other components may be supplied with power and which:

a) are used:

- 1) to receive signals from the connected detectors, manual call points, or any other devices (e.g. input/output units);
- 2) to determine whether these signals correspond to a fire alarm condition;
- 3) to indicate any such fire alarm condition audibly and visually;
- 4) to indicate the location of the danger;
- 5) possibly to record any of this information;

b) are used to monitor the correct functioning of the system and give audible and visible warning of any faults (e.g. short circuit, open circuit, or fault in the power supply);

c) if required, are able to pass on the fire alarm signal:

- to audible or visible fire alarm devices;
- through suitable transmission equipment to an alarm receiving centre;
- through further control equipment to an automatic fire extinguishing system.

3.5

detection zone

subdivision of the protected premises such that the occurrence of a fire within it will be indicated by a fire alarm system separately from an indication of fire in any other subdivision

NOTE A detection zone is separately indicated to assist in location of the fire, evacuation of the building and fire-fighting.

3.6**detector**

part of a fire detection system that contains at least one sensor which constantly, or at frequent intervals, monitors at least one physical and/or chemical phenomenon associated with fire, and that provides at least one corresponding signal to initiate a warning

NOTE This definition is intended to include heat alarms and smoke alarms (see 3.18 and 3.31 respectively).

3.7**dwelling**

unit of residential accommodation occupied (whether or not as a sole or main residence):

- a) by a single person or by people living together as a family; or
- b) by not more than six residents living together as a single household, including a household where care is provided for residents; or
- c) by persons who do not live together as a family, but who live in self-contained single-family flats, maisonettes or bedsits within the unit

NOTE Parts a) and b) accord with the definition adopted under building regulations. The definition in c) relates only to some types of house in multiple occupation and specifically excludes hostel type accommodation, for which BS 5839-1 is more appropriate. It can, however, include houses with long term lodgers.

3.8**false alarm**

fire signal resulting from a cause(s) other than fire

NOTE False alarms may be sub-divided into four categories:

- a) unwanted alarms, in which a system has responded, either as designed or as the technology may reasonably be expected to respond, to any of the following:
 - a fire-like phenomenon or environmental influence (e.g. smoke from a nearby bonfire, dust or insects, processes that produce smoke or flame, or environmental effects that can render certain types of detector unstable, such as rapid air flow);
 - accidental damage;
 - inappropriate human action (e.g. operation of a system for test or maintenance purposes without prior warning to building occupants and/or an alarm receiving centre);
- b) equipment false alarms, in which the false alarm has resulted from a fault in the system;
- c) malicious false alarms, in which a person operates a manual call point or causes a fire detector to initiate a fire signal, whilst knowing that there is no fire;
- d) false alarms with good intent, in which a person operates a manual call point or otherwise initiates a fire signal in the belief that there is a fire, when no fire actually exists.

3.9**final circuit**

circuit connected to current-using equipment, or to a socket-outlet or socket-outlets or other outlet points for the connection of such equipment

3.10**final voltage**

<of a battery> voltage at which the cell manufacturer considers the cells to be fully discharged at the specified discharge current

3.11**fire alarm device**

component of a fire alarm system, not incorporated in the control and indicating equipment, which is used to give a warning of fire

NOTE For example, a sounder or visual indicator.

3.12**fire alarm sounder**

audible fire alarm device

3.13

fire detection and fire alarm system

system that comprises a means for automatically detecting one of the characteristic phenomena of fire and a means for providing a warning to occupants

NOTE This definition is intended to include fire detection and fire alarm systems that comprise one or more smoke alarms, as well as systems that comprise separate detectors, alarm sounders and control equipment.

3.14

fire-resisting construction

construction that is able to satisfy for a stated period of time some or all of the appropriate criteria given in the relevant parts of BS 476

3.15

fire risk

combination of the probability of fire occurring and the magnitude of the consequences of fire

3.16

flat

dwelling, forming part of a larger building, that has all its rooms on one level or not more than half a storey height apart

3.17

habitable room

any room in a dwelling other than a kitchen, utility room, bathroom, dressing room or WC

3.18

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

3.19

house in multiple occupation

house that is occupied by persons who do not form a single household

3.20

inner room

room from which escape is possible only by passing through another room (the access room: see 3.1)

3.21

maisonette

dwelling, forming part of a larger building, which includes rooms on two or more levels that are more than half a storey height apart

3.22

maximum alarm load

maximum load imposed on a fire alarm system power supply under fire conditions, comprising the power required for simultaneous operation of all fire alarm devices, fire signals from all automatic fire detectors and manual call points in the building, any power drawn by other systems and equipment in the alarm condition and any power required for transmission of fire signals to an alarm receiving centre (if a facility for this is provided)

3.23

mixed system

arrangement whereby two different Grades of fire detection and fire alarm system are provided within one dwelling for the purpose of satisfying two different fire safety objectives

3.24

mobile home

transportable unit of living accommodation that does not meet the requirements for construction and use of road vehicles but that retains means for mobility

3.25**monitored wiring**

wiring in which an open circuit will result in a fault warning (but not an alarm of fire), while a short circuit will result either in a fault warning or an alarm of fire

NOTE BS 5839-1 recommends that an open circuit or a short circuit both result in a fault warning but not an alarm of fire; for some systems, this part of BS 5839 recommends compliance with the recommendations of BS 5839-1.

3.26**multi-sensor fire detector**

fire detector that monitors more than one physical and/or chemical phenomenon associated with fire

3.27**normal power supply**

supply from which the fire detection and fire alarm system is expected to obtain its power under normal conditions

NOTE The normal power supply is usually derived from the public electricity supply system.

