NHS in Scotland Firecode

Scottish Health Technical Memorandum 82

Alarm and detection systems

Guidance revised December 1999
All previous guidance is superseded

Index Contents Help

About this publication

This document contains guidance on the design and installation of fire detection and alarm systems in Scottish healthcare premises. Its purpose is to supplement BS 5839: Part 1 by providing recommendations that are specific to hospitals. It is essential that SHTM 82 is read in conjunction with BS 5839: Part 1.

Of basic importance to the fire safety strategy in hospitals is the principle that, should a fire occur, it is rapidly detected, an alarm is given and the fire brigade is called. The value of automatic fire detection in this respect has long been recognised.

The immediate and total evacuation of a hospital in the event of fire is usually neither desirable nor necessary and because of this it is staff, not patients, who need to be alerted when the fire alarm system operates. The alarm needs to be phased to allow progressive horizontal evacuation of the building.

This version updates version 1 issued in April 1998 and reflects Scottish legislation and practice. However, the principles contained are the same as the version used in England, Wales and Northern Ireland.

LIST OF REVISIONS

Some document references have changed to reflect Scottish versions recently issued.

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Executive summary

This Scottish Health Technical Memorandum (SHTM) provides guidance on the design and installation of new fire detection and alarm systems in NHS hospitals. It applies to both new and existing hospitals. It also covers modifications to existing fire alarm systems required by alterations or extensions to existing hospital buildings.

This guidance is intended for those responsible for specifying, designing, installing or approving fire alarm systems in hospitals and should be read in conjunction with BS5839: Part 1. This SHTM should also be read with other relevant Firecode documents.

The document covers a wide range of alarm and detection technology, from conventional systems to multi-criteria detectors in addressable systems. There is also substantial information and guidance on design philosophy and technical recommendations.

Contents

1.0 Introduction

Scope and purpose

1.1 This Scottish Health Technical Memorandum (SHTM) provides guidance on the design and installation of new fire detection and alarm systems in NHS hospitals. It applies to both new and existing hospitals. It also covers modifications to existing fire alarm systems required by alterations or extensions to existing hospital buildings.

1.2 Although generally applicable to secure units for the mentally ill or mentally handicapped, in such premises there may be additional requirements that arise because of security considerations.

1.3 The guidance is intended for those responsible for specifying, designing, installing or approving fire alarm systems in hospitals, for example:

a. estates and fire safety staff of an NHS trust or healthcare property;

b. architects, and mechanical and electrical engineering consultants;

c. fire safety consultants;

d. building control officers;

e. fire officers of the local fire authority;

