

# A guide to BS5839

## **BS5839: Part 1: 1988 TESTING AND MAINTENANCE**

### **DAILY INSPECTION**

Check that the Charger On indicator shows. Inspect for any fault indicator showing or sounder operating. Inform the designated responsible person of any fault.

### **WEEKLY TEST**

Ensure that all indicators show by resetting according to the instructions provided with the panel and check that the internal sounder operates. Operate a call point or detector to test the system. Check that the sounders operate. Reset the fire alarm panel. Each week choose a different zone in rotation, so that way all call points are tested in rotation. Check all call points and detectors and ensure that none are obstructed in any way. Enter results of tests into log book.

### **QUARTERLY TEST**

Check all previous log book entries and clarify that any remedial action has been taken. Check the battery and its connections. Operate a call point or detector in each zone to test the fire alarm as per above. Remove mains supply and check that the battery is capable of supplying the alarm sounders.

### **ANNUAL TEST**

As per above. Additionally test all detectors and call points and check for operation.

### **EVERY 2 - 3 YEARS**

Clean smoke detectors to ensure correct operation and freedom from false alarms. Special equipment is required for cleaning smoke detectors.

### **EVERY 4 YEARS**

Replace sealed lead acid batteries. If the operating temperature exceeds 25oC continuously, then the battery may need to be replaced sooner.

## **System Overview**

Most commercial and industrial premises are nowadays required to have a fire alarm system installed to BS 5839. The system is better described as a fire detection & alarm system, as it's primary function is firstly to detect a fire or fire condition, and secondly to sound audible alarms in all of part of the building.

At its simplest, the system may be operated purely by Break Glass Units (called a manual system). At it's most complex, the system may have very many different types of smoke, heat other types of detectors spread throughout the building and possibly linked with other buildings.

Is essential that the fire alarms are correctly designed, specified and installed.

The system may primarily be designed to protect life (although the premises are may protected) hence reliable, long term operation is essential.

The design and installation details of the fire alarm should always be agreed with all relevant parties including the Local Fire Office (Fire Brigade), the local District Surveyor (Council), Insurers, site Fire Officers, as well as architects, and structural engineers. All may impose specific requirements relevant to their field.

The over-riding standard for the design of the system is BS 5839. This is a comprehensive document and is nearly always cited as the required standard. It includes requirements such as for the detection cabling to be fire proof (hence the common use of MICC in fire alarm systems), battery backup to be provided and a wealth of other design features.

It is common for the fire alarm system in a building to be classified in accordance with classifications noted in BS 5839.

These are:-

Systems for protecting life.

**Type M** - Manual System - A system that relies upon manual Break Glass Units (BGU) being operated by building occupants. If a BGU is smashed then the alarms sound. This system depends upon the presence of people.

**Type L1** - Life 1 - A system with automatic detectors installed throughout the building, including escape routes, stairs, every room, store and void. In addition, BGUs are installed on all exits and between zones. This system will operate even when people are not present.

**Type L2** - Life 2 - A system with automatic detectors installed along all escape routes as well as in high risk areas, such as plant rooms, storage facilities or any other area where a fire would cause a high risk to life. In addition, BGUs are installed on all exits and between zones. This system will operate even when people are not present.

**Type L3** - Life 3 - A system with automatic detection installed only along escape routes and in areas where free passage is essential to protect life. BGUs are also installed at exits and between zones. Systems for protection property.

**Type P1** - Property 1 - A system with automatic detectors installed throughout the building, including escape routes, stairs, every room, store and void. In addition, BGUs are installed on all exits and between zones. This system will operate even when people are not present. In most cases a P1 system can be taken as having the same cover as an L1 system.

**Type P2** - Property 2 - A system with automatic detectors installed only in high risk areas, such as plant rooms, storage facilities or any other area where there is a high risk of fire. In addition, BGUs are installed on all exits and between zones. Note that an P2 system does not necessarily cover escape routes and may not provide adequate life protection.

The type of system used will depend upon the building however the following arrangements are common. Note that the actual requirements MUST BE VERIFIED these are a guide only. BS5839 Classification Type of System Type of premises

#### **M**

Small office building with clear escape routes and occupants who know the building

#### **L1**

A residential care home or hotel. Or building with specific access/structural risks.