3.28**principal habitable room**

habitable room (see 3.17) that is normally the most frequently used room for general daytime living purposes

3.29**sheltered housing**

block or group of dwellings, with each dwelling incorporating its own cooking and sanitary facilities, designed specifically for persons who might require assistance, e.g. elderly people, and where some form of assistance is available at all times

NOTE 1 This should not be taken as implying that assistance need be provided on the premises.

NOTE 2 Sheltered housing usually includes amenities common to all occupiers, such as living rooms, guest rooms, etc., which are outside the scope of this part of BS 5839.

3.30**smoke**

particulate and aerosol products of combustion, whether this be of the smouldering or open flame type

3.31**smoke alarm**

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

3.32**social alarm system**

system that provides facilities for alarm initiation, signal transmission, alarm reception, reassurance and assistance, for use by elderly and other persons considered to be living at risk

3.33**special tool**

tool not likely to be carried by a member of the general public

NOTE Where this standard recommends the use of a battery that can be removed without the use of a special tool, the use of slot-headed screws would be an acceptable means of securing the battery, since various articles can be used as screwdrivers.

3.34**standby supply**

electricity supply that provides power to the fire detection and fire alarm system when the normal supply fails

3.35**variation**

intentional departure from a specific recommendation of this standard

NOTE 1 Since this part of BS 5839 is a code of practice, its contents take the form of recommendations, rather than requirements. Accordingly, variations might be appropriate in certain circumstances.

NOTE 2 Variations do not include errors in design, installation or commissioning.

NOTE 3 In many cases, variations will need the agreement of interested third parties, such as the authority enforcing fire safety legislation or the fire insurer.

4 Fire risk assessment

4.1 Commentary

A fire detection and fire alarm system, although it can do nothing to reduce the incidence of fire, can help to lessen the resultant loss in terms of injury to occupants or damage to property. However, the system needs to take into account the ability of the persons it is designed to protect to react to the warning and to make use of the time for escape that it is intended to give them, and needs to be regarded as just one component of a properly engineered approach to fire safety.

In order to maximize the cost-benefit of a fire detection and fire alarm system, it is essential that the system design be appropriate to the fire risk. Accordingly, the design of any fire detection and fire alarm system installed in accordance with this part of BS 5839 needs to be based on a good understanding of fire risk in dwellings.

A high fire risk demands high reliability in the early detection of fire and warning of occupants, regardless of where the fire starts, and high reliability on the part of the system to operate correctly when required; a low fire risk might not justify the cost, complexity and extent of such a system. For example, at one extreme, the single occupant of an existing small bungalow might be adequately protected at very low cost if the occupier installs one battery-operated smoke alarm, whereas the risk to which the families in a six-storey house in multiple occupation are exposed would warrant much greater expenditure on a more complex and comprehensive system.

It is therefore essential that the design of the system, particularly in respect of factors such as the number and siting of detectors and the form of power supply, takes into account the following probabilities:

- a) the probability of fire occurring;*
- b) the probability of injury or death of occupants if fire occurs;*
- c) the probability of the system operating correctly at the time of a fire;*
- d) the probability of early detection and warning of occupants in the event of fire.*

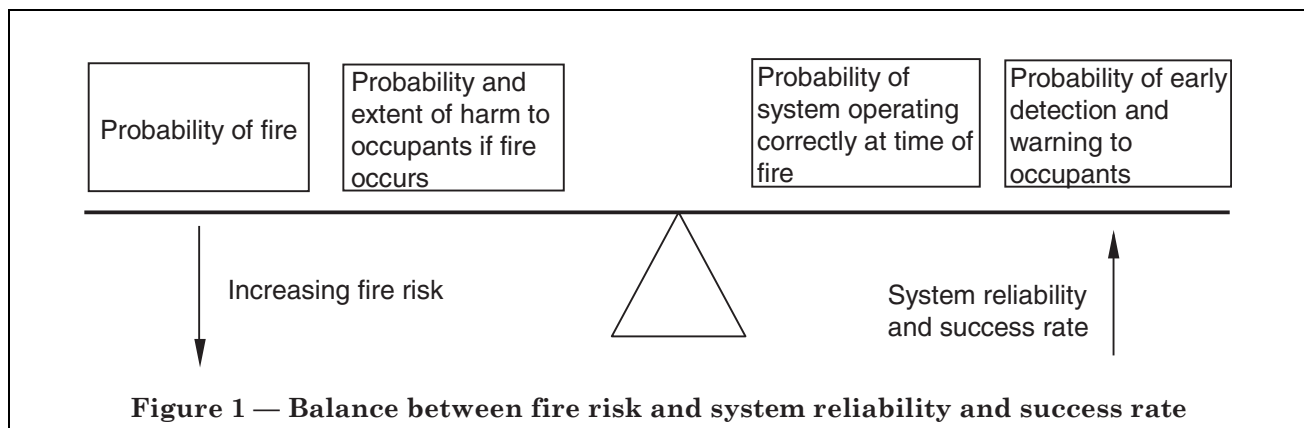
NOTE 1 The combination of a) and b) may be regarded as the fire risk (see 3.15).

NOTE 2 c) may be regarded as the system reliability.

NOTE 3 d) may be regarded as a form of success rate for the system.

NOTE 4 A significant increase in c) or d) is likely to involve additional cost and system complexity.

It is important that system design ensures that there is an appropriate balance between the fire risk and the system reliability and success rate (see Figure 1).



The factors that are relevant to consider in a qualitative assessment of fire risk are discussed in Annex A; the implications of the various factors on system design are also described. Clause 9 contains recommendations on the Grades and Categories of system (see Clauses 7 and 8) that are considered generally appropriate for generic types of dwelling covered by this part of BS 5839.

