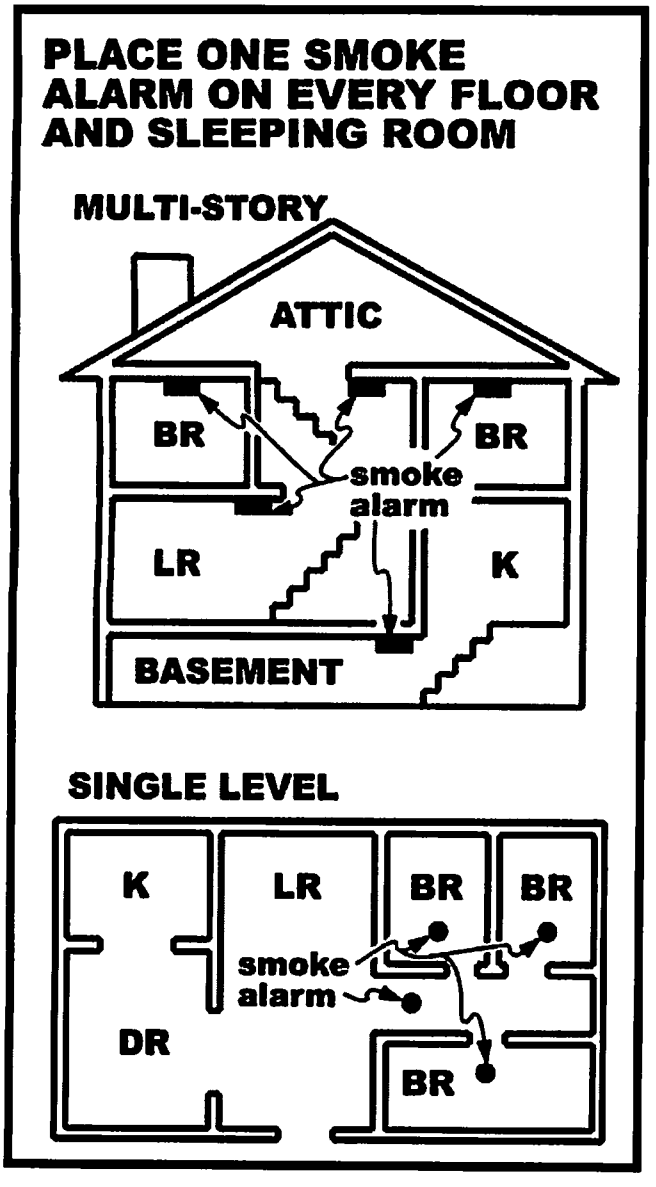
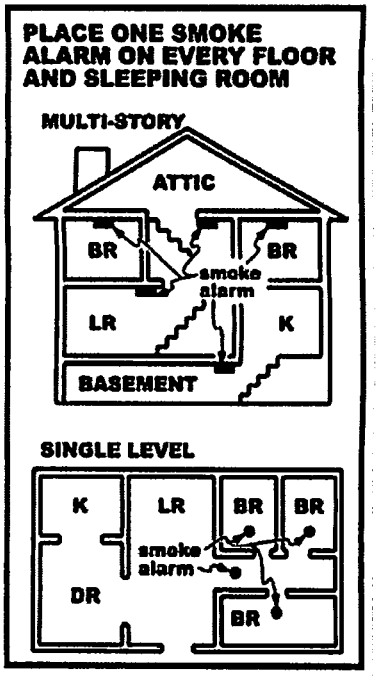

PLACE ONE SMOKE ALARM ON EVERY FLOOR AND SLEEPING ROOM
MULTI-STORY
ATTIC
BR
BR
smoke alarm
LR
K
BASEMENT
SINGLE LEVEL
K
LR
BR
BR
smoke alarm
DR
BR

In the UK the placement of detectors are similar however the installation of smoke alarms in new builds need to comply to the British Standards BS5839 pt6.

