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Fire protection in student accommodation

Protection of people, assets and reputation

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The high number of fire brigade call-outs to student accommodation shows that this is an area that demands close attention. The great majority of these fire alarm incidents are also found to be false alarms. This is not only a significant cost factor, as frequent false alarms lead inevitably to a feeling of complacency among the residents and a reluctance to evacuate the building every time a fire alarm is activated. This student apathy was cited as a significant contributing factor leading to the death of three students in the Seton Hall fire[1], New Jersey in 2000. The challenge is to eliminate false alarms, while still ensuring early detection of any real fires in their incipient stage so that they can be dealt with quickly and easily.

Purpose built (or converted) accommodation for university and college students frequently consists of a number of self-contained community units. Each of these units is made up of a small number of bedrooms with either ensuite or shared bathroom facilities, together with a large kitchen/lounge area. As in normal domestic housing, the kitchen is always a critical area, however, the age, inexperience and composition of the tenants are significant factors that influence their behavior and lead to an increased risk of fire-related incidents and false alarms.

Reducing the number of false alarms is obviously a high priority and installing the appropriate fire detectors that are designed to respond correctly to the various deceptive phenomena can go a long way towards eliminating such nuisance alarms.

Minimizing the risks must be the main objective of the responsible parties. Achieving this goal not only requires the installation and maintenance of an appropriate fire protection infrastructure, it also relies on establishing a clear fire safety policy and ensuring that the in-house fire protection regulations are fully understood and complied with.

[1] http://en.wikipedia.org/wiki/Boland_Hall_fire

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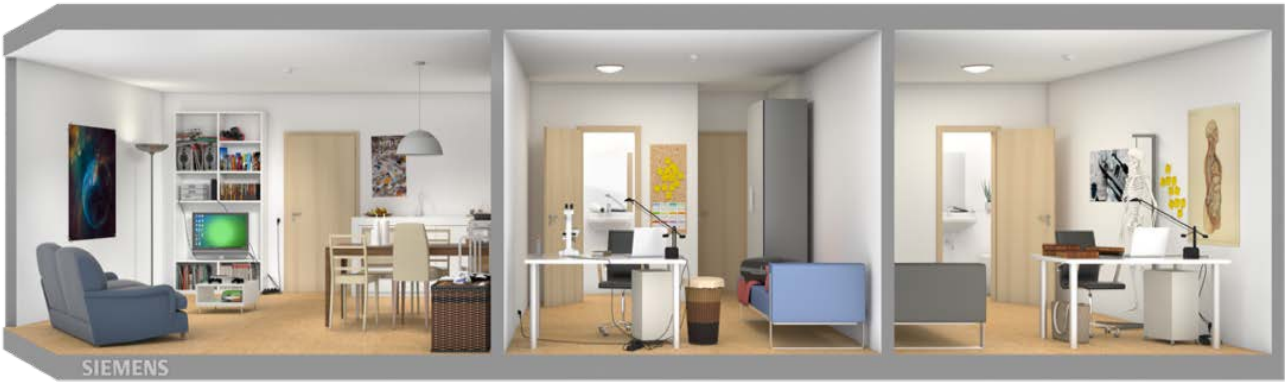

Introduction

Highlights

- Approx. 60% of all fire brigade call outs in the UK were due to false alarms.[1)]
- Kitchen fires account for approx. 80% of student accommodation fires.[2)]
- Reducing the number of false alarms helps eliminate student apathy and unnecessary fire brigade call-outs.
- Ensuring that fire safety regulations are understood and followed is essential.

1) Fire Statistics Great Britain 2013-2014
2) NFPA's Fire Analysis & Research Division

In terms of fire protection, student accommodation can be considered a critical area with one of the main contributing factors being the behavior of the students themselves. Lack of thought for the possible consequences of their actions is surprisingly common and generally attributed to their age and inexperience, together with the lack of supervision, group dynamics and youthful high spirits. This can often be compounded by the effects of alcohol and the desire to create a party atmosphere (e.g. decorative textile materials attached to walls and ceilings; the use of candles, joss sticks, spotlights, etc.).