Although this standard advocates that, where practicable, the actual design of a fire detection and fire alarm system be based on a fire risk assessment, it is considered that the level of fire risk in dwellings covered by this part of BS 5839 is unlikely ever to be sufficiently low to obviate the need for some form of fire detection and fire alarm system.

4.2 Recommendations

The following recommendations are applicable.

- a) A fire detection and fire alarm system, complying with the recommendations of this part of BS 5839, should be installed in all dwellings described in Clause 1, whether new or existing.

NOTE 1 The recommendation for retrospective installation of a fire detection and fire alarm system in an existing dwelling relates primarily to dwellings in which there is no, or no appropriate, fire detection and fire alarm system. It is not specifically recommended that an existing fire detection and fire alarm system installed in accordance with BS 5839-6:1995 be upgraded to meet the recommendations of this current version of BS 5839-6.

- b) Final design of a fire detection and fire alarm system for any particular dwelling should, where reasonably practicable, be based on a form of fire risk assessment, particularly if it is proposed to deviate from the guidance given in Clause 9 or if there are risk factors additional to those encountered in typical examples of the dwelling types defined in Clause 9.

NOTE 2 The information contained in Annex A is likely to be of value in any such fire risk assessment and in determining the basic principles for system design, particularly the appropriate Grade and Category of system (see Clauses 7 and 8).

- c) In many situations, occupant characteristics and other relevant factors are not known to the designer or specifier (e.g. in the case of new dwellings). In such cases, design should follow the recommendations given in Clause 9.

NOTE 3 At the stage at which approval of system design is granted under building regulations, occupant characteristics and other relevant factors are generally unknown.

5 System components

5.1 Commentary

The reliability of whatever form of fire detection and fire alarm system is installed to perform its functions on demand will, to a significant degree, be governed by the reliability of individual components. In general, it is advisable that all components, such as manual call points, detectors, control and indicating equipment (if incorporated in the system) and fire alarm devices, comply with relevant British Standards, and have undergone type testing to these standards. It is advisable to use components having certification under a recognized product certification scheme (comprising third-party certification of product conformity against a relevant standard, based on testing and continuing surveillance, together with assessment of the manufacturer's quality assurance system against BS EN ISO 9000).

Where there is no relevant British, European or International Standard, it is advisable that care is taken to ensure, as far as possible, that the components are fit for their purpose. Third-party approval against an appropriate test standard can provide assurance of this.

Compliance of an individual component with a recognized standard does not necessarily ensure that it will operate satisfactorily in conjunction with another component that complies with the relevant standard for that component. It is essential that compatibility between components is taken into account by the designer of the system.

5.2 Recommendations

The following recommendations are applicable.

- a) Smoke alarms should conform to the requirements of BS 5446-1:2000.
- b) Heat alarms should conform to the requirements of BS 5446-2.
- c) Smoke alarm systems intended to warn deaf or hard of hearing people in the event of fire should conform to the requirements of BS 5446-3.
- d) Manual call points should conform to the requirements of BS EN 54-11 for Type A ("single action") manual call points.
- e) Point smoke detectors should conform to the requirements of BS EN 54-7.
- f) Point heat detectors should conform to the requirements of BS EN 54-5 for Class A1 or A2 detectors.
- g) Carbon monoxide fire detectors should, in the absence of any relevant British, European or International Standard, be capable of satisfying the requirements of LPS 1265.
- h) Beam type smoke detectors should conform to the requirements of BS EN 54-12.
- i) Control and indicating equipment for Grade A systems should conform to the requirements of BS EN 54-2.
- j) Control and indicating equipment for Grade B systems should either conform to the requirements of BS EN 54-2 or comply with the recommendations of Annex C.
- k) Audible fire alarm devices for Grades A and B systems should conform to the requirements of BS EN 54-3.
- l) Power supply equipment for Grade A systems should conform to the requirements of BS EN 54-4.
- m) Cables for Grade A systems should comply with the recommendations of Clause 16.

6 Monitoring of circuits

6.1 Commentary

In many simple systems that incorporate interconnecting wiring for the supply of power to detectors, or for the interconnection of smoke alarms and heat alarms, the wiring is unmonitored. However, monitoring of wiring reduces the amount of time for which a system is likely to be disabled before a fault in the wiring is discovered. If the risk to life from fire is high, or the wiring is likely to be subject to mechanical damage or damage by rodents, systems that incorporate monitored wiring are of benefit.

Similarly, in simple systems, monitoring of the state of power supplies is not generally warranted. In more complex systems, which tend to be used in premises in which the risk to life is greater, the additional complexity associated with monitoring of power supplies is likely to be justified.

6.2 Recommendations

The following recommendations are applicable.

- a) In Grade A systems, monitoring of power supplies and circuits external to control and indicating equipment should comply with the recommendations of **12.2.1** of BS 5839-1:2002.
- b) In Grade B systems, monitoring of power supplies and circuits external to control and indicating equipment should comply with **C.8** of Annex C.
- c) In Grade C systems, an open or short circuit fault in any circuit, external to control and indicating equipment, serving manual call points (if present), fire detectors or fire alarm devices should result in a fault warning at the control and indicating equipment (see Clause **17**), or in a fire alarm signal in the dwelling, within 100 s of the occurrence of the fault.
- d) In Grade C systems, failure or disconnection of the normal power supply (see **3.27**) should result in a visual indication at the control and indicating equipment (see Clause **17**) within 30 min of the occurrence of the fault or disconnection. The indication may take the form of either of the following:
 - 1) a normally illuminated indicator is extinguished; or
 - 2) a fault indicator is illuminated.