BS 5839: Pt.6: 2004 recommends that a new-build property consisting of no more than 3 floors (less than 200sqm per floor)) should be fitted with a Grade D, LD2 system Building Regulations in England,Wales & Scotland recommend that BS 5839: Pt.6 should be followed, but as a minimum a Grade D, LD3 system should be installed. Building Regulations in Northern Ireland require a Grade D, LD2 system to be installed, with smoke alarms fitted in the escape routes and the main living room and a heat alarm in the kitchen, this standard also requires all detectors to have a main supply and a battery back up.

have a working smoke detector on every level. The United States requires smoke detectors on every habitable level and within the vicinity of all bedrooms. Habitable levels include attics that are tall enough to allow access.



Place smoke detectors where they will do the most good.

In new construction, minimum requirements are typically more stringent. All smoke detectors must be hooked directly to the electrical wiring, be interconnected and have a battery backup. In addition, smoke detectors are required either inside or outside every bedroom, depending on local codes. Smoke detectors on the outside will detect fires more quickly, assuming the fire does not begin in the bedroom, but the sound of the alarm will be reduced and may not wake some people. Some areas also require smoke detectors in stairways, main hallways and garages.

Wired units with a third "interconnect" wire allow a dozen or more detectors to be connected, so that if one detects smoke, the alarms will sound on all the detectors in the network, improving the chances that occupants will be alerted, even if they are behind closed doors or if the alarm is triggered one or two floors removed from their location. Wired interconnection may only be practical for use in new construction, especially if the wire needs to be routed in areas that are inaccessible without cutting open walls and ceilings. As of the mid-2000s, development has begun on wirelessly networking smoke alarms, using technologies such as ZigBee, which will allow interconnected alarms to be easily retrofitted in a building without costly wire installations.

Detectors on the ceiling should be placed several inches away from any wall. If the ceiling is not flat, the detector should be placed at or near the highest point. If the highest point is a small recess, then the detector should be placed at the next highest level. Detectors placed on a wall should be several inches, but no more than a foot (30 cm), from the top. Detectors should not be placed on a wall if the ceiling has a deep recess, if the ceiling slopes steeply or for a long distance. Detectors should be several horizontal feet away from a heating or cooling register, window, corner, the edge of a ceiling fan's sweep and doors to a kitchen or bathroom. They should be placed as far away as possible from combustion sources, like oil and gas-fired furnaces, space heaters, clothes dryers and water heaters, without compromising coverage or safety. Smoke detectors in a basement should be placed at the bottom of the stairs and an additional detector should be placed in or near any sleeping areas in the basement.

It is recommended, and sometimes required, that smoke detectors not be placed in kitchens because the small amounts of smoke and particulates generated while cooking can set them off. Detectors designed for use near a kitchen may have a silencing button to cancel accidental triggering.

Detectors should not be placed in a bathroom or near a bathroom door because moisture may cause false alarms or damage the detector. False alarms reduce the effectiveness of smoke detectors in preventing harm and property damage because people soon begin to assume that the alarm is false. Heat detectors, which sound an alarm when the temperature reaches a certain point and/or when it climbs more rapidly than a certain rate, can be used in kitchens, garages and areas with combustion sources that would otherwise generate nuisance alarms.

detector.

Smoke detectors with missing batteries are also a concern. As a result, many detectors sold today are designed to provide a visual indication of a missing battery. One popular brand of smoke detector will not allow the user to close the battery door until a battery has been placed in the alarm; another contains a spring-loaded protrusion obstructing the attachment holes when the battery is missing, preventing reattachment to the wall or ceiling and making a missing battery situation immediately obvious. Some local governments do not permit the installation of smoke detectors with removable batteries.

In new construction, most building codes today require smoke detectors to be wired to the electrical mains of buildings. Many of these units also include a battery backup to ensure operation during a power outage.

Rechargeable batteries should *never* be used in battery powered smoke detectors, since common NiMH and NiCd rechargeable batteries have a high self-discharge rate. This is true even though they may provide much more power than alkaline batteries if used soon after charging, such as in a portable stereo. Also, a problem particularly prevalent in older technology rechargeable batteries is a rapid voltage drop at the end of their useful charge. This is of concern in devices such as smoke detectors, since the battery may transition from "charged" to "dead" so quickly that the low-battery warning period from the detector is either so brief as to go unnoticed, or may not occur at all.