#### **L2**

A large complex office building where many people work. An older style building with many corridors and small rooms.

#### **L3**

A medium sized office building, retail premises or factory. Where large numbers of people are present, but escape is relatively easy.

#### **P1**

A large complex office building where a high

risk exists throughout or where a small fire could easily spread and cause extensive damage.,

#### **P2**

A listed building or older style premises where fire damage could be expensive.

System audibility is required to be 65db or 10db above background noise. Special requirements existing for buildings housing people who are sleeping such as hotels and care homes etc. The requirements for audibility are not linked with or dependent on, the type of system installed. All areas must have sufficient audibility.

### Systems Available and Applications

#### **Break Glass Units (BGU).**

A small devices (approx 100x100mm) usually mounted adjacent to fire exits and where an escape route leaves a zone. Smashing the glass will cause a circuit to be either made or broken.

#### **Automatic detectors.**

These devices all constantly monitor the surroundings and in the event of a fire condition will cause a circuit to be either made or broken.

#### **Smoke Detectors.**

May be either optical or ionisation type. These devices detect the actual presence of smoke in the surroundings. Strict rules exist regarding the location and siting of these devices. Very sensitive devices "Very Early Smoke Detection & Alarm (VESDA)" exist and are used in very high risk areas.

**Heat Detectors.** May be either fixed temperature or rate of rise devices. The devices monitor the temperature of the ambient air. If the temp rises above a fixed temp or rise too quickly, then an alarm is initiated.

**Flame Detectors** These devices monitor room or areas surfaces and initiate an alarm if a flame is detected

**Beam Sensors** These devices rely on a infra-red beam being transmitted across a room or space at high level. A sensor picks up the beam and if the beam has been obstructed or reduced in strength (by smoke) then an alarm is initiated.

**Sounders** These devices produce a high volume sound and are located throughout the building. In the event of fire, all the sounders will be energised (unless the fire offices states otherwise) and they will continue until silenced at the panel.

Several types of sounder exist. The most common type used to be the familiar bell but nowadays, electronic sounders are more common due to the range of types, sizes and tones available. Specific guidelines are included in BS 5839 regarding the type of sound and required audibility.

**Fire Alarm Panel** The fire alarm panel is the heart of the fire alarm system. It monitors the detection wiring and devices for faults and operation. If an alarm condition is identified then the panel activates the sounders as well as any other controlled equipment such as remote communicators. The panel is fitted with various indicators and internal buzzers. The zone in which the alarm originates is shown, also with addressable systems, the actual device number and location may be given.

The fire alarm panel may contain standby batteries (else they are located remotely). The panel may operate on an addressable or conventional basis.

The fire alarm panel must always be situated in a position where the Fire Brigade can easily see and find it (normally by a front entrance). It is hence best to obtain their agreement prior to installation. Special arrangements may exist in large complex sites with secondary or "repeater" panels being common in areas such as security desks, second entrances and fire control points.

**Zoning.** All but the smallest building will require segregation as far as the fire alarm system is concerned. The primary purpose of zoning is to aid the identification and to speedily locate a fire. In essence, the building should be split up into small areas (zones) in which operation of any devices in the zone will cause a zone indication at the panel. Zone divisions are dependent upon many factors, all detailed in BS 5839. However, it is common for zone divisions to be closely related to the building fire compartmentation. A zone should not exceed 2000m<sup>2</sup>

**Technology.** Many, many different forms of technology exist in fire alarm systems, and all manufacturers use their own methods of monitoring and alarm. However, most systems fall into one of two categories:-

**Conventional systems.** These systems rely on fairly old technology, with a series of radial cables running from the main alarm panel to the devices on each zone. If a

device operates then the panel only indicates the appropriate zone. The actual device which operates is not indicated. Such systems are still commonly used for small buildings, or where cheap simple operation is required

**Addressable Systems** These systems rely on modern multiplexing technology to individually address each device in the system. When a device operates, the panel indicates both the appropriate zone and the actual device number or even room location. This considerably helps fire location and helps fire crews to get to the point of fire origin very quickly. Such systems are wired on by means of one or more loops with only the loop ends being connected at the panel. Obvious cable savings can be made using an addressable system.