NOTE This standard contains no recommendations for monitoring of wiring or power supplies in Grades D, E or F systems. However, BS 5446-1:2000 requires that mains-powered smoke alarms (which are used in Grades D and E systems) incorporate a power supply indicator, which is continuously illuminated when mains power is present. BS 5446-2 makes the same requirement for heat alarms.

7 Grades of system

7.1 Commentary

This standard covers many types of fire detection and fire alarm system, which differ widely in cost, complexity, reliability and level of self-monitoring (see Clause 6). Some of the simpler forms of system are not suitable for dwellings in which the fire risk is judged to be high, while expenditure on the most complex systems might be inappropriate for low-risk dwellings (see Clause 4).

For the purpose of specifying a fire detection and fire alarm system and the associated engineering design parameters, this part of BS 5839 groups systems into six Grades. Some of the recommendations of this part of BS 5839 apply to all Grades of system, while other recommendations apply only to particular Grades.

The Grades are defined as follows.

Grade A: *A fire detection and fire alarm system, which incorporates control and indicating equipment conforming to BS EN 54-2, and power supply equipment conforming to BS EN 54-4, and which is designed and installed in accordance with all the recommendations of sections 1 to 4 inclusive of BS 5839-1:2002, except those in the following clauses, for which the corresponding clauses of this part of BS 5839 should be substituted.*

<i>Clause/subclause of BS 5839-1:2002</i>	<i>Corresponding clause/subclause of BS 5839-6</i>
16 (Audible alarm signals)	13 (Audible fire alarm devices and audibility)
18 (Fire alarm warnings for people with impaired hearing)	14 (Fire alarm warnings for deaf and hard of hearing people)
20 (Manual call points)	18 (Manual call points)
25.4e (Capacity of standby batteries)	15.2c (Capacity of standby batteries)
27 (Radio-linked systems)	21 (Radio-linked systems)

Grade B: *A fire detection and fire alarm system comprising fire detectors (other than smoke alarms and heat alarms), fire alarm sounders, and control and indicating equipment that either conforms to BS EN 54-2 (and power supply complying with BS EN 54-4) or to Annex C of this part of BS 5839.*

Grade C: *A system of fire detectors and alarm sounders (which may be combined in the form of smoke alarms) connected to a common power supply, comprising the normal mains and a standby supply, with central control equipment.*

- Grade D:* A system of one or more mains-powered smoke alarms, each with an integral standby supply. (The system may, in addition, incorporate one or more mains-powered heat alarms, each with an integral standby supply.)
- Grade E:* A system of one or more mains-powered smoke alarms with no standby supply. (The system may, in addition, incorporate one or more heat alarms, with or without standby supplies.)
- Grade F:* A system of one or more battery-powered smoke alarms. (The system may, in addition, also incorporate one or more battery-powered heat alarms.)

In the case of Grade D, Grade E and Grade F systems, where more than one smoke alarm is installed the smoke alarms normally need to be interlinked (see 13.2). Any heat alarms also need to be interlinked with the smoke alarms.

Guidance documents supporting legislation, and written requirements produced by enforcing authorities, often specify only a minimum level of system engineering, rather than a particular form of system. These Grades are defined in such a way that a requirement for one Grade of system can be satisfied (normally at higher cost) by the installation of a higher Grade of system; for example, if the fire risk justified the installation of a Grade D system, it would be acceptable to install a Grade A, Grade B or Grade C system.

Because of the wide range of systems covered by the recommendations of this part of BS 5839, the specification of requirements for a system by a purchaser, user, enforcing authority or insurer, or the description of a system by a designer or installer, by reference to this standard, without a reference to system Grade, will have little meaning.

Annex B provides further information on each Grade of system, including the advantages and disadvantages of each Grade.

7.2 Recommendations

The following recommendations are applicable.

- a) Any statutory requirements imposed by enforcing authorities, and any requirements imposed by property insurers, for a fire detection and fire alarm system for a dwelling should clearly state the Grade of system required.
- b) If any party is instructed to design a fire detection and fire alarm system for a dwelling (e.g. by means of a purchase or tender specification), the instruction should include a clear reference to the Grade of system required.
- c) The relevant system certificate (see Clause 23) should clearly state the Grade of system that has been designed or installed.

NOTE In the case of a Grade A system, there will be a separate design certificate, which will indicate the Grade of system that has been designed (see Annex E). In other Grades of system, a single certificate will normally be issued, indicating the Grade of system that has been designed, installed and commissioned (see Clause 23 and Annex F.)

8 Categories of system

8.1 Commentary

8.1.1 General

Fire detection and fire alarm systems are usually installed in dwellings to protect life. However, the level of protection afforded to occupants needs to be related to the fire risk (see Clause 4). The appropriate level can therefore vary considerably. For the purposes of this standard, systems are classified as follows, according to the level of protection that they afford.

Category LD: a fire detection and fire alarm system intended for the protection of life.

NOTE 1 The designation "LD" is used to distinguish these systems, which are intended only for dwellings, from Category L systems as defined in BS 5839-1, which are intended for the protection of life in any type of building.

Category LD systems are subdivided into:

- Category LD1: a system installed throughout the dwelling, incorporating detectors in all circulation spaces that form part of the escape routes from the dwelling, and in all rooms and areas in which fire might start, other than toilets, bathrooms and shower rooms;*
- Category LD2: a system incorporating detectors in all circulation spaces that form part of the escape routes from the dwelling, and in all rooms or areas that present a high fire risk to occupants (see Clause 4);*
- Category LD3: a system incorporating detectors in all circulation spaces that form part of the escape routes from the dwelling.*

Category PD: a fire detection and fire alarm system intended for the protection of property.