Kitchens are recognized as a major source of domestic fires and the additional factor of "the careless student" (e.g. leaving cooking unattended, failing to clean grills and toasters etc.) makes the common kitchen/lounge of a student accommodation unit a high risk area.

Creating an awareness and respect for the potential dangers is the key organizational challenge facing the management of such premises. Clear fire protection guidelines need to be defined and strictly enforced, together with compulsory induction and follow-up training.

These guidelines should be aimed at preventing dangerous situations arising. A key objective of the training is to generate an awareness of the consequences of inappropriate behavior. Thoughtless actions such as covering smoke detectors in cling film (in an attempt to prevent activation by smoking materials) or propping open fire doors can easily lead to the effectiveness of the fire protection system being compromised. The guidelines should also target behavior that may lead to false alarms caused by the excessive generation of deceptive phenomena such as steam.

It is a well-documented fact that the number of false alarms in student accommodation is extremely high. This is not only a nuisance and a waste of public money due to the unnecessary attendance of the local fire services, it can easily lead to student complacency after numerous evacuations of the building have turned out to be false alarms. In some of these cases the manual call points had been activated deliberately as a prank. However, the great majority of false alarms (which are frequently caused by deceptive phenomena such as steam) could have been avoided by the use of correctly positioned multi-criteria fire detectors with the appropriate settings.

In general young, physically able students can easily rescue themselves when a fire alarm requires the evacuation of the building. However, some students may have physical disabilities that could make this very difficult. These circumstances must be taken into consideration in the assessment of individual risks and in defining the appropriate evacuation measures for these individuals.

The group dynamic can lead to thoughtless actions that may create potentially dangerous situations.

Basic conditions

Objectives

- Reducing the risk of fire-related incidents and eliminating false alarms
- Alerting people in the affected rooms before hazardous fumes create a dangerous situation
- Timely evacuation of all people at risk (including those requiring assistance)
- Protection of property and assets

Typical fire hazards

- Negligence while cooking (e.g. leaving cooking unattended or flammable materials coming into contact with a hotplate)
- Overloading of electrical installations (e.g. cables, switches, etc.) by connecting too many devices via multi-way adapters
- An overload or short circuit caused by an electrical appliance (e.g. electric heater, kettle, iron, etc.)
- Danger created by negligent human behavior (e.g. careless handling of candles, smoking products, electrical appliances, etc.)

Typical development of a fire

- The majority of fires in bedrooms start with a smoldering phase and progressively generate increasing quantities of visible smoke. If such an incipient fire is detected at an early stage, it can be dealt with quickly and easily.
- When electrical equipment overheats, small quantities of an aerosol will be generated. If the power is not interrupted during this phase, then a smoldering fire can develop, which produces increasing amounts of visible smoke. If such a fire can be detected in the early stages, it can still be dealt with easily and the damage can be limited to a small area (or just to the device itself).
- If the fire has been caused by carelessness (e.g. burning candles during a festive occasion) or even deliberately (arson) then we may be confronted with an open fire from the outset.

Critical Points

- Preventing delayed fire detection (e.g. by the fire aerosols being diluted by the airflow from the HVAC system)
- Preventing false alarms due to deceptive phenomena. For example:
  - Steam from the shower or from a boiling kettle
  - Cigarette smoke (including fumes from e-cigarettes and vaporizers)
  - Rapid increase in temperature caused by an electric heater
  - Fumes from cooking
  - Aerosols from hair sprays or the use of hair-straightening tongs
- Ensuring safe and orderly evacuation of all people at risk, including those needing assistance (e.g. physically handicapped persons etc.).
- Any damage must be limited to a single room by ensuring that fire cannot spread to neighboring areas.

Solution

A fire protection concept for student accommodation must not only address the technical measures, but also the organizational and educational issues.

