

Fire detection and alarm systems for buildings —

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

UDC 696.6:614.842.4:654.924.5:64.066

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee FSM/12, Fire detection and alarm systems, upon which the following bodies were represented:

- AEA Technology
- British Cable Makers' Confederation
- British Fire Protection Systems Association Ltd.
- British Fire Services' Association
- British Telecommunications plc
- Chartered Institution of Building Services Engineers
- Chief and Assistant Chief Fire Officers' Association
- Consumer Policy Committee of BSI
- Department of Health
- Department of the Environment (Building Research Establishment)
- Department of the Environment (Central Advice Unit)
- Department of the Environment (Property and Buildings Directorate)
- Electrical Contractors' Association
- Home Office
- Institute of Fire Safety
- Institution of Electrical Engineers
- Institution of Fire Engineers
- London Fire and Civil Defence Authority
- Loss Prevention Council
- Ministry of Defence
- National Association of Fire Officers
- National Caravan Council Limited
- National Inspection Council for Electrical Installation Contracting
- National Quality Assurance
- Trades Union Congress

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

- Engineering Industries Association
- Professional Lighting and Sound Association

This British Standard, having been prepared under the direction of the Consumer Products and Services Sector Board, was published under the authority of the Standards Board and comes into effect on 15 November 1995

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The following BSI references relate to the work on this standard:
Committee reference FSM/12
Draft for comment 94/303229 DC

ISBN 0 580 25104 7

Amendments issued since publication

Amd. No.	Date	Comments
9135	April 1996	Indicated by a sideline in the margin

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Foreword

This part of BS 5839 has been prepared by Subcommittee FSM/12/1, Installation and servicing, under the direction of Technical Committee FSM/12, Fire detection and alarm systems. No existing standard is superseded but, whereas BS 5839-1 provides recommendations for fire detection and alarm systems in buildings generally, this part of BS 5839 should now be used for specific guidance on fire detection and alarm systems in dwellings.

In the United Kingdom, between 70 % and 80 % of all fire deaths and injuries occur in dwellings, a total of approximately 600 deaths and more than 10,000 injuries per annum. Many of those who die are the most vulnerable in the community, namely the elderly, the socially deprived, and the very young. The installation of a fire detection and 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 during the 6 years immediately preceding the publication of this part of BS 5839 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.

In recent years, there has been substantial growth in the use of automatic fire detectors, particularly self-contained smoke alarms, for the protection of life in dwellings. There is evidence to suggest that this is reducing the number of deaths from fire. The installation of automatic fire detectors is normally 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 alarm system may be required by the enforcing authorities. These factors have given rise to the need for a suitable code of practice, as BS 5839-1 does not contain recommendations on domestic smoke alarms (other than in the form of an Appendix), nor does it address the special design requirements for domestic fire alarm installations.

The guidance in this standard is not intended for occupiers of dwellings, but is intended for architects and other building professionals, enforcing authorities, contractors 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 experienced persons.

As a code of practice, this part of BS 5839 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.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their 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.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 36, an inside back cover 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 alarm systems in dwellings and dwelling units that are designed to accommodate a single family, and in houses in multiple occupation which 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, NHS housing in the community for mentally handicapped or mentally ill people (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.

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 Home Departments¹⁾. However, recommendations are given for simple systems which may be installed by non-specialists. The recommendations refer principally to fire detection and alarm systems installed for the purpose of life safety. However, recommendations are given for systems that are also intended to protect property.

2 References

2.1 Normative references

This part of BS 5839 incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on page 36. For dated references, only the edition cited applies; any subsequent amendments to or revisions of the cited publication apply to this part of BS 5839 only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

2.2 Informative references

This British Standard refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

3 Definitions

For the purposes of this part of BS 5839, the following definitions apply.

3.1

access room

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

3.2

addressable system

a system in which signals from each detector and/or call point are individually identified at the control panel

3.3

circulation area; circulation space

an area or space, including a stairway, mainly used as a means of passage between a room and an exit from the building

3.4

detector

a component of a fire detection and alarm 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 smoke alarms (see 3.25).

¹⁾ The Home Office (in England and Wales), the Scottish Home and Health Department and the Northern Ireland Office.