**Radio Addressable Systems.** As above but wireless with many obvious benefits including substantial cost savings on some designs with rapid installation time.

**Remote communication** In buildings which may be unoccupied or which may be occupied but unsupervised at night, it is often the requirement of the local fire office to provide a form of remote communication, such as a signal to a central monitoring station or an autodialler which dials a telephone number and repeats a recorded message. Such systems can greatly reduce the time in which the Fire Brigade attends.

**Wiring.** BS 5839 is slightly "woolly" in regards to the type of wiring that is required. It is clear that all sounder cabling (and any other wiring that must function after a fire has been detected) must be fireproof. However, the detection cabling can be treated differently. It is considered that detection wiring is only needed to detect the fire (i.e.: until the alarms sound) from then on, strictly speaking, the cabling is not needed.

In reality however, it is generally accepted that fire resisting cabling is to be used throughout the system for both detection and alarm cabling. MICC cable is considered by some to be the best form of cabling for fire alarm applications, although other more flexible alternatives are nowadays available.

#### **Levels of Protection**

BS 5839 : Part 6 defines five different 'Levels of Protection'. The level of protection will determine the rooms and areas in which

smoke alarms must be installed. Levels beginning with the letters LD indicate that the objective is to protect the occupants. Levels beginning with the letters PD indicate that the objective is property protection. Since smoke alarms will normally be used only to protect occupants, only the three LD levels are considered in this Guide\*\*. These are defined as follows:

LD1 : Detectors installed in all circulation spaces (e.g. hallways and staircases) and in all rooms and areas in which fire might start, other than toilets, bathrooms and shower rooms.

Thus, if a specification calls for a type LD1 system, smoke alarms should be installed in all rooms and areas of the house, except those, such as kitchens, that are unsuitable for smoke alarms; heat detectors should be installed in these rooms.

LD2 : Detectors installed in all circulation spaces that form Although BS 5839 : Part 6 recommends type LD3 protection as the minimum standard of protection for those single-family dwellings in which smoke alarms are suitable, it should be stressed that the Standard recommends the installation of additional smoke alarms (so providing LD2, or in some cases even LD1, protection) if:

The risk to occupants is higher than in a 'typical' dwelling. Possible examples could be the need for smoke alarms to be installed in living rooms and dining rooms if the occupiers smoke, or in bedrooms if they smoke in bed. It might also be appropriate to install smoke alarms in rooms, particularly bedrooms, in which portable heaters or solid-fuel fires are used during the night, or in which electric blankets are used, particularly by high-risk groups such as the elderly. Houses in which the principal occupant is elderly or in which there are several elderly occupants or young children may warrant additional smoke alarms. If occupants' mobility is impaired, additional smoke alarms may also provide greater time for them to escape in the event of fire.

The means of escape from the dwelling suffers from some shortcoming. A particular example would be a lounge, dining room or bedroom with no suitable window for escape, located off another room e.g. a bedroom off a lounge. A fire in the lounge could trap people in the bedroom, and a

smoke alarm should be provided in the lounge to give early warning of fire.

Where any doubt exists as to the need for, or appropriate locations of, additional smoke alarms, the advice of the fire brigade or other fire safety specialists should be sought. Advice can also be provided by the TTS Fire & Security Ltd.

### **Locating and Siting Smoke Alarms**

Smoke alarms should be sited in accordance with the following guidance to ensure both adequate detection and alarm sounder audibility:

