

**BASIC GUIDE TO FITTING A SMOKE ALARM  
IN A DOMESTIC DWELLING**

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## Introduction

A smoke alarm can give you those precious few minutes of warning which could help you and your family to get out safely. Many deaths and injuries could be prevented if people had early warning and were able to get out in time. Buying and fitting a smoke alarm could help save your own and your family's life. This section describes what smoke alarms are, then goes on to explain how many you should fit, where you should fit them and how to look after them.

### What is a smoke alarm?

Smoke alarms, or smoke detectors as they are sometimes known, are small devices, about the size of a hand. They are fitted to the ceiling and are able to detect fires in their earliest stages and sound a loud warning alarm. This alarm can give you those precious few minutes of warning time which will help get you and your family out safely. Smoke alarms are cheap and can be easy to install. If you are installing a simple battery smoke alarm follow the manufacturer's instructions on how to fit and position the alarm. If you have difficulties, or want more information, you should get in touch with your local fire and rescue service. The local fire and rescue service may be able to make arrangements to have the alarm fitted for you if you are unable to do it for yourself. The instructions will also give you guidance on battery replacement and maintenance. If however you would like to understand the subject more fully then read on.

### Purpose for installing a fire alarm

The first consideration is to establish what the purpose for installing a fire alarm is. The most obvious is to warn you that there is a fire in the premises but more importantly to warn you when you are at the most vulnerable e.g. when you are sleeping or in another room. It also needs to warn you that your primary escape route and circulation areas are being threatened from fire. The primary escape route is the quickest route from any room to the final exit door that leads outside the premises and to ultimate safety. In dwellings on the upper floors, it would be from the room, onto the landing, down the stairs, into the hall and out of the front door. If you are on the ground floor then the escape route would be from the room, into the

hall and out of the front door. To protect this means of escape route then all doors should be kept closed especially at night to prevent smoke from a fire, smoke logging it.

If there is a fire in a room and left to its own devices it will eventually burn through the door and make the escape route impassable. Before this happens a small amount of smoke will percolate between the frame and the door, because no door is a perfect fit and there is always a small gap. If you install a fire detector in the escape route, then this small amount of smoke will actuate the sensor and set off the alarm giving you and your family time to escape before the escape route is impassable.

Any rooms or cupboards that you consider are a high fire risk and open onto the means of escape route, you may consider installing a fire detector in that room or cupboard to give a quicker warning and improve you escape from the premises. If you deem this necessary then those detectors should be linked together.

### **How should you choose a smoke alarm?**

There are many types of alarm on the market and they cost from around £5.00 upwards and can be operated by battery (Dry Cell) or mains powered, with or without a backup battery. Where you require more than one detector they should be linked together using hard wiring or wireless network. You can buy them at most DIY, hardware and electrical shops and some supermarkets.

Always look for an alarm which conforms to the British Standard this means that the alarm has achieved a standard acceptable to the British Standards Institution. (BSI) To ensure the fire alarm meets the minimum standard you should always select one that carry the well-known kite mark.

There are a number of fire alarms that use various methods of detection and it is important to select the most appropriate. The Code of practice for the design, installation and maintenance of fire detection and fire alarm systems in dwellings is BS 5839-6:2004 and a copy should be available at your local reference library.

If you are unable to obtain a copy your local Fire and Rescue Service will be happy to give you advice on which one is best suited for you.

### **The way you should select the correct fire detection system**

#### **Grades and Categories**

Six different grades of fire detection systems are defined in the British Standard BS 5839: Part 6: 2004 and generally speaking the greater the fire risk the more sophisticated the system should be. Briefly, the Grades are as follows:

##### Grade A

- A full system with control and indicating equipment installed to BS 5839: Part 1

##### Grade B

- Detectors and sounders using simpler specified equipment

#### Grade C

- Detectors and sounders or alarms with central control

#### Grade D

- Mains powered alarms with an integral stand-by power supply

#### Grade E

- Mains powered alarms with no stand-by power supply

#### Grade F

- Battery powered alarms

Three different categories of life protection systems are defined. Briefly these are starting at the highest:

#### LD1

• Alarms in all circulation spaces that form part of escape routes and all areas where a fire might start, but not bathrooms, shower rooms or toilets.