3.5 dwelling

a 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 persons who do not live together as a family, but who live in self-contained single-family flats or maisonettes within the unit.

NOTE The definition in a) is more restricted than that used in the documents supporting building regulations. The definition in b) relates only to some types of house in multiple occupation and specifically excludes hostel type accommodation, for which BS 5839-1 is more appropriate.

3.6 final circuit

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

3.7 final voltage (of a battery)

the voltage at which the cell manufacturer considers the cells to be fully discharged at the specified discharge current

3.8 control equipment

equipment that, on receipt of a fire signal, controls the giving of a fire alarm by one or more of the following:

- a) fire alarm sounders;
- b) indicating equipment;
- c) a transmitter which is capable of transmitting fire alarm signals to a remote location.

3.9 indicating equipment

equipment that provides visual indication of any fire alarm or fault warning signal received from control equipment

3.10 fire alarm sounder

a component of a fire detection and alarm system for giving an audible warning of fire

3.11 fire detection and alarm system

a 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 alarm systems that comprise one or more smoke alarms, as well as systems that comprise separate detectors, alarm sounders and control equipment.

3.12 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

3.13 fire risk

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

NOTE This differs from the definition in BS 4422, which defines fire risk as the risk of fire occurring. However, the above definition accords with the definition of risk used in other standards and with that used in the safety field by organizations such as the Health and Safety Executive (HSE).

3.14 flat

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

3.15 house in multiple occupation

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

3.16 habitable room

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

3.17 inner room

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

3.18 maisonette

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

3.19 maximum alarm load

the maximum electrical load imposed on the power supply to the fire detection and alarm system by the simultaneous operation of all alarm devices, any visible and audible indications at any control and indicating equipment, etc., when fire signals are generated by the maximum number of detectors that can simultaneously give them

3.20 mobile home

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

3.21**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 This definition differs from that in BS 5839-1, in which monitored wiring is defined in such a way 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 that monitoring be in accordance with the definition in BS 5839-1 (see 14.2).

3.22**normal supply**

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

3.23**sheltered housing**

a 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.

3.24**smoke**

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

3.25**smoke alarm**

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

3.26**social alarm system**

a 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

3.27**standby supply**

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

3.28**zone**

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

NOTE A zone is separately indicated to assist in location of the fire and to assist fire-fighters.

4 Risk analysis**4.1 General**

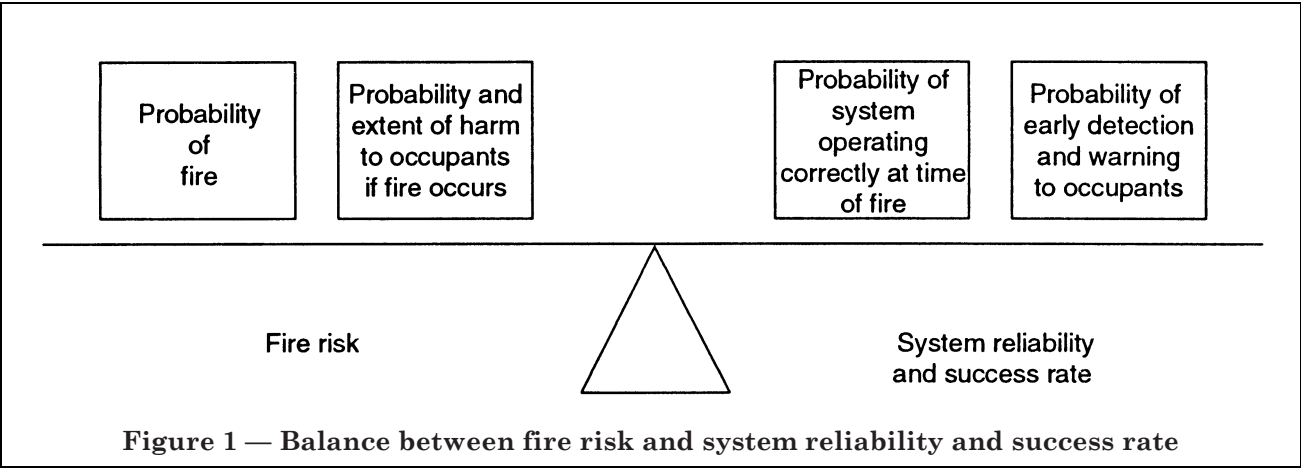
A fire detection and alarm system, although it can do nothing to reduce the incidence of fire, can help to lessen the resultant loss in terms of injury to occupants or damage to property. However, the system should be regarded as just one component of a properly engineered approach to fire safety. System design should take into account the contribution of all other fire precautions to the reduction of the risk.