- At least one smoke alarm should be located between the sleeping areas and the most likely sources of fire (living room and kitchen).
- In a single storey dwelling, one smoke alarm may be sufficient, in which case it should be sited as close as possible to the living accommodation. If there are rooms (other than toilets, bathrooms or shower rooms) on either side of a bedroom, a smoke alarm should be sited in the hallway, mid-way between these rooms.
- In a two storey house, at least one smoke alarm should be located on each storey.
- In a conventional two storey house, one smoke alarm should be sited on the ground floor between the staircase and any room in which fire might start. A further smoke alarm should be sited on the upstairs landing.
- Additional smoke alarms should be provided in long hallways of all dwellings. Within such circulation areas, no door to any room should be further than 7.5 m from the nearest smoke detector.
- In open-plan accommodation, where a stair may be open to a living/dining area, the living/dining area should be treated as a circulation area.
- Under flat ceilings, the distance from any point in the room or area that is to be protected to the nearest smoke alarm should never be more than 7.5 m. (or 5.3 m in the case of a heat detector).
- Smoke alarms should preferably be mounted on ceilings, unless the ceiling temperature is likely to be significantly greater than the general air temperature. If ceiling mounting is not possible, wall mounting may be considered in small rooms or short hallways. However, smoke alarms should not be mounted on poorly insulated external walls.

- If smoke alarms are mounted on walls in small rooms or short hallways, they should be mounted so that:  
the smoke entry grille is between 150 mm and 300 mm below the ceiling; and  
the smoke entry grille is above the top of any doorway.
- Smoke alarms should not be mounted adjacent to, or directly above, heaters or air-conditioning vents.
- Smoke alarms should be sited in positions that are reasonably accessible, particularly in the case of models containing batteries, so that the False Alarm Control ('hush button') can be operated and that the smoke alarm may be de-mounted to change batteries.
- Smoke alarms should not be located closer than 300 mm to walls or light fittings.
- In order that the smoke alarms will wake people from sleep, there is a need to ensure that there is a smoke alarm within 3 m of each bedroom door.

**NOTE:**

The above guidance will ensure only protection of circulation spaces (a type LD3 system). Such protection cannot be depended upon to save the life of anyone in the room in which fire starts. In many circumstances, the risk of fire may justify a type LD2 or LD1 system. This will necessitate detectors (whether heat or smoke) in some rooms of the dwelling. In houses of multiple occupancy a manual call point should be installed by exit doors and on each floor level.

**False Alarms**

Occasional false alarms from smoke alarms are inevitable, but installers should site smoke alarms in such a way as to avoid unnecessary false alarms. However, avoidance of false alarms should never take precedence over effective fire detection.

Guidance on selection of the most suitable type of smoke alarm in order to provide optimum fire detection while avoiding unnecessary false alarms. Note that the smoke alarm nearest to any kitchen should be of the optical type. This will normally be the case, because all smoke alarms in circulation spaces should normally be of the optical type. However, optical smoke alarms should not be sited close to bathrooms, showers or rooms from which steam may escape. Nevertheless, because these rooms normally open off circulation spaces, false alarms should normally be

avoided by careful siting of the smoke alarms, rather than using ionisation chamber detectors.

**Alarm Sound Levels**

It is essential that, whenever any of the smoke alarms in the dwelling detects a fire, the sound level of the alarm (from either that smoke alarm or other smoke alarms interconnected with it) is sufficient to wake up at least the adult members of the household. The sound level in any bedroom is likely to be satisfactory if there is a smoke alarm in the bedroom, interconnected to all other smoke alarms in the dwelling. However, if this is not the case, the nearest interconnected smoke alarm to the bedroom, capable of sounding an alarm whenever fire is detected anywhere in the dwelling, should not be further than 3 m from the bedroom door.

In some dwellings, such as flats, maisonettes and houses in multiple occupation, doors to rooms may be fire doors, which tend to attenuate the sound from smoke alarms more than normal, domestic doors. In these cases, great care should be taken to ensure that the sound level in bedrooms is sufficient. In some houses in multiple occupation, the local authority may demand that the sound level at the bedheads in some or all bedrooms is 75dB(A) when the bedroom doors are closed. This should be determined before finalising the number of smoke alarms required, because 75dB(A) is unlikely to be produced at the bedhead unless there is a smoke alarm within the bedroom.

If occupants suffer from severe hearing impairment, BS 5839 : Part 6 recommends that special alarm devices, such as high intensity beacons and vibrating pillow or mattress pads, be provided.