#### LD2

• Alarms in all circulation spaces that form part of escape routes and rooms or areas that present a high fire risk.

#### LD3

- Alarms in circulation spaces that form part of escape routes.

BS 5839: Part 6: 2004 emphasises that no one type of fire detector is most suitable for all applications. Consideration must be given to the most suitable type of detection - optical, ionisation and heat.

### **Examples of various Domestic properties**

#### Existing Tenanted Properties

Two and three storey - Grade D, LD3

- Mains alarms with battery back-up
- Optical alarms in circulation spaces – hallways and landings
- If a fire risk assessment shows the property or occupier to be a high fire risk, increase the number of alarms installed to meet the risk - e.g. follow recommendations for an LD2 installation
- All alarms must be interconnected
- The sound pressure level of the alarm signal measured at the doorway of each bedroom with the door open should be at least 85dB (A) This is the definitive guidance to which Architects, Building Professionals, Enforcing Authorities, Landlords and Installers should refer for recommendations on the design, installation and use of smoke and heat alarms in the majority of domestic dwellings. Landlords in both the public and private sector are considered to have a Duty of Care to fit compliant smoke and heat alarm systems.

#### Existing Tenanted Properties

Single storey - Grade F, LD3

- Battery powered with a minimum battery life of 5 years.
- Optical smoke alarm in circulation spaces – hallway.

- If a fire risk assessment identifies a concern that the occupier cannot or may not replace a battery, use mains alarms or mains with battery back-up
- If a fire risk assessment shows the property or occupier to be a high fire risk, increase the number of alarms installed to meet the risk - e.g. follow recommendations for an LD2 installation

### What do Building Regulations Demand?

Architects, builders and installers must comply with Building Regulations and install mains powered alarms in new and materially altered dwellings.

#### Grade D, LD3

- Mains alarms with battery back-up with the mains supply taken from a lighting circuit or a dedicated circuit from the distribution board
- Smoke alarms are required in the circulation spaces such as hallways and landings. In general optical alarms are recommended
- Heat alarm to be installed in the kitchen where there is no door separating the kitchen from the circulation space,
- Smoke and heat alarms must be interconnected
- Alarms may be interconnected using radio-links

#### Northern Ireland

Building Regulations (Northern Ireland) Technical Booklet E (Fire Safety) requirements were amended in June 2005 to:

#### Grade D, LD2

- Mains alarms with a battery back-up
- Smoke alarms are required in the circulation spaces, hallways and landings
- A smoke alarm is required in the 'principal habitable room' e.g. living room
- A heat alarm is required in every kitchen
- Loft conversions require all the above to be installed
- Smoke and heat alarms must be interconnected
- Alarms may be interconnected using radio-links

#### Scotland

Building Standards Technical Handbook No 2 (Fire) requirements are currently:

#### Grade D, LD3

- Mains smoke alarms with battery back-up
- Smoke alarms are required in the circulation spaces, hallways and landings
- Smoke alarms must be interconnected
- Alarms may be interconnected using radio-links

#### England & Wales

Building Regulations Approved Document B (Fire Safety) minimum requirements are currently Grade D, LD3, but it also defines that installation should be to BS 5839 Pt.6 and therefore Grade D, LD2 is recommended.

### Selecting the correct fire detection sensor

**Optical Alarms** - Optical sensors are more responsive to smouldering fires producing large particle smoke typical of fires involving furniture and bedding. They are more immune to invisible smoke produced by 'burning the toast' and similar cooking fumes. This makes them ideal for siting in hallways close to kitchens where false alarms from ionisation alarms may

be a particular problem. The BS 5839: Pt.6: 2004 Standard recommends the use of optical alarms in circulation spaces of a dwelling, such as hallways and landings. Optical alarms are prone to false alarm if exposed to steam and should not be located too close to poorly ventilated bathrooms or shower rooms.