NOTE 2 The designation "PD" is used to distinguish these systems, which are intended only for dwellings, from Category P systems as defined in BS 5839-1, which are intended for the protection of property in any type of building.

Category PD systems are subdivided into:

- Category PD1: a system installed throughout the dwelling, incorporating detectors in all rooms and areas in which fire might start, other than toilets, bathrooms and shower rooms;*
- Category PD2: a system incorporating detectors only in defined rooms or areas of the dwelling in which the risk of fire to property is judged to warrant their provision.*

A system is rarely installed solely for the protection of property. Accordingly, Category PD systems will normally be designed to comply with the recommendations of this part of BS 5839 for a Category LD system, thereby constituting a combined Category LD and Category PD system.

Because of the wide range of systems covered by the recommendations of this part of BS 5839, the specification of requirements for a system by a purchaser, user, enforcing authority or insurer, or the description of a system by a designer or installer, by reference to this standard, without a reference to system Category, will have little meaning.

8.1.2 Systems for the protection of life (Category LD)

All dwellings need to be provided with an appropriate fire detection and fire alarm system. The greatest benefit to life safety is given by a full-coverage system (Category LD1). Such a system will give the earliest practicable warning of fire to occupants, wherever ignition occurs.

However, a good level of protection can normally be obtained from a Category LD2 system, in which detection is only provided at points where the fire risk is high or where combustion products would present a significant hazard to life. A Category LD2 system might, for instance, have detectors only in the circulation areas of the dwelling, the living room and the kitchen; other areas might be left without detector coverage. The areas protected by a Category LD2 system include escape routes, i.e. those areas that would be protected by a Category LD3 system.

A Category LD3 system is intended only to protect circulation areas that would be used as escape routes, by giving a warning if smoke is detected in these areas, so that occupants can escape before heat or smoke make this impossible. A Category LD3 system cannot be expected, with any degree of reliability, to protect people who might be involved with the fire at ignition or in its early stages. This Category of system might not therefore prevent the death or serious injury of occupants in the room where the fire originates; it is intended only to ensure escape for those not immediately involved. If no detector is installed in the room in which fire starts, the time available for evacuation of other areas once fire is detected in the circulation area might be quite short.

In a large family house adapted to provide accommodation for several households in separate self-contained units (a house in multiple occupation), a fire in one dwelling unit can be a hazard to occupants of other units. In this case, the fire detection and fire alarm system normally needs to extend across the boundaries between occupancies or be interconnected with systems in other occupancies. In practice, it is often appropriate for there to be a single integrated fire detection and fire alarm system that will alert all occupants before a fire in any dwelling threatens the communal escape routes, and that will provide early warning of any fire that starts in these escape routes. This objective is additional to that of enabling occupants of the dwelling in which fire starts to escape before their escape routes become impassable owing to heat or smoke (see also 9.1.5).

In the case of purpose-built flats or sheltered housing, the degree of compartmentation between occupancies is normally sufficient to ensure that fire is contained in the dwelling of origin for a prolonged period. During this time, other occupants can remain in reasonable safety within their own dwellings. Accordingly, this part of BS 5839 does not provide recommendations for fire detection and fire alarm systems that incorporate detectors in the communal areas or ancillary accommodation (e.g. plant rooms) within purpose-built flats or sheltered housing. If, however, the provision of detection in these areas is considered desirable, it is essential to refer to the guidance contained in BS 5588-1, and it is appropriate that such fire detection and fire alarm systems comply with the recommendations of BS 5839-1.

8.1.3 Systems for the protection of property (Category PD)

A fire can start virtually anywhere in a dwelling, although the probability of fire varies significantly from one room to another (see Annex A, Table A.1). If the fire is not detected at an early stage, it can grow until it becomes difficult or impossible to extinguish. The highest level of property protection will therefore be given by a Category PD1 system (giving full coverage of all parts of the dwelling). In a large house of high value, or with contents of high value, such a system is generally the only Category acceptable to fire insurers. The system will normally have a facility for automatic transmission of fire alarm signals to an alarm receiving centre (see Clause 20).

A lower level of protection, still giving a useful reduction in fire risk, can sometimes be obtained by the installation of fire detectors only in those parts of the building in which there is significant potential for ignition. A Category PD2 system provides partial cover of this nature.

8.2 Recommendations

The following recommendations are applicable.

- a) Any statutory requirements imposed by enforcing authorities, and any requirements imposed by property insurers, for a fire detection and fire alarm system for a dwelling should clearly state the Category of system required.
- b) If any party is instructed to design a fire detection and fire alarm system for a dwelling (e.g. by means of a purchase or tender specification), the instruction should include a clear reference to the Category of system required.
- c) If a fire detection and fire alarm system is intended to protect both life and property, and specific recommendations for the two Categories of system differ, then the system should comply with the recommendations for each of the Categories.

NOTE 1 For example, a system whose sole purpose is to provide full-coverage property protection (Category PD1) need only have a small number of sounders, but if it is also used to provide coverage of the circulation areas for life safety (Category LD3), the number of sounders should be sufficient to give warning throughout the dwelling.