**User Instructions**

Occupiers should be provided with suitable instructions on the smoke alarms installed. BS 5839 : Part 6 sets out the information that should be contained in these instructions.

**Certification**

Once the installation has been completed and instructions have been handed over to the occupier (or the owner in the case of a house in multiple occupation), a certificate of compliance with BS 5839 : Part 6 should

be issued. It should be noted that, because BS 5839 : Part 6 is only a code of practice, as opposed to a rigid set of regulations, it may have been appropriate to deviate from its recommendations, subject to the agreement of the purchaser and any relevant enforcing authority (normally building control in the case of new dwellings or the environmental health officer in the case of houses in multiple occupation). The certificate should specify the type and grade of system, and should indicate any deviations from the recommendations of the British Standard in respect of this type and grade of system.

A model installation certification is contained in BS 5839 : Part 6.

The IEE Wiring Regulations further require the issue of a certificate for the entire electrical installation in the case of a new house.

### **Legislation & Guidelines**

The design and installation of a fire alarm system is governed by a range of regulations and legislation. However, in many situations, legislation on covers the objective of the system i.e.: to adequately protect.

The sure way ensure compliance is to discuss fully with the relevant authorities and to above all ensure full compliance with BS5839.

### **British Standards.**

Also refer to The British Standards Institution

BS 5446:Part 1:1990 "Components of automatic fire alarm systems for residential premises". Specification for self-contained smoke alarms and point-type smoke detectors

BS 4422:Part 3:1990 "Glossary of terms associated with fire. Fire detection and alarm" Terms used to describe the operation of fire alarms systems and specific types of fire detectors.

BS 7671:1992 "Requirements for electrical installations". IEE Wiring Regulations. Sixteenth edition. This is the all encompassing "Bible" in relation to the design, installation and use of electrical installations and equipment in buildings. It is relevant here due to the need to segregate LV cabling (which fire alarm cables normally are), also for the installation of associated controls and equipment.

BS 7807:1995 "Code of practice for design, installation and servicing of integrated systems incorporating fire detection and alarm systems and/or other security systems for buildings other than dwellings" Provides recommendations for the integration of a security system with other security systems for use in and around buildings.

BS 5839:Part 1:1988 "Fire detection and alarm systems for buildings. Code of practice for system design, installation and servicing" Covers all systems, from simple manual installations with several manual call points to complex automatic installations with manual call points, detectors, connection to the fire service and initiation of ancillary services.

BS 5839:Part 2:1983 "Fire detection and alarm systems for buildings. Specification for manual call points" Gives requirements and methods of testing

BS 5839:Part 3:1988 "Fire detection and alarm systems for buildings. Specification for automatic release mechanisms for certain fire protection equipment." Constructional and performance requirements for mechanisms intended to hold open (or closed) fire protection equipment such as fire doors, dampers etc., releasing on manual operation or receipt of a fire signal.

BS 5839:Part 4:1988 "Fire detection and alarm systems for buildings. Specification for control and indicating equipment" Requirements and tests for the equipment, including any associated power supply unit. Does not cover indicating equipment installed at remote manned centres.

BS 5839:Part 5:1988 "Fire detection and alarm systems for buildings". Specification for optical beam smoke detectors Requirements, methods of test and performance criteria for detectors with ranges between 1 m and 100 m.

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

BS 5839-8:1998 "Fire detection and alarm systems for buildings. Code of practice for the design, installation and servicing of voice alarm systems". Provides recommendations for the planning, design, installation and servicing of voice alarm systems in and around buildings

BS 6387:1994 "Specification for performance requirements for cables required to maintain circuit integrity under fire conditions" Applicable to cables rated at voltages not exceeding 450/750 V and for mineral-insulated cables complying with BS 6207.

#### **Combined Standards**

BS EN 54-1:1996 Fire detection and fire alarm systems.

BS EN 50130-4:1996 Alarm systems. Electromagnetic compatibility. Product family standard: Immunity requirements for components of fire, intruder and social alarm systems

#### **International Standards**

See also IEC search page

IEC 60331 (1970-01) "Fire resisting characteristics of electric cables Performance requirements, sample and test conditions, source of heat and test procedure". Has the status of a group safety publication in accordance with IEC Guide 104.