In order to maximize the cost-benefit of a fire detection and alarm system, it is essential that the system design be appropriate to the fire risk.

Accordingly, the design of any fire detection and alarm system installed in accordance with this part of BS 5839 should 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 a small bungalow might be adequately protected at very low cost by the installation of one mains-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 3.13).

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.

System design should ensure that there is an appropriate balance between the fire risk and the system reliability and success rate (see Figure 1).

The factors that should be considered in formulating a qualitative assessment of fire risk are given in 4.2 and 4.3; the implications of the various factors on system design are also described. Clause 8 contains guidance on the grades and types of system (see clauses 6 and 7) that are considered generally appropriate for generic types of dwelling covered by this part of BS 5839.

Final system design should preferably be based on the considerations given in 4.2 and 4.3, particularly if it is proposed to deviate from the guidance given in clause 8 or if there are risk factors additional to those encountered in typical examples of the dwelling types defined in clause 8. However, in many cases, occupant characteristics and other relevant factors are not known to the designer (e.g. in the case of new dwellings). In such cases, design should be based on the guidance given in clause 8.

4.2 Assessment of fire risk and implications for system design

In assessing the fire risk, each room in the dwelling should be considered separately. The assessment should be based on recognized fire statistics²⁾.

In considering the probability of fire in a room, account should be taken both of statistical data on the relative likelihood of fire in a room of that type (e.g. living room, bedroom), and of all potential sources of ignition within the room. In considering the potential for injury or death to occupants, account should be taken both of statistical data on the relative likelihood of injury or death due to fires that start in a room of that type, and of all occupant characteristics that are relevant to their probability of injury or death from fire.

It should be noted that the level of fire risk in any dwelling covered by this part of BS 5839 is unlikely to be sufficiently low to obviate the need for a fire detection and alarm system. Accordingly, it is recommended that a system be installed in all dwellings described in clause 1, whether new or existing, in accordance with the guidance given in this standard.

In assessing the fire risk to which occupants of a dwelling are exposed, the following should be taken into account, along with the design considerations described in clause 5.

- a) The presence of smoke in escape routes is the greatest impediment to safe escape in the event of fire. It is essential that any fire that starts in a circulation area, or smoke that spreads into a circulation area, be detected as early as possible. Smoke detectors should therefore be installed in the circulation areas of all dwellings.

²⁾ A suitable source of statistical information is *Fire Statistics United Kingdom* [2], published annually by the Home Office.

b) In the United Kingdom, approximately 40 % of fires in dwellings involve cooking appliances, but these fires account for only 10 % of the deaths that occur. Approximately 15 % of all fire deaths result from fires that originate in kitchens. However, in single-family dwellings, it is unlikely to be necessary to install detectors in kitchens for the protection of life, but it is essential that a smoke detector be sited in any adjacent circulation space.

c) Smokers' materials are the second most common cause of accidental fires in dwellings. Fires started by smokers' materials are the most common cause of fatalities, resulting in around one third of fatalities in accidental fires. In most cases, the item ignited is bedding or furniture. If occupants are known to smoke, there is greater justification for installing smoke detectors in living rooms and dining rooms, particularly as older furniture may not be resistant to ignition by a smouldering cigarette or a match. If the occupants smoke in bed, consideration should be given to the installation of smoke detectors in bedrooms.

d) Space heating appliances are the second most common cause of fatalities from fire in dwellings. Such fires often result when combustible materials are placed too close to the source of heat. If portable heaters or solid-fuel fires are used during the night, there may be justification for installing smoke detectors in the relevant rooms, particularly if these are bedrooms.