How do they work?

1. A light beam is pulsed in the sensor chamber every 10 seconds to 'look' for smoke. Any smoke present has to be visible to the naked eye so that the receptor can 'see' it. If no smoke is detected, the alarm will remain in a standby state.
2. Using the light scattering principle when large particle smoke is detected, the light beam will be scattered onto the light receptor or using the obscuration principle when sufficient number of large particles of smoke are detected and prevent the light beam reaching the receptor.
3. This will then send an electrical signal to the IC (Integrated Circuit).
- 4 This causes the alarm to sound.

**Ionisation Alarms** - Ionisation type sensors are particularly sensitive to the almost invisible smoke produced by fast flaming fires. This makes them more liable to false alarm due to cooking fumes if sited in a hallway close to a kitchen. Ionisation alarms are less vulnerable to false alarms caused by dense tobacco smoke, excessive dust and insect ingress. The BS 5839: Pt.6: 2004 Standard recommends that ionisation alarms should not be used in hallways and landings, where there is a risk of false alarms caused by cooking fumes.

How do they work?

1. Inside the sensor chamber is a minute (safe) radioactive element that ionises the air within. This causes a small current to flow in the chamber and this will remain constant for the life of the alarm unless smoke particles enter.
2. When smoke enters the sensor chamber, the balance of the current is disturbed.
3. This is detected by the electronics in the alarm circuitry and a signal is sent to the Integrated Circuit (IC).
4. This causes the alarm to sound.

### **Insect Screen**

Smoke Alarms are sophisticated electronic devices. Protection from external contamination is vital to maintain the fire detecting sensitivity of the product and to minimise false alarms. A fine mesh insect screen reduces false alarms caused by insect contamination and fibres, whilst allowing free access of smoke to the sensor chamber.

**Heat alarms** – Heat sensors are less likely to cause false alarm problems as they are not responsive to any type of smoke or fumes, only heat. Because of the potential for a slower response than smoke alarms, they should only be used in a fire alarm system that also includes smoke alarms, and all of the alarms must be interconnected. BS 5839: Pt.6: 2004 recommends that heat alarms should be used in kitchens. It goes on to suggest that they may also have a role to play in the main living room but they should not be installed in circulation spaces or areas where fast response to fire is required.

How do they work?

1. A thermistor (a heat sensitive resistor) is sited in the sensor chamber of the alarm.
2. When the temperature raises the resistance of the thermistor reduces.
3. The IC continuously monitors the resistance of the thermistor. When this indicates the temperature is 58°C or over, the IC sends a signal to the sounder circuit.
4. The alarm then sounds.

**The Multi-Sensor** - The Multi-Sensor combines the best features of an optical alarm – quick response to slow smouldering fires and immunity to kitchen fumes, with the best features of a heat alarm – quick response to a fast flaming fire and immunity from contamination. This makes it the ideal choice for all rooms in a dwelling except a kitchen. The Multi- Sensor is less prone to contamination and effectively eliminates the problems of nuisance alarm associated with the ionisation and the optical type alarms.

How do they work?

1. A custom algorithm written into the integrated circuit monitors and interprets the signal from...
  - ❖ An ultra fast temperature sensor and...
  - ❖ A high performance optical sensor.
2. This combination allows detection of both fast flaming and slow smouldering fires.
3. This means the alarm will respond quickly to a wider range of fire types than any of the other individual sensor types.

### **Fitting your smoke alarm**

Self contained smoke alarms are simply screwed into the ceilings and should be fitted as close to the centre of the entrance hall or room as possible, but at least 30 centimetres (12 inches) away from any wall or light fitting. In escape routes there should be a detector within 1.5 metres of the entrance to all habitable rooms and any cupboards that pose a fire risk, in some situations this may require additional smoke alarms. You should always make sure that your alarm is fitted in a place where it can be heard throughout your home - particularly when you are asleep. If your home is on one level, you should fit the alarm in the hallway between the living and sleeping areas but to achieve the 1.5 metres it may mean an additional smoke detector. If your home has more than one storey, the best place to fit it, is in the hallway close to the bottom of the staircase, and a second alarm on the upstairs landing.