The American National Fire Protection Association, through its fire protection program, urges homeowners to replace smoke detector batteries with a new alkaline battery every six months, for example when changing clocks for daylight saving time, and to replace the entire smoke detector after ten years of use. The used battery will probably still have the majority of its charge, and can be reused in less critical applications, such as a backup for a digital alarm clock.

Testing

Virtually all modern smoke alarm units come equipped with a "test" button. Alternatively, artificial smoke can be purchased, which also tests the detection mechanism itself. One simple way to test a smoke alarm is to light and extinguish a match, then wave it beneath the detector. The smoke detector should be sensitive enough to trip its alarm if a small amount of smoke enters it. Waving a lit match underneath the detector to test it is not recommended, as it could set the smoke alarm and the rest of the house on fire. Smokers may blow cigarette smoke into the detector, but the tars in the cigarette smoke deposited on the detector may make it less effective.

Installation and placement

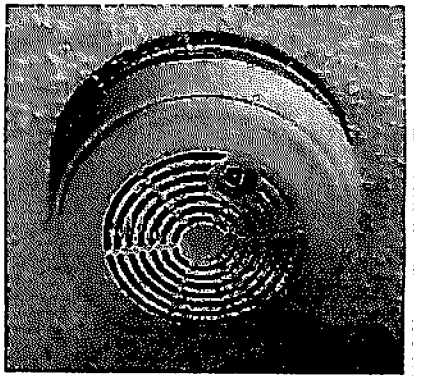
In the United States, most state and local laws regarding the required number and placement of smoke detectors are based upon standards established in Article 72 of NFPA fire code.

Laws governing the installation of smoke detectors vary depending on the locality. Homeowners with questions or concerns regarding smoke detector placement may contact their local fire marshal or building inspector for assistance. However, some rules and guidelines for existing homes are relatively consistent throughout the developed world. For example, Canada and Australia require a building to

the effectiveness of the various alerting methods is sparse. Research findings suggest that a low frequency (520 Hz) square wave output is significantly more effective at awakening high risk individuals.[3]

Reliability and service life

In 2004, NIST issued a comprehensive report entitled Performance of Home Smoke Alarms — Analysis of the Response of Several Available Technologies in Residential Fire Settings (http://smokealarm.nist.gov/). The report concludes, among other things, that *"smoke alarms of either the ionization type or the photoelectric type consistently provided time for occupants to escape from most residential fires"*, and *"consistent with prior findings, ionization type alarms provided somewhat better response to flaming fires than photoelectric alarms, and photoelectric alarms provided (often) considerably faster response to smoldering fires than ionization type alarms"*.



Residential ceiling-mounted smoke detector

The National Fire Protection Agency strongly recommand the replacement of home smoke alarms every 10 years.] Smoke alarms become less reliable with time, primarily due to aging of their electronic components, making them susceptible to nuisance false alarms. In ionization type alarms, decay of the ^{241}Am radioactive source is a negligible factor, as its half-life is far greater than the expected useful life of the alarm unit.

Cleaning and false alarms

Regular cleaning can prevent false alarms caused by the build up of dust or other objects such as flies, particularly on optical type alarms as they are more susceptible to these factors. A vacuum cleaner can be used to clean ionisation and optical detectors externally and internally. However, on commercial ionisation detectors it is not recommended for a lay person to clean internally.[4]

Batteries

Most residential smoke detectors run on 9-volt alkaline or carbon-zinc batteries. When these batteries run down, the smoke detector becomes inactive. Most smoke detectors will signal a low-battery condition. The alarm may chirp at intervals if the battery is low, though if there is more than one unit within earshot, it can be hard to locate. It is common, however, for houses to have smoke detectors with dead batteries. As a result, public information campaigns have been created to remind people to change smoke detector batteries regularly. In Australia, for example, it is advertised that all smoke alarm batteries should be replaced on the first day of April every year. In regions using daylight saving time, these campaigns may suggest that people change their batteries when they change their clocks or on a birthday.