e) Fires caused by electrical appliances and wiring account for approximately 14 % of all fires in dwellings, but result in only around 8 % of deaths. Approximately one fifth of the fires involving electrical appliances (other than cooking or heating appliances) are caused by electric blankets and bed warmers. However, these fires result in as many as two thirds of the fatalities that occur in fires ignited by electrical appliances. Use of electric blankets, particularly by high-risk groups such as the elderly, increases the justification for providing smoke detectors in bedrooms.

f) Arson is a growing problem; the number of maliciously ignited fires in dwellings doubled in the 10 years from 1981 to 1991. Malicious ignition is the second most common cause of all fires in dwellings, although the proportion of deaths that result remains under 10 %. Malicious ignition is a more significant cause of fire in multiple-occupancy dwellings than in single-family dwellings. If malicious fire-raising is a significant possibility, the level of protection should be high. If malicious ignition by a third party is considered to be a significant threat (e.g. by passing burning material through a letter box), the system should be capable of providing early warning of a fire inside the dwelling that starts in the vicinity of any entrance door.

g) Elderly people are at significantly greater risk from fire than other age groups. For those aged 80 years or more, the probability of dying from fire is several times that for those aged from 30 to 59 years. Those aged from 60 to 80 years are also at slightly increased risk. Children under 5 years are at greater risk than adults. Dwellings in which the principal occupant is elderly, or in which there is a number of elderly occupants or young children, should be protected to an appropriately high level.

h) Socially deprived occupants on a low income are more likely to suffer death or serious injury from fire than those in higher socio-economic groups. For those most at risk, replacement of batteries in smoke alarms may, of necessity, be a low priority. In these cases, a more reliable power supply for the fire detection and alarm system is essential.

i) It has been estimated that the risk of death from fire in a house in multiple occupation is eight to ten times higher than in a single-family dwelling³⁾. Accordingly, it is essential that there is a high level of protection by a highly reliable fire detection and alarm system in all houses in multiple occupation. It is also essential that a warning is given in the event of a fault that impairs the standard of protection.

j) People with impaired mobility require more time to escape. To allow for this, the system should ensure earlier warning in the event of fire; this may necessitate the provision of detectors in certain rooms as well as in circulation areas.

³⁾ From *Amenity Standards for Houses in Multiple Occupation* [3].

k) Approximately one half of all fatalities from fire in single-family dwellings occur in the room where the fire originates. In houses in multiple occupation, the proportion is approximately 60 %. In this connection, it should be noted that, if the door of the room where the fire originates is closed, a smoke detector outside the room is unlikely to operate at an early enough stage to prevent loss of life in the room.

l) The combined number of fires originating in living rooms and dining rooms is similar to the number of fires originating in bedrooms. However, nearly half of all fatal fires in dwellings start in living rooms or dining rooms, whereas approximately 30 % start in bedrooms. This suggests that, if detectors are installed within rooms in a dwelling, the living room and dining room should be the first priority, followed by the bedrooms. However, it may be appropriate to reverse these priorities if the fire risk in the living room or dining room is low but occupants smoke in bed, or if bedrooms contain potential sources of ignition such as electric blankets or other electrical appliances.

m) Occupants of dwellings are at greater risk when they are asleep. It is therefore essential that fire detection and alarm systems are capable of operating correctly when occupants are asleep and are capable of arousing occupants from normal sleep.

4.3 Additional considerations for property protection systems

The matters described in 4.2 relate to the risk to life from fire. All systems within the scope of this part of BS 5839 should be designed to protect occupants in the event of fire. Only in exceptional circumstances (e.g. in a house of historic importance in which no one sleeps) should the objective of the system be solely the protection of property. However, the objective of the system may sometimes be the protection of property as well as of life. A fire detection and alarm system for the protection of property should be able to automatically detect fire and result in the summoning of the fire brigade at an early enough stage in fire development to ensure that, when the fire brigade arrives, the fire is relatively restricted in extent.

If the attendance time of the fire brigade is incompatible with the probable rate of fire spread, and water supplies for fire-fighting are limited, the provision of additional fire protection measures to limit fire development prior to the arrival of the fire brigade should be considered in the case of properties of particular importance (e.g. a historic country mansion).

This clause describes additional considerations that should be taken into account in assessing the risk to property from fire, and the implications for the design of systems intended to protect property as well as life.