NOTE 2 The combined system should be described as a Category X/Y system (e.g. LD2/PD2 or LD3/PD2, etc.).

d) Any requirement for a Category LD2 system (e.g. in a statutory notice issued by an enforcing authority or in a purchase specification) should be supplemented by information regarding the rooms in which fire detectors are to be installed (over and above the fire detectors in the circulation areas required to satisfy the recommendations of this standard for a Category LD3 system). Similarly, any requirement for a Category PD2 system should be supplemented by information regarding the areas of the dwelling that are to be protected by automatic fire detectors.

e) The relevant system certificate (see Clause 23) should clearly state the Category of system that has been designed and should, in the case of a Category LD2 or PD2 system, provide a brief description of the areas of the dwelling that are protected by fire detectors.

NOTE 3 In the case of a Grade A system, there will be a separate design certificate, which will indicate the Category of system that has been designed (see Annex E). In other Grades of system, a single certificate will normally be issued, indicating the Category of system that has been designed, installed and commissioned (see Clause 23 and Annex F).

9 Choice of system

9.1 Commentary

9.1.1 Grade of system

System Grade relates to the engineering aspects of the fire detection and fire alarm system. Higher Grades of system tend to provide a greater level of control and monitoring of the system, or greater reliability and availability to perform correctly in the event of fire. The Grade of system that needs to be installed depends on the nature of the dwelling, the level of fire risk and the characteristics of the occupants.

Grade F systems, comprising one or more battery-operated smoke alarms, are the least reliable in the long term because of the need for battery replacement. For new dwellings, a Grade D system (in which the normal power supply for each smoke alarm is derived from the mains electricity supply and a standby supply is provided) or higher is justified.

However, because of their low cost and ease of installation, Grade F systems (comprising battery-powered smoke alarms) may be considered for installation in existing dwellings. Their reliability can be improved by use of batteries that have a long anticipated life and that cannot be removed without the use of a tool. Nevertheless, Grade F systems are not appropriate in dwellings in which the fire risk to occupants is high nor where there cannot be a reasonable certainty that, when the dwelling is occupied, batteries will be replaced within a short time (typically no more than five days) of a battery fault warning indication. Otherwise, a system in which the normal supply is derived from the mains needs to be used (e.g. a Grade D system).

If, in an existing dwelling, a Grade F system would be acceptable, it is acceptable to install a Grade E system (comprising mains powered smoke alarms). However, if there are likely to be periodic interruptions to the mains supply, whether due to the inability of the occupier to pay for supplies or due to unreliability of the mains electricity supply, a Grade D system or higher (in which there is a standby supply) is then necessary. Where there is a need for readily accessible control of the fire detection and fire alarm system, a Grade C system or higher might be provided. Where the fire risk calls for a high standard of system monitoring and availability, it might be appropriate to install a Grade B system. If the dwelling is very large, or is subdivided into a significant number of dwelling units, a Grade A system is likely to be appropriate.

If the purpose of the system is property protection, fire insurers might require a Grade A system. However, for smaller properties, a Grade B or Grade C system might be sufficient.

9.1.2 Category of system

System Category relates to the level of protection afforded to occupants. The Category of system that is appropriate depends primarily on the fire risk (see Clause 4). All dwellings need to be protected to at least the standard afforded by a Category LD3 system. However, for new dwellings, a Category LD2 system is appropriate. If the risk to occupants from fire in any part of the dwelling is deemed to be high, a Category LD2 or Category LD1 system is always appropriate. For example, a Category LD2 or Category LD1 system needs to be considered if the occupants suffer from any disability (mental or physical) that could delay their escape from fire. If it is intended to protect reliably any occupant in the room where a fire originates, a suitable Category LD2, or a Category LD1, system needs to be provided.

In a house in multiple occupation divided into a number of separate units of accommodation, there might not be the same degree of compartmentation as in purpose-built blocks of flats. As it is impossible to control occupants' activities, and there is no overall supervision of the entire dwelling, it is essential that all occupants are warned before a fire in any self-contained dwelling unit threatens their safety. In order to meet this objective, in all except the smallest such houses in multiple occupation, communal areas need to be protected by siting detectors generally in accordance with the recommendations of BS 5839-1 for a Category L2 system; these are similar to, but more onerous than, the recommendations of this part of BS 5839 for a Category LD2 system (see Table 1).

9.1.3 Appropriate systems for typical dwellings

Dwellings covered by this part of BS 5839 can be divided into a number of broad classes. Table 1 shows the minimum Grades and Categories of system recommended for the protection of life in typical dwellings in each class. Attention is, however, drawn to building regulations, which govern fire precautions in new dwellings, and to other legislation concerning fire precautions in certain types of existing dwelling (such as houses in multiple occupation). Where fire precautions are subject to legislative control, the enforcing authority, or the guidance that supports the legislation, needs to be consulted before a decision on the appropriate Grade and Category of system is reached.

Table 2 shows the minimum Grades and Categories of system appropriate for the protection of property in typical dwellings. In the case of large dwellings, the installation of a fire detection and fire alarm system might be required by fire insurers or might be taken into account by the insurer. In this case, the insurer needs to be consulted before a decision on the Grade and Category of system is reached.

It is important to note that Table 1 and Table 2 relate only to typical dwellings in each class, and these examples of dwellings are not intended to be comprehensive. If any doubt exists as to the appropriate system for any dwelling, the advice of specialists, such as the fire and rescue service, fire consultants or, if appropriate, the fire insurer, needs to be sought, and the choice of system needs to be based on a risk assessment (see Clause 4). In some circumstances, this might determine that a higher standard of protection (i.e. with additional detectors) is warranted.

9.1.4 Specification of systems

When specifying a system by reference to this part of BS 5839, the Grade and Category of system always need to be stated.

The specification for a Category PD2 or LD2 system always needs to include details of the areas and rooms of the dwelling that are to be protected. Where mixed or combined Grades or Categories of system are required in a dwelling, the Grade(s) or Category(ies) of system required in each part of the dwelling need to be specified (see also 9.1.5).