IEC 60332-2 (1989-03) "Tests on electric cables under fire conditions. Part 2: Test on a single small vertical insulated copper wire or cable" Specifies a method of testing a small insulated wire under fire conditions when the method specified in IEC 332-1 is not suitable because some small conductors may melt during the application of the flame. Has the status of a group safety publication in accordance with IEC Guide 104.

#### **Legislation**

Refer also to the Her Majesty's Stationary Office (HMSO) Government Web Site for further items of legislation and literature.

Health & Safety at Work Act 1974 - Massive item of legislation which encompasses all aspects of Health & Safety in the workplace. This has been constantly added to over the years. It now comprises and references a whole series of separate regulations and codes of practice documents.

Fire Precautions (workplace) Regulations 1997

Fire Precautions Act 1972. Comprehensive act covering all aspects of building construction means to avoid fire. Includes specific requirements for the application of fire alarm systems.

Factories Act 1962. Act covering working practices, conditions and environmental

requirements for the welfare of persons working in industrial environments. Offices, Shops & Railway Premises Act 1963. This act includes the legal requirement for premises operators to ensure fire precautions.

Electricity Act 1989 - In the words of the official HMSO title. "An Act to provide for the appointment and functions of a Director General of Electricity Supply and of consumers' committees for the electricity supply industry; to make new provision with respect to the supply of electricity through electric lines and the generation and transmission of electricity for such supply; to abolish the Electricity Consumers' Council and the Consultative Councils established under the Electricity Act 1947; to provide for the vesting of the property, rights and liabilities of the Electricity Boards and the Electricity Council in companies nominated by the Secretary of State and the subsequent dissolution of those Boards and that Council; to provide for the giving of financial assistance in connection with the storage and reprocessing of nuclear fuel, the treatment, storage and disposal of radioactive waste and the decommissioning of nuclear installations; to amend the Rights of Entry (Gas and Electricity Boards) Act 1954 and the Local Government (Scotland) Act 1973; and for connected purposes." Electricity at Work Regulations 1989 - Regulations covering the whole aspect of ensuring that the workplace is safe in regards to the use of electrical equipment. (a part of the H&S at Work act) Construction (design & management) regulations 1994 - Another wide reaching set of regulations which cover the whole process of construction safety. It focuses on carrying out risk assessments and altering the design or management process to account for such risks. Again this forms part of the H&S at work act 1974.

#### **BS 5839 Part 6**

##### **Introduction**

The purpose of this simple guide is to assist specifiers and installers in complying with the recommendations of BS 5839 : Part 6 when installing smoke alarms in dwellings and while every reasonable endeavor has been made to ensure the accuracy of the information, it is the responsibility of the reader to ensure that

they satisfy the recommendations of the British Standard in any particular case. No liability is accepted for the consequences of any errors or omissions in this guide. The guide is not intended to be a substitute for the British Standard, the contents of which should be carefully studied by contractors installing smoke alarms in dwellings. There are a lot of similarities between the latter part 6 of BS 5839 1995 and the earlier BS 5839 Part 1 for commercial properties but in essence part 1 demands a fully monitored centrally controlled system with alert devices throughout the premises achieving at least 65 Db(A) with the following levels most commonly implicated but there are others.

### Scope

BS 5839 pt6 covers all residential dwellings, both new and old. This part applies to bungalows, multi storey houses, individual flats and maisonettes, mobile homes, sheltered houses, NHS housing in the community for mentally handicapped or mentally ill people, mansions and houses divided into several self contained 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. Compliance with the standard does not of itself confer immunity from legal obligations.

### The Products

The British Standard recommends that all smoke alarms should conform to BS 5446 : Part 1. It also recommends that they should have been type tested, and preferably have been approved under a recognised approval scheme. All TTS smoke alarms fully meet the requirements of BS 5446 : Part 1 and have BSI kitemark and CE approval. This facilitates incorporation of a domestic heat detector, which can be used to trigger a nearby smoke alarm to which it is wired. Heat detectors are very much slower in their response to fire than smoke detectors. They should only be used as supplementary protection to smoke alarms, in rooms, such as kitchens, where constant false alarms would occur if smoke alarms were installed (or, less commonly, in rooms in which a fire would not cause an early threat to escape routes). In particular, heat

detectors should never be installed in circulation spaces that form escape routes from the house; smoke alarms must be used in these areas.