Since a fire that starts anywhere in the house will result in damage, detectors should be provided in some or all rooms of the dwelling. It is unlikely to be sufficient to provide detectors only in circulation areas. The primary considerations should be the probability of fire in each room and the probability that fire will be discovered before significant spread occurs. Accordingly, there may be a need for fire detectors in kitchens, living and dining rooms, for example, as well as in boiler rooms and other infrequently visited areas (e.g. cellars and roof spaces) where there are likely sources of ignition. Table 1 may be used as a basis for prioritizing the areas in which additional detectors should be installed.

There is evidence that the presence of fire detectors can result in a reduction in the amount of damage in the event of fire, provided that prompt action is taken when fire is detected. Even in dwellings protected by smoke alarms, property has on occasions been saved because neighbours heard the alarms when the dwelling was unoccupied. However, a good level of property protection can usually be achieved only if there is a means for automatic transmission of fire signals to the fire brigade when the dwelling is unoccupied (see clause 18).

Table 1 — Relative frequency of fire in rooms within dwellings^a

Room	Proportion of all domestic fires
Kitchen	46 %
Bedroom, bedsitting room	15 %
Living room, dining room	14 %
Access area	5 %
Ashpit, refuse area	4 %
Store	2 %
Bathroom, cloakroom, WC	2 %
Roof space	1 %
Laundry	1 %
Airing cupboard, drying cupboard	1 %
Miscellaneous and unknown	9 %

^a Based on *Fire Statistics United Kingdom* [2], published by the Home Office.

5 Design considerations

5.1 Battery-operated smoke alarms

The simplest form of fire detection and alarm system is a single battery-operated smoke alarm. The protection afforded by these devices is obtained at very low cost and they are relatively simple to install in existing dwellings.

Battery-operated smoke alarms conforming to BS 5446-1 give an audible fault warning before an increase in the internal resistance, or a decrease in the terminal voltage, of the battery prevents correct operation. Provided that the battery is always replaced when necessary, battery-operated smoke alarms can provide a degree of protection at minimal cost. However, the audible fault warning can be disabled by removal of the battery, and failure to then replace the battery results in loss of protection. The socio-economic groups most at risk from fire are those least likely to be able to ensure that a healthy battery is always present. Batteries can also be removed for use in other appliances or to prevent false alarms. The ability of battery-operated smoke alarms to detect a fire some years after initial installation is therefore not considered to be high.

5.2 Mains-powered smoke alarms

Mains-powered smoke alarms are potentially more reliable than battery-operated devices because they require less attention by the user. The cost of the fire detection and alarm system is, however, higher, owing to the need to install a mains power supply to the smoke alarms, and to the higher cost of the smoke alarms themselves. This additional cost and complexity is, nevertheless, justified in the case of fire detection and alarm systems in new dwellings. It is also justified in the case of systems installed in existing dwellings occupied by persons who may not be able to replace batteries soon after the audible fault warning of a battery-operated smoke alarm sounds (e.g. elderly or socially deprived occupants).

Mains-powered smoke alarms suffer from the disadvantage that there is no protection when the electrical supply to the circuit supplying the detectors is interrupted. This interruption can occur for any of the following reasons.

a) The electricity supply to the dwelling may be interrupted due to a fault in the public electricity supply. In this case, the fault is unlikely to exist for more than a few hours and, in most areas of the United Kingdom, faults of this type occur infrequently. The proportion of time for which mains-operated detectors are disabled by supply faults is likely to be almost negligible.

b) The electricity supply to the dwelling may be disconnected deliberately by the public electricity supplier in order to carry out essential maintenance or other work. This would normally occur only after occupiers have been notified. Disablement for this reason is infrequent, usually of relatively short duration and normally occurs during the day, when the fire risk to occupants is lower.

c) The electricity supply to the dwelling may be disconnected deliberately by the public electricity supplier for contractual reasons (e.g. failure by the occupier to pay for supplies). Disablement of this type is largely, but not solely, associated with social deprivation.

d) The electricity supply within the dwelling may be disconnected at a coin- or card-operated meter because of the inability of the occupier to pay for further supplies. This is usually associated with social deprivation.

e) The circuit supplying the smoke alarm(s) may be interrupted due to a fault or to the unwanted tripping of a protective device (e.g. a miniature circuit breaker or residual current device), or by deliberate action on the part of the occupier (e.g. due to a previous false alarm).