Organizational measures

When students first take up residence, it is essential that they are instructed in good fire safety practice. This should be reinforced by regular follow-up training and informative literature, such as student fire safety advice flyers etc.

Management responsibilities also include the following:

- Conduct regular inspections to ensure that fire safety guidelines are being adhered to.
- Ensure that all electrical equipment (including the fire protection system itself) is tested and maintained on a regular basis.
- Ensure that emergency exits are neither locked nor obstructed in any way.
- Ensure that an evacuation plan and general fire safety regulations are prominently displayed in each unit.
- Create a personal evacuation plan (PEEP[2]) for all physically handicapped residents.
- Provide hearing impaired students with appropriate warning devices (e.g. vibrating pillows etc.).

[2] PEEPs: All students with mobility impairments should be known to the management, who will have taken this into consideration when allocating them appropriate rooms (e.g. on the ground floor etc.). Personal emergency evacuation plans (PEEPs) should be created for all such persons, including those who may have suffered some more recent mobility-impairing accident. Such plans may involve a "buddy" system, whereby someone is nominated to assist the handicapped person in cases of emergency.

The fire-safety guidelines should highlight student behavior that has been known to create dangerous situations in similar environments. The following practices should be banned:

- Smoking anywhere on the premises (including e-cigarettes)
- The use of halogen lamps and fog-generating devices
- Tampering with the fire protection system in any way (e.g. removing detectors or covering them with cling-film etc)
- Disconnecting door closers and propping open fire doors
- The use of candles, joss sticks and incense burners
- The use of flammable materials as wall-hangings or floor coverings
- The hanging of any materials from the ceilings

Further guidelines that encourage safe behavior should include the following:

- Never leave cooking unattended
- Regularly clean toasters and grills etc.
- Do not overload electrical power sockets (e.g. by stacking multi-way adapters)
- Take care when using electrical appliances in the bedrooms and make sure they are switched off when not in use

Technical measures

The following example indicates what devices are required to provide optimal fire protection in a typical student accommodation unit consisting of a number of bedrooms, a common kitchen/lounge and a corridor. Achieving the correct balance in each of these areas between robust behavior towards deceptive phenomena and providing adequate sensitivity to react promptly to an incipient fire requires both experience and expertise.

The kitchen is an area where considerable deceptive phenomena can be expected (e.g. steam from boiling water, cooking aerosols, etc.). The kitchen must therefore be equipped with an ASA neural smoke/heat detector with parameter settings selected to ensure a robust reaction to such deceptive phenomena, while providing an early warning to incipient fires. The traditional solution (in many countries) of simply installing a heat detector in kitchens is clearly inadequate. An incipient fire caused by the overheating of an electrical appliance may develop into a full-blown fire before the heat generated is sufficient to activate the heat detector. An ASA neural detector that is correctly positioned (at an appropriate distance away from the immediate cooking area), however, can practically eliminate false alarms while still reacting quickly to genuine events.

The student bedrooms represent a more sensitive environment. To provide maximum safety for the occupants, who may be sleeping, we must be sure that any incipient fire will be detected at the earliest stage of its development. As long as the guidelines regarding student behavior are strictly followed, however, correctly positioned ASA-detectors with a balanced parameter set will be well able to recognize an incipient fire, while practically eliminating false alarms. It is important that the room layout is taken into consideration when determining the optimal detector position. For example, the detector should not be positioned near the door to the shower and not in the direct path that the steam would take as it escapes through the open window. As student bedrooms tend to be relatively small, determining the optimal position requires both the appropriate expertise and experience.

As the corridor will not generally be subject to deceptive phenomena, an optical smoke detector may be used in this case. However, care must be taken with its positioning. It should be installed in the middle of the ceiling, but well away from the door to the kitchen. A manual call point should also be installed in the corridor to permit manual alarm activation. This should be installed close to the external door and should be fitted with a protective cover to prevent accidental activation.

All detectors must be equipped with a sounder base, which has been designed to create a sufficient intensity of sound to awaken a sleeping person when installed in the same room.