Some detectors are also being sold with a lithium battery that can run for about 7 to 10 years, though this might actually make it less likely for people to change batteries, since their replacement is needed so infrequently. By that time, the whole detector may need to be replaced. Though relatively expensive, user-replaceable 9-volt lithium batteries are also available. They should only be used in a fairly new

detector, and also makes it safer for people at home, as it is less radioactive. Alpha radiation, as opposed to beta and gamma, is used for two additional reasons: Alpha particles have high ionization, so sufficient air particles will be ionized for the current to exist, and they have low penetrative power, meaning they will be stopped by the plastic of the smoke detector and/or the air, reducing the risk of harm to people.

Air-sampling detector

An air-sampling smoke detector, sometimes called a VESDA® system, is capable of detecting microscopic particles of smoke. Most air-sampling detectors are aspirating smoke detectors, which work by actively drawing air through a network of small-bore pipes laid out above or below a ceiling in parallel runs covering a protected area. Small holes drilled into each pipe form a matrix of holes (sampling points), providing an even distribution across the pipe network. Air samples are drawn past a sensitive optical device, often a solid-state laser, tuned to detect the extremely small particles of combustion. Air-sampling detectors may be used to trigger an automatic fire response, such as a gaseous fire suppression system, in high-value or mission-critical areas, such as archives or computer server rooms.

Air-sampling smoke detection systems are classed as High Sensitivity Smoke Detectors (HSSDs) and provide multiple levels of alarm threshold, such as Alert, Action, Fire 1 and Fire 2. Thresholds may be set at levels across a very wide range of smoke levels. This allows early notification of a developing fire, allowing intervention before a fire has developed beyond the smoldering stage, thereby increasing the time available for evacuation and possibly enabling emergency firefighters to arrive earlier and minimize fire damage. Fire thresholds can be set to notify local or municipal emergency responders and ultimately to discharge fire suppression systems.

Alarms and alerts

A second function of the detector is to alert persons at risk. Several methods are used and documented in industry specifications published by Underwriters Laboratories.[2]

Alerting methods include:

- Audible tones
  - usually around 3200 Hz due to component constraints (Audio advancements for persons with hearing impairments have been made; see External links)
  - 85 dBA at 10 feet
- Spoken voice alert
- Visual strobe lights
  - 110 candela output
- Tactile stimulation, e.g., bed or pillow shaker (No standards exist as of 2008 for tactile stimulation alarm devices.)

While current technology is very effective at detecting smoke and fire conditions, the deaf and hard of hearing community has raised concerns about the effectiveness of the alerting function in awakening sleeping individuals in certain high risk groups such as the elderly, those with hearing loss and those who are intoxicated. Between 2005 and 2007, research sponsored by the NFPA has focused on understanding the cause of a higher number of deaths seen in such high risk groups. Initial research into

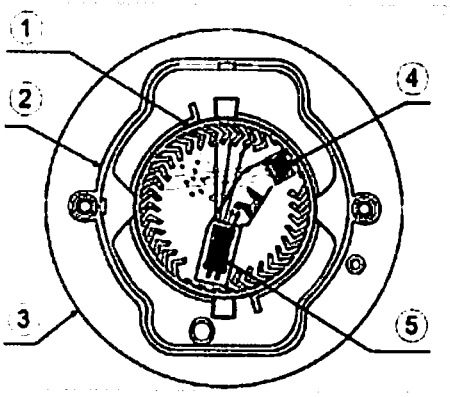
rose above the safe limit. The contact was made by bridging a gap with a conductor, or allowing one plate to fall on another. The connection of the two plates was caused simply by a block of butter which melted as the temperature rose.

While home smoke detectors were available during most of the 1960s, the price of these devices was rather high. Before that, alarms were so expensive that only major businesses and theaters could afford them. The first truly affordable home smoke detectors were invented by Duane D. Pearsall in 1967, featuring individual battery powered units that could be easily installed and replaced. Although commonly attributed to NASA, smoke detectors were not invented as a result of the space program, though a variant with adjustable sensitivity was developed for Skylab.[1]

Optical detector

An optical detector is a light sensor. When used as a smoke detector, it includes a light source (incandescent bulb or infrared LED), a lens to collimate the light into a beam, and a photodiode or other photoelectric sensor at an angle to the beam as a light detector. In the absence of smoke, the light passes in front of the detector in a straight line. When smoke enters the optical chamber across the path of the light beam, some light is scattered by the smoke particles, directing it at the sensor and thus triggering the alarm.