In order to ensure reliability and provide a suitable means for deliberate disconnection in the event of a fault that results in a prolonged false alarm indication, smoke alarms operated only from a mains supply should be supplied from a dedicated circuit at the dwelling's main distribution board (see 13.6).

A further disadvantage of smoke alarms operated solely from a mains supply is that, if a fault occurs on the circuit supplying the detectors, a warning is not always given. The smoke alarm(s) could, therefore, unknown to the occupants, remain disconnected for a considerable time. Although this could be overcome by connecting the smoke alarm to a circuit supplying, for example, regularly used lighting, the benefits would be outweighed in many cases by the risk of failure of a lighting circuit due to fire damage, before fire has been detected and adequate warning has been given to occupants.

Fire detection and alarm systems comprising smoke alarms operated solely from a mains supply should preferably incorporate a dedicated visual and/or audible means of indicating mains failure (see 13.6).

In many typical single-family dwellings in which occupants are not considered to be at high risk from fire, the reliability of mains-operated smoke alarms may be sufficient to provide an adequate degree of protection. However, consideration should be given to the relative frequency of mains supply failures or disconnections and the likelihood that, during such periods, occupants will use methods of lighting, heating and cooking that will increase the fire risk.

5.3 Mains-powered smoke alarms with standby supplies

The reliability of systems comprising mains-powered smoke alarms can be improved by the use of devices that incorporate, within each smoke alarm, a standby supply (e.g. a primary or secondary battery or a capacitor), which powers the smoke alarm when the mains supply is unavailable. The installation of mains-powered smoke alarms with standby supplies should be considered if the reliability of the mains supply is not high, or if the fire risk is likely to be high during periods of failure or disconnection of the mains supply to the dwelling.

Because of its capability to operate in the event of mains failure, a fire detection and alarm system comprising mains-powered smoke alarms that incorporate a standby supply may be connected to a lighting circuit (see 13.5). This has the advantage that the circuit is unlikely to be disconnected for a prolonged period of time. However, consideration should be given to the difficulty of disabling a smoke alarm that is permanently in the alarm state due to a fault, without isolating lighting.

5.4 Fire detectors supplied with power from a common power supply unit

More effective control and monitoring of a fire detection and alarm system can be provided by connecting all fire detectors to a common power supply, comprising the normal mains, rectified and regulated as appropriate, with a standby supply, such as a secondary battery. Examples of such systems include:

- a) one or more smoke alarms operating at extra-low voltage and connected to a control unit at an appropriate location in the dwelling;
- b) intruder alarm systems or social alarm systems that incorporate control and indicating equipment to which one or more fire detectors are connected; the detectors can be smoke alarms or fire detectors with independent sounders.

This type of system normally incorporates a secondary battery of a type unsuitable for use in normal domestic appliances and therefore unlikely to be removed for other purposes.

5.5 Systems of a type described in BS 5839-1

A higher standard of control, monitoring and system availability can be achieved by installing a system of the type recommended in BS 5839-1. Such systems comprise dedicated fire alarm control and indicating equipment, fire detectors and fire alarm sounders. Where wiring is used to connect the fire detectors and fire alarm sounders to the control and indicating equipment, the wiring is monitored so that a fault indication is given at the control and indicating equipment in the event of specified faults in the wiring. The cost and complexity of these systems is significantly greater than that of the systems described in 5.1 to 5.4. Systems of the type recommended in BS 5839-1 may nevertheless be appropriate where the risk is high and a commensurately high level of reliability is required. However, adequate protection of a dwelling may be possible without following all the recommendations of BS 5839-1.