### Applications

It should first be ensured that standard smoke alarms are a suitable form of fire detection. Smoke alarms are suitable for most flats, maisonettes and single or two storey houses (including houses in multiple occupation) unless they are:

- (i) very large (more than 200 m<sup>2</sup> on any floor);
- or (ii) unusually high (with the upper floor more than 4.5m above ground level).

Larger properties need a form of fire detection and alarm system with a central control panel. The system then becomes BS 5839 Part 1 design. However, in a house in multiple occupation, regardless of size, smoke alarms may be used to give warning to occupants of a fire in their own accommodation, while communal escape routes are protected by a full fire detection and alarm system.

For new dwellings, battery operated smoke alarms should not be used. These should only be used for retrofitting in existing bungalows, flats and owner occupied two storey houses in which there is adequate means of escape in the event of fire. Mains operated smoke alarms should be used for all new dwellings and for retrofitting in rented maisonettes and two storey houses. (They should also be used for single storey bungalows and flats if, for example, occupants could be trapped in a lounge, dining room or bedroom, due to a fire in another room through which it is necessary to pass in order to escape from the property; this might occur if, for example, there is a bedroom off a lounge, and there is no window in the bedroom suitable for escape.) Mains operated smoke alarms should also be used in preference to battery operated devices if the occupants are considered to be at high risk from fire or if they may not be able to replace batteries soon after a low battery fault warning is given.

Both the ionisation chamber and optical smoke alarms have a wide application range, and either type will be effective in giving a sufficiently early warning of fire in many circumstances. However, the optical smoke alarm responds better to some types of fire than the ionisation chamber



type, whereas other fires are more readily detected by the ionisation chamber smoke alarm. Avoidance of false alarms may also dictate the use of one type of smoke alarm in a particular location, rather than the other.

The most common cause of false alarms is fumes generated by cooking. Optical smoke alarms are generally less sensitive to, for example, smoldering toast than ionisation chamber smoke alarms (although the optical smoke alarm will respond if the toast catches fire). Because of this, BS 5839 : Part 6 recommends that the smoke alarm nearest to a kitchen should be of the optical type. For effective fire detection, the British Standard also recommends that optical smoke alarms should be used in the circulation areas of the house. Accordingly, to comply with the British Standard, optical smoke alarms should be used in the hallways and staircases. This should be particularly noted if compliance with the British Standard is a requirement of a building control authority.

In other locations, smoke alarm choice should depend mainly on the type of fire that may be expected. In many cases, this will be something of an unknown, and, often, either type of detector can be used. Under these circumstances, avoidance of false alarms should be taken into account.

In some dwellings, electricity supplies may be disconnected because the occupiers are unable to pay for supplies. Disconnection may be at a coin or card operated meter or may be due to deliberate disconnection by the supplier. If this is likely to occur, smoke alarms with battery back-up should be installed. In practice, in many cases, there will be insufficient information regarding the occupiers, who may, in any case change. Accordingly, TTS recommend the use of smoke alarms with battery back-up in most circumstances, as is now quite common practice.

### Connection to Mains Supply

Warning: Installation of mains powered smoke alarms should be undertaken only by a qualified electrician. Installation should be undertaken in accordance with BS 5839 : Part 6 and BS 7671 (IEE Wiring Regulations).

Mains-only smoke alarms with no battery back-up should be connected on a single independent, dedicated circuit at the dwelling's distribution board. No other

electrical equipment should be connected to this circuit. The circuit should preferably not be protected by any r.c.d., whether dedicated to the circuit or common to all circuits derived from the distribution board. If, however, r.c.d. protection is essential for electrical safety, the British Standard recommends two options:

(i) The r.c.d. should be dedicated to the smoke alarm circuit (which should then not be served by any other r.c.d.); or

(ii) The r.c.d. protection should be arranged so that the r.c.d. serving the smoke alarm circuit operates independently of any r.c.d. protection for circuits supplying socket outlets or portable equipment. (For example, this could be satisfied by a distribution board with a time delayed 100mA r.c.d. serving the entire board, and 30mA r.c.d. protection on socket outlets, etc. It would be expected that, in the event of earth leakage on a socket outlet circuit, the 30mA r.c.d. would operate without the 100mA r.c.d. necessarily operating.)