9.1.5 Mixed systems

Normally, even in the largest of dwellings, a single fire detection and fire alarm system serves the entire dwelling. However, exceptions might arise in some dwellings in order to meet different objectives.

An example of such an exception is a house in multiple occupation that has three or more storeys. One objective of installing a fire detection and fire alarm system is to warn all occupants before a fire in any one dwelling threatens the communal escape routes. This objective could be met by complying with the recommendations of BS 5839-1 for a Category L3 fire detection and fire alarm system, which involves the installation of smoke detectors within the communal escape routes and either heat, smoke or carbon monoxide detectors in rooms or areas adjoining the communal escape routes.

The purpose of the detectors in the accommodation adjoining the escape routes is only to give a warning to occupants of other dwellings before the fire breaks through the door of the dwelling in which it originates. The detectors within dwellings may be sited on the ceiling or wall close to the dwelling entrance door. The siting and type of detector might not therefore be such as to provide a sufficiently early warning for occupants in the dwelling of fire origin to escape. These occupants could be adequately protected by installing smoke alarms within the circulation areas of self-contained dwelling units, following the principles adopted in purpose-built flats. (If necessary, these smoke alarms could also be supplemented by interlinked heat or smoke alarms in specific rooms.)

An advantage of this arrangement is that false alarms due to, for example, cooking activities in one dwelling, are unlikely to result in disturbance of all occupants, particularly if heat detectors are installed in areas adjoining escape routes for the purpose of complying with the recommendations of BS 5839-1.

Although this arrangement (a “mixed system”) results in a mixture of system Grades, it meets both life safety objectives. Alternatively, the objectives could be met by a single system which has detectors sited in accordance with BS 5839-1 and that incorporates smoke detectors in communal escape routes and in the circulation spaces within dwellings (and detectors in any rooms in which protection is necessary) within dwellings. Other means might then be incorporated to prevent unnecessary disruption to all residents as a result of a false alarm in one dwelling unit (see Clause 12). This arrangement can also simplify maintenance of the system. Similarly, in sheltered housing or blocks of flats, detectors installed within the dwellings are not intended to give a warning in other dwellings (other than, in the case of sheltered housing, a warden’s flat: see BS 5588-1). If, nevertheless, fire detection in either communal escape routes or selected high-risk areas such as plant rooms or communal living rooms, is required, an entirely separate system could be installed in these areas (see 8.1.2).

Mixed systems might also be acceptable where, for example, a Grade B Category PD2 system is installed for property protection in one part of a dwelling, while, for protection of life, a Grade D Category LD3 system is installed throughout the circulation areas of the dwelling.

If two separate systems are installed (e.g. a BS 5839-1 system supplemented by smoke alarms), it is essential that occupiers are aware of the separate nature of the systems. For example, occupiers of a house in multiple occupation need to be aware of the need to maintain any smoke alarms provided in individual dwellings, even though a separate system is installed for protection of escape routes.

9.2 Recommendations

The following recommendations are applicable.

a) Where there is a need to specify a fire detection and fire alarm system for a dwelling in which the characteristics of the occupants are unknown (e.g. for a new dwelling under building regulations), or for a group of dwellings in which occupant characteristics will vary (e.g. when specifying requirements for retrofitting of smoke alarms throughout the properties of a local authority), the recommendations given in Table 1 should be followed.

NOTE Where Table 1 refers to a house with a specific number of storeys (e.g. a two-storey house), basement storeys can be ignored.

b) Where there is a need to specify a fire detection and fire alarm system for a single, specific dwelling, in which occupant characteristics are known or can be anticipated (e.g. when imposing requirements for a house in multiple occupation under legislation, or designing a system on behalf of a specific occupier), the recommendations in Table 1 should be followed, but may be modified on the basis of a fire risk assessment (see Clause 4).

c) If a fire detection and fire alarm system is required under legislation, before selecting the Grade and Category of system, there should be appropriate consultation with the relevant enforcing authorities and/or appropriate reference to guidance documents that support the legislation in question.

d) Table 2 provides recommendations for the minimum Grade and Category of system that should be installed for property protection in typical dwellings. However, if a fire detection and fire alarm system is intended to satisfy the requirements of fire insurers, before selecting the Grade and Category of system, there should be appropriate consultation with the fire insurers.

e) Any specification for a system that is intended to satisfy the recommendations of this part of BS 5839 should identify the Grade and Category of system required.

f) It is acceptable to install a mixed system (see 3.23) in a dwelling in any situation in which there is more than one fire safety objective that can be satisfied by more than one Grade of fire detection and fire alarm system.

Table 1 — Minimum Grade and Category of fire detection and fire alarm system for protection of life in typical dwellings