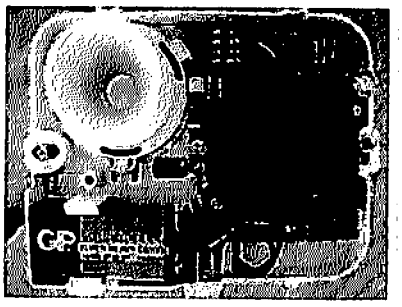
Also seen in large rooms, such as a gymnasium or an auditorium, are devices to detect a projected beam. A unit on the wall sends out a beam, which is either received by a receiver or reflected back via a mirror. When the beam is less visible to the "eye" of the sensor, it sends an alarm signal to the fire alarm control panel.



Optical Smoke Detector
1: optical chamber
2: cover
3: case moulding
4: photodiode (detector)
5: infrared LED

Optical smoke detectors are quick in detecting slow-burning, smoky fires. They are less sensitive to false alarms from steam generated in the kitchen or bathroom than are ionization smoke alarms.

Ionization detector



Inside a basic ionization smoke detector. The black, round structure at the right is the ionization chamber. The white,

This type of detector is cheaper than the optical detector; however, it is sometimes rejected for environmental reasons. It can detect particles of smoke that are too small to be visible. It includes less than a milligram of radioactive americium 241 (^{241}Am). The radiation passes through an ionization chamber, an air-filled space between two electrodes, and permits a small, constant current between the electrodes. Any smoke that enters the chamber absorbs the alpha particles, which reduces the ionization and interrupts this current, setting off the alarm.

^{241}Am, an alpha emitter, has a half-life of 432.2 years. This means that it does not have to be replaced during the useful life of the

Smoke detector

From Wikipedia, the free encyclopedia

A **smoke detector** or **smoke alarm** is a device that detects smoke and issues an alarm to alert nearby people that there is a potential fire. A household smoke detector will typically be mounted in a disk-shaped plastic enclosure about 150 mm in diameter and 25 mm thick, but the shape can vary by manufacturer.

Because smoke rises, most detectors are mounted on the ceiling or on a wall near the ceiling and, to avoid the nuisance of false alarms, are mounted away from kitchens. To increase the chances of waking sleeping occupants, most homes have at least one smoke detector near any bedrooms; ideally, in a hallway, as well as in the bedroom itself.

Smoke detectors are usually powered by one or more batteries, but some can be connected directly to the power mains. Detectors that are directly connected to the main's often have a battery as a power supply backup in case the main's power fails. In either case, it is usually necessary to replace the batteries once a year to ensure appropriate protection if alkaline or carbon-zinc batteries are used. (See more at Batteries, below.)

Most smoke detectors work either by optical detection (photoelectric) or by physical process (ionization), but some of them use both detection methods to increase sensitivity to smoke. Smoke detectors may operate alone, may be interconnected to cause all detectors in an area to sound an alarm if one is triggered, or may be integrated into a fire alarm or security system. Smoke detectors with flashing lights are available for people who are deaf or hearing impaired, although recent research suggests that their waking effectiveness is poor (see below).

A smoke detector cannot detect carbon monoxide to prevent carbon monoxide poisoning, unless it has an integrated carbon monoxide detector. These are also available as a separate detector. Most companies that manufacture smoke detectors also manufacture carbon monoxide detectors.

The smoke detector is one of three items of fire safety apparatus that are recommended for homes and that can be installed by the consumer. The second is a fire extinguisher, and the third is a fire blanket, a section of fire retardant cloth, normally 1 m^2 (3 ft x 3 ft), that can be applied to a small fire to smother it.

Contents

History

The first automatic electric fire alarm was invented in 1890 by Francis Robbins Upton and Fernando J. Dibble, (US patent no. 436,961). Upton was an associate of Thomas Edison, although there is no evidence that Edison contributed to this project.

It is a widely spread misinformation that the first electric fire alarm was patented in 1902 by George Andrew Darby of Birmingham, England, as this falls 10 years after the real first fire alarm was invented. There is a fun (and seemingly unconfirmable) anecdote regarding Darby's device. Apparently it indicated an increased temperature by closing an electrical circuit to sound an alarm if the temperature