A hand-held fire extinguisher should be provided in each accommodation unit, although students are generally not expected to be trained to fight any fires themselves. This should be left to members of staff, who are trained in the correct use of the equipment provided.

All doors that open onto the corridor should be fitted with self-closing mechanisms and should not be propped open in any way.

Students should be made aware of the fire risks when cooking e.g. never leave cooking unattended.

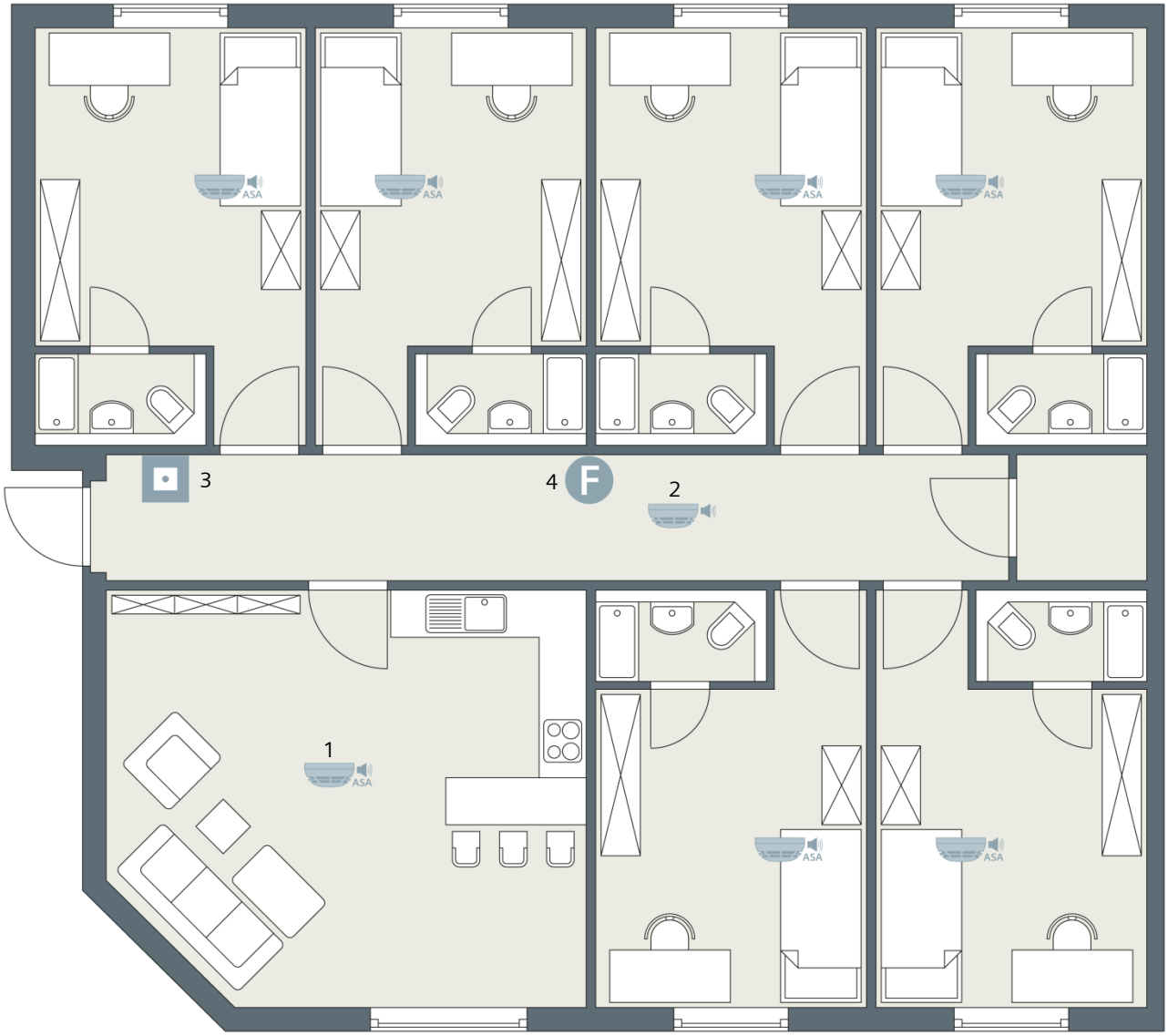

Figure 1 Positioning of the system elements

System elements

1. ASA neural fire detector (with sounder base)
2. Optical smoke detector (with sounder base)
3. Manual call point
4. Hand-held fire extinguisher