BS 5839 : Part 6 recommends that there be a method of silencing or disabling smoke alarms in the event of a prolonged false alarm, perhaps due to a fault or a build up of pollution in the detector chamber. However, to comply with BS 5839 : Part 6, there must be a means of silencing or disablement. This recommendation can be satisfied if the dedicated circuit serving the smoke alarms is protected by a miniature circuit breaker (as opposed to a fuse); the British Standard recognises a miniature circuit breaker as a suitable and readily accessible means of silencing.

Because of the back-up batteries, these smoke alarms can be connected to either:

(i) a single dedicated circuit at the distribution board.

or (ii) a separately electrically protected, regularly used local lighting circuit. However, if the smoke alarms are connected to a lighting circuit, isolation of the detector for maintenance may be less convenient due to the need to isolate the lighting circuit.

For models with battery back-up, the British Standard does not specifically recommend against r.c.d. protection of the relevant circuit. However, TTS would still advise that it be ensured that the circuit used is not subject to nuisance tripping due to r.c.d. protection.

### Interconnection of Smoke Alarms

If two or more smoke alarms are installed, they should normally be interconnected to maximise the extent of the audible warning when one detects a fire. In new dwellings, smoke alarms should always be interconnected. It is essential that interconnected smoke alarms are all supplied from a single common circuit.

### Wiring

All wiring should be installed in accordance with BS 7671 (IEE Wiring Regulations). The wiring of smoke alarms need not be fire resisting. The mains supplies, and any interconnections between smoke alarms, may be wired in any suitably rated cable designed for a.c. mains installations. However, care should be taken to ensure that the mains supply cable, and the cable used for interconnection of smoke alarms, is not exposed to damage. BS 5839 : Part 6 recommends that the cables are protected, by for example capping under plaster, conduit, or trunking, in any areas where they may be subject to impact, abrasion or rodent attack.

Where cables pass through walls, a smooth clearance hole should be provided. If additional mechanical protection is necessary, a smooth-bore sleeve should be sealed into the wall. Care should be taken to ensure that the ends of the sleeve are free from sharp edges. Cable penetrations should be filled and should maintain the fire resistance of any fire resisting walls or floors.

Joints in cables should be avoided but, where unavoidable, should be enclosed in a suitable and accessible junction box. Reliable termination methods should be adopted.

### Grades of System

BS 5839 : Part 6 defines various 'Grades' of system. These will be used by enforcing authorities and specifiers to specify the type of fire detection equipment that is to be installed. Smoke alarms can be used in Grade C\*, D, E and F systems, which are suitable for protection of most normal flats, maisonettes and houses.

Grade F systems comprise one or more battery-powered smoke alarms.

Grade E systems comprise one or more mains-powered smoke alarms.

Grade D systems comprise one or more mains-powered smoke alarms,

each with an integral standby supply, such as a battery.

The grades are intentionally defined in such a way that higher grades are always of a better standard than lower grades. So, if a specification calls for a Grade F system, this can always be satisfied by installing mains powered smoke alarms. Similarly, if a specification calls for a Grade E system, the requirement can be satisfied by installing mains-powered smoke alarms either with or without battery back-up.

Grade C systems comprise one or more smoke detectors / alarms with a central control panel, however, Grade C systems may also comprise 12V smoke detectors integrated with an intruder alarm system, subject to the integrated system complying with BS 5839: Part 6.

Grade A and B systems are not considered in this Guide. Smoke alarms cannot be used to satisfy the recommendations of the British Standard for Grade A or B systems; these systems use complete fire detection and alarm systems with separate detectors, sounders and control equipment.

This information has been compiled from a number of sources on the Internet.