For extra protection you can fit alarms in any room where you think a fire may start, for example the lounge or bedroom. Do not fit a smoke alarm in the kitchen or bathroom, as the steam or cooking fumes may trigger the alarm. Cigarette smoke will not normally set off an alarm. In some cases you may be able to link more than one alarm together so if one senses smoke they will all sound an alarm. If you are fitting a battery alarm then it is simple a DIY project but if you are fitting a mains alarm then you must employ the services of a qualified electrician. If an A, B, or C grade system is required to be fitted then you should involve the services of a competent fire alarm engineer.

## **Looking after your smoke alarm**

Smoke alarms need very little maintenance. A few minutes of your time each year will ensure that your alarm is working and could help save the lives of you and your family. Regular routine testing and maintenance is very important. All smoke alarm systems should be tested at least monthly using the integral test button. Systems should also be checked if the occupier has been away or in the case of mains powered detectors, the power has failed.

Smoke alarms should be cleaned periodically in accordance with manufacturers' recommendations. Vacuum the inside of the alarm to ensure that dust isn't blocking the sensor chamber. Where experience shows that excessive levels of dust are compromising the effectiveness of the system, more frequent cleaning and servicing may be required.

Change the battery in the alarm when you hear the low level battery warning signal which could be one to ten years. Make a note of the date of the change. The life of a detector is about ten years and should be replaced after this period of time.

## **Smoke alarms for people with hearing impairment**

Many people whose hearing is not severely impaired are still able to hear a conventional smoke alarm but it maybe a good idea to link two or more alarms to improve the warning signal coverage. This way smoke detected in the living room will set off another alarm in the bedroom. An electrician will be able to advise you about linking the alarms. For people who would not be able to hear a conventional smoke alarm there are special devices available which make use of a vibrating pad or flashing light instead of the auditory signal, the vibrating pad alarms are particularly useful for deaf blind people.

Further information is available from the Royal National Institute for Deaf People. You may also find it useful to contact local voluntary organisations or the Social Services Department who may be able to offer advice and assistance on products specially designed to help people with disabilities

## **Further Information**

For further information, help and advice go to your local council or fire brigade who will be happy to advise you on fire prevention and safety.

If looking for a good electrician, ask friends and neighbours to introduce you to trustworthy people they know about. Elderly people especially should try to have someone they know with them when they have someone, they don't know, to call at their home. Your local Age Concern or Citizens Advice Bureau can give advice on what local voluntary groups there are, which can help you, and what benefits may be due to you, their addresses and telephone numbers can be obtained from your local telephone directory or public library.

## **Useful Tips**

- Never disconnect or take the batteries out of your alarm if it goes off by mistake.
- Battery operated alarms are the cheapest option, but the batteries may need to be replaced every year or when the low battery warning operates.

- A lot of people forget to check the batteries, so longer life batteries are better. An alarm with ten-year batteries is the best option.
- Mains-powered alarms are powered by your home power supply. Generally they don't need replaceable batteries, but need to be installed by a qualified electrician.
- You can have linked alarms installed, so that when one alarm detects a fire they all go off together. This is useful if you live in a large house or over several levels.
- Don't put smoke alarms in or near kitchens or bathrooms where smoke or steam can set them off by accident.
- If it is difficult for you to fit your alarm yourself contact your local Fire and Rescue Service for help.
- Make checking your smoke alarm part of your regular household routine. Test it by pressing the button until the alarm sounds. If it doesn't sound it maybe defective or you need to replace the battery.
- If your smoke alarm starts to beep on a regular basis, you need to replace the battery immediately.
- If it is a ten year alarm, you will need to replace the whole alarm every ten years.