Details	Comments/Notes
Automatic fire detectors in the kitchen/lounge area: ASA neural fire detectors	Early detection of all types of fire and a robust response to deceptive phenomena (steam, heat) ▪ Parameter set with robust behavior to deceptive phenomena
Automatic fire detectors in student bedrooms: ASA neural fire detectors	Medium deceptive phenomena at the detector ▪ Parameter set with balanced detection behavior
Automatic fire detector in corridor: Optical smoke detector	Low deceptive phenomena at the detector ▪ Parameter set with standard sensitivity
Manual call points: MCPs	Manual activation of a fire alarm (via the fire detection panel) ▪ Single or double action (depending on local regulations) ▪ Fitted with protective MCP covers
Warning devices: Sounders	All detectors should be mounted with sounder bases.
Manual suppression: Hand-held fire extinguisher	Manual suppression of minor fires ▪ Recommended type: foam
Automatic suppression: Sprinkler system	In some countries sprinkler systems are mandatory in such applications.
Positioning of the system elements: (see Figure 1)	**Detectors in the bedrooms** ▪ On the ceiling at least 0.5 m from the walls ▪ In the area of the bed ▪ As far as possible from the bathroom door ▪ Away from the airflow of the HVAC system **Detector in the kitchen/lounge area** ▪ On the ceiling at least 0.5 m from the walls ▪ As far as possible from the cooking area and the oven ▪ Away from the airflow of the HVAC system **Detector in the corridor** ▪ On the ceiling at least 0.5 m from the walls ▪ In a central position, but at least 3m away from kitchen door **Manual call point** ▪ Next to the main door to the accommodation unit (inside). ▪ At a height of 1.4 m ± 0.2 m **Hand-held fire extinguisher** ▪ In a central position in the corridor ▪ Handle height 1.0 m ± 0.2 m

Practical experience

As described in the introduction, student accommodation frequently consists of several different areas each with its own set of challenges. The corridor is non-critical and can be served by a standard optical smoke detector, however, the kitchen and bedrooms require a more sophisticated solution. Modern fire detection systems offer the possibility of adapting the detection behavior of the detectors to such different situations. Selecting the appropriate parameter sets and taking care to specify the correct positioning of the detectors are essential factors in providing optimal fire protection.

Fire detection in kitchen area

Prior to the development of the intelligent multi-criteria ASA detector, kitchen areas were often supervised solely by heat detectors. The thinking behind this application was that basic smoke detectors could easily be deceived by steam and other vapors generated during normal cooking procedures, whereas the detection of a rapid temperature rise could be used to indicate the presence of a fire.

Experience has clearly demonstrated that correctly positioned ASA-detectors with the appropriate settings can ensure reliable detection of smoldering fires while eliminating any danger of false alarms. Such a solution is a considerable improvement on the previous method, where the reliance on temperature rise alone could often result in a dangerous delay before an incipient fire could generate sufficient heat to activate the heat detector.

Fire detection in bedrooms

The parameter sets offered by the ASA neural fire detector can handle all the typical fire-related scenarios and remain insensitive to the wide range of deceptive phenomena that might be encountered in the student bedrooms. For example:

Steam

False alarms in student rooms are frequently triggered by steam from the shower. The majority of people have the water below 45 °C when taking a shower, which is typically unproblematic.

However, water temperatures of over 50 °C can create volumes of steam that may potentially cause problems. In some cases people may also use the shower for steaming clothes, creating very hot steam for several minutes. If the bathroom door is then suddenly opened letting the accumulated steam escape into the bedroom it is possible that this can trigger a false alarm. To reduce this risk, the detector should not be positioned close to the bathroom door.