Class of dwelling	Minimum Grade and Category of system for installation in:					
	New or materially altered dwellings complying with the recommendations of BS 5588-1 or guidance that supports national building regulations ^a		Existing dwellings complying with the recommendations of BS 5588-1 or guidance that supports national building regulations ^a		Existing dwellings where structural fire precautions are of a lower standard than those recommended in BS 5588-1 or guidance that supports national building regulations ^a	
	Grade	Category	Grade	Category	Grade	Category
Single-family dwellings^b and shared houses^c with no floor greater than 200 m² in area Owner-occupied bungalow, flat or other single-storey unit Rented bungalow, flat or other single-storey unit Owner-occupied maisonette or owner-occupied two storey house Rented maisonette or rented two storey house Three-storey house Four- (or more) storey house	D	LD2 ^d	Fe	LD3 ^f	D	LD2 ^g
	D	LD2 ^d	Fe ^h	LD3 ^f	D	LD2 ^g
	D	LD2 ^d	Fe	LD3 ^f	D	LD2 ^g
	D	LD2 ^d	D	LD3 ^f	D	LD2 ^g
	D	LD2 ^d	D	LD3 ^f	D	LD2 ^g
	B	LD2 ^d	D	LD2 ^{d l}	B	LD2 ^{d g}
Single-family dwellings^b and shared houses^c with one or more floors greater than 200 m² in area Bungalow, flat or other single-storey unit Maisonette or two-storey house Three- (or more) storey house	D	LD2 ^d	D	LD3 ^f	D	LD2 ^g
	B	LD2 ^d	B	LD2 ^{d i}	B	LD2 ^{d g}
	Grade A, Category LD2, with detectors sited in accordance with the recommendations of BS 5839-1 for a Category L2 ^{d i j} system					
Houses in multiple occupation^k (HMOs) HMOs of one or two-storeys with no floor greater than 200 m ² in area Other HMOs: Individual dwelling units, within the HMO, comprising two or more rooms Communal areas of the HMO	D	LD2 ^d	D	LD3 ^{l f}	D	LD2 ^{l g}
	D ^m	LD2 ^d	D ^m	LD3 ⁿ	D ^m	LD2 ^g
	Grade A, Category LD2, with detectors sited in accordance with the recommendations of BS 5839-1 for a Category L2 system ^o					

Table 1 — Minimum Grade and Category of fire detection and fire alarm system for protection of life in typical dwellings (*continued*)

Class of dwelling	Minimum Grade and Category of system for installation in:					
	New or materially altered dwellings complying with the recommendations of BS 5588-1 or guidance that supports national building regulations ^a		Existing dwellings complying with the recommendations of BS 5588-1 or guidance that supports national building regulations ^a		Existing dwellings where structural fire precautions are of a lower standard than those recommended in BS 5588-1 or guidance that supports national building regulations ^a	
	Grade	Category	Grade	Category	Grade	Category
<i>Sheltered housing (individual dwelling units only)^p</i>	C	LD2 ^d	C ^q	LD3 ^f	C ^q	LD2 ^g
<i>Housing providing NHS supported living in the community</i>						
Dwellings of one-, two- or three-storeys occupied by no more than six residents	C	LD1	C	LD1	C	LD1
Other dwellings	Grade A, Category LD1, with detectors sited in accordance with the recommendations of BS 5839-1 for a Category L1 system					

^a In England and Wales, Approved Document B published by the Office of the Deputy Prime Minister. In Scotland, the Technical Standards published by the Scottish Executive. In Northern Ireland, Technical Booklet E published by the Department of Finance and Personnel.

^b Including dwellings with long-term lodgers, but not boarding houses, the latter of which are outside the scope of this part of BS 5839.

^c Houses shared by no more than six persons, generally living in a similar manner to a single family (e.g. houses rented by a number of students).

^d Heat detectors should be installed in every kitchen and the principal habitable room (see 3.28). Where more than one room might be used as the principal habitable room, a heat detector should be installed in each of these rooms. The detector in the principle habitable room (but not the kitchen) may alternatively be a smoke or carbon monoxide fire detector. However, a heat detector is preferred in view of its lower potential for false alarms and the lesser need for maintenance.

^e Grade E if there is any doubt regarding the ability of the occupier to replace batteries in battery-operated smoke alarms soon after a battery warning is given (see 9.1.1) but Grade D, if, in addition, there is a significant likelihood of the electricity supply being disconnected because the occupier is unable to pay for supplies.

^f Category LD2 if a risk assessment justifies the provision of additional detectors (see Clause 4).

^g Detectors should be of a type and be so located as to compensate for the lower standard of structural fire precautions (for example, a smoke detector should be installed in the access room to a habitable inner room that has no door or window through which escape is possible). Further detectors might be necessary if a risk assessment justifies their provision. In some cases, a Category LD1 system might be necessary.

^h The batteries in the smoke alarm(s) should have an anticipated life (taking into account monthly testing and fire alarm signals with an aggregate duration of 100 minutes per annum) of at least five years. Removal of batteries should necessitate the use of a tool.

ⁱ Further detectors might be necessary if a risk assessment justifies their provision.

^j BS 5839-1 recommends that detectors are installed in escape routes and, generally, in rooms opening onto escape routes. Notwithstanding the recommendations of BS 5839-1, detectors may be omitted from rooms opening directly onto staircase landings and opening onto escape corridors of six metres or less in length.

^k Other than houses with long-term lodgers and houses shared by no more than six persons, generally living in a similar manner to a single family (e.g. houses rented by a number of students).

^l Detectors should be installed in communal circulation routes and within any circulation spaces in individual dwelling units comprising two or more rooms (e.g. in hallways and on staircase landings).

^m The detectors in individual dwelling units may be incorporated within the system installed in communal areas.

ⁿ Category LD2 if a risk assessment justifies the provision of additional detectors (see Clause 4). For example, the conditions in a single room bedsit might be such that the provision of a heat or smoke detector in the bedsit is justifiable.

^o Heat detectors should be installed in every communal kitchen. Heat or smoke detectors, as appropriate (taking into account the fire risk and the potential for false alarms), should be installed in every communal lounge.

^p See also 20.2q).

^q Many social alarm systems installed in sheltered housing have facilities for connection, monitoring and separate identification of signals from smoke alarms. If an existing social alarm system does not provide such a facility, it might be acceptable to install a Grade D system, provided that any fire signal is relayed to the warden's accommodation [see recommendation 20.2q)].