5.6 System planning

Regardless of the nature and configuration of the system adopted, the probability of escape by occupants in the event of fire will only be sufficiently high if there is an adequate number of detectors and if the sound level of the audible warning to occupants is sufficient to arouse them from sleep. Recommendations for the siting of fire detectors are given in clause 10. Recommendations on the sound pressure level of audible warnings are given in clause 12. In some dwellings, it may not be possible to achieve the standard of audibility recommended in clause 12 unless more than one sounder operates when fire is detected. For example, in dwellings of two or more storeys, or in large single-storey dwellings, the audibility of the alarm given by any one of the two or more smoke alarms that might be required to ensure adequate protection may not be sufficient to alert all occupants, particularly if they are asleep. The smoke alarm in the area of fire origin is, in these cases, unlikely to produce an adequate sound level throughout the house. If two or more smoke alarms are installed, they should normally be interconnected, whether by wiring or radio, to ensure that, when any one device detects fire, all smoke alarms in the dwelling give a fire alarm warning. In new dwellings, all smoke alarms in the dwelling should be interconnected in this manner. In order to comply with the recommendations of clause 12, the number of smoke alarms required can exceed that necessary to comply with clause 10. If systems incorporating dedicated alarm sounders are installed, careful consideration should be given to the siting of sounders to ensure compliance with the recommendations of clause 12.

5.7 Silencing and disablement facilities

5.7.1 Reliability of the system can be affected if the rate of false alarms is high: occupants may disable the system to silence the alarm or avoid further false alarms. The method of disablement could be such as to result in prolonged disablement, long beyond the time necessary to silence or temporarily prevent false alarms. In order to avoid the use of undesirable methods of disablement, all fire detection and alarm systems within the scope of this part of BS 5839 should be provided with suitable and readily accessible means by which the user can silence fire alarm signals without the use of a tool.

NOTE 1 A fuse does not constitute a suitable means of silencing, since its removal and replacement involve a degree of skill.

NOTE 2 Suitable and readily accessible means of silencing do not include any means involving disconnection of a battery, except in the case of mains-operated smoke alarms with a standby battery that can be removed without the use of a tool. Even in the case of such smoke alarms, the need to remove a battery in order to silence the alarm could be undesirable if occupants are elderly or disabled.

NOTE 3 A "hush" facility, which greatly reduces the sensitivity of a smoke alarm for a temporary period, is regarded as a suitable means of silencing the alarm in compliance with the recommendations of this clause.

In the case of systems incorporating control and indicating equipment, dedicated facilities may also be provided for disabling the system, for use during periods when false alarms are known to occur (e.g. during certain cooking activities).

Except in the case of systems incorporating control and indicating equipment conforming to BS 5839-4, the method of silencing may be the same as the method of disablement. In the case of smoke alarms, the silencing control may be combined with the test control.

5.7.2 If a fire detection and alarm system within the scope of this part of BS 5839 is silenced or disabled, by means of dedicated silencing or disablement facilities specifically provided to comply with the recommendations of **5.7.1**, one of the following conditions should be met.

- a) The system should be restored automatically to the normal condition not more than 30 min after the action of silencing or disablement.
- b) An audible warning should sound for a minimum of 0.008 s at least every 10 min.
- c) In systems with control and indicating equipment, a visual and audible warning should be given at the control and indicating equipment. The audible warning should sound for a minimum of 0.5 s at least every 10 min.

NOTE 1 A miniature circuit breaker on a circuit supplying smoke alarms, but supplying no other electrical equipment except a dedicated mains failure monitor, conforms to the recommendation for a suitable and readily accessible means of silencing, but is not considered to be a dedicated silencing or disablement facility. The recommendations of **5.7.2** do not therefore apply to miniature circuit breakers.

NOTE 2 In the case of smoke alarms connected to a lighting circuit, the option described in **5.7.2b)** may be preferable so that continual false alarms due to a permanent detector fault can be prevented without isolating the lighting circuit.

5.8 Monitoring

In many simpler systems which incorporate interconnecting wiring for the supply of power to detectors, or for the interconnection of smoke 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 should be used.

5.9 Test facilities

Even if the wiring of a system is monitored, regular routine testing is important and should be considered at the design stage. It may be desirable to include a means of manually testing any wiring circuits, and such a means should always be provided if wiring or other interconnections are unmonitored. The test facility may be used to test detector operation as well as to confirm the integrity of any external circuit connected to the detector. In systems incorporating manual call points, a manual call point may be used for manually testing detector and/or call point circuits, but the location of the call point on the associated circuit should be such that operation of the call point is an effective test of all wiring of the circuit.