The situation may be exacerbated if the window is left slightly open to get rid of the steam, as the steam tends to travel along the ceiling to escape through the open window. In a small room the detector may well be directly in the path of this steam cloud.

Cigarette smoke

Although smoking in student accommodation is not generally permitted, the possibility of cigarette smoke should still be taken into consideration. In addition, the use of e-cigarettes and vaporizers is becoming increasingly popular and these are known to generate quantities of aerosols that may lead to false alarms with some types of optical smoke detector.

Modern student bedrooms are generally small and have a standard height of about 2.5 m. Tests have shown that in such rooms it is possible that an alarm can be triggered by cigarette smoke, particularly if the smoker stands directly underneath the detector and blows the smoke toward the detector. If the distance between the smoker and the detector is increased by as little as 0.5 m (e.g. when the smoker is sitting on a chair), the smoke concentration is not sufficient to trigger a false alarm and positioning the smoke detector above the bed could be a possible solution. However, taking into account the history of false alarms in student accommodation and the number of other deceptive phenomena that may be encountered, the most reliable solution is to install an ASA neural fire detector (with balanced detection behavior) to provide the necessary robustness.

Aerosol sprays

Although aerosol sprays have been identified as possible causes of false alarms, today's high quality detectors provide a high degree of immunity to such deceptive phenomena, unless the detector is deliberately sprayed from close range (and for a period of time).

Burnt toast is a common cause of unnecessary fire alarm activations.

Further considerations

Interference from the HVAC system

Whenever a smoke detector with a temperature sensor (ASA neural fire detector) is used, the detector must not be mounted in the airflow of the heating unit. Otherwise, the local rapid and significant temperature rise caused by the heating being turned on (or turned up) may lead to the triggering of a false alarm.

Alarming

The minimum sound pressure level considered sufficient for rousing a sleeping person is 75 dBA at the bed head. This can best be achieved if each detector is installed together with a standard sounder base. As the residents may include a number of hearing impaired persons, alternative warning devices should be considered (e.g. beacons, vibrating pillows, automatically switching the main room lights ON and OFF etc.).

Evacuation

Escape routes must be kept free from blockages at all times. Adequate signage must be provided together with appropriate emergency lighting.

Smoke control

Smoke is the biggest danger to life. This is not only due to the risk of asphyxiation, but also as a hindrance to panic-free evacuation. Preventing smoke from spreading and keeping the escape routes free from smoke can be achieved by automatically closing all fire doors. This can be greatly assisted by appropriate control of the air-handling system.

Extinguishing

In an increasing number of countries an automatic sprinkler system is becoming mandatory in such applications.

Manual fire extinguishers should be provided within each accommodation unit as well as at each floor landing. These ensure that small fires can be dealt with rapidly and effectively and any consequential damage can be kept to a minimum. In particular foam extinguishers with a content of 6 liters should be used: they are a manageable size and are suitable for a wide range of fires. A fire blanket should also be provided in the kitchen area to smother fat-fires etc.

Steam from showers is a typical deceptive phenomenon that must be taken into account.

ASA*technology*

For intelligent, reliable fire detection with genuine alarm guarantee

ASA*technology* is a unique technology from Siemens that converts signals into mathematical data which is compared with programmed values in real time using intelligent algorithms. The special signal analysis process is very reliable in preventing false alarms caused by deceptive phenomena, such as steam, tobacco smoke or exhaust emissions.

Find out more about **Sinteso** or **Cerberus PRO** fire detectors with **ASA***technology*.

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- Fully forwards and backwards compatible systems, to ensure any system provided is equipped to integrate the latest technology Siemens has to offer
- Clear and fast alerting and evacuation processes

All these aspects are at the core of comprehensive fire protection. Only when these are fulfilled can you be assured that people in your buildings are safe and assets and business operations are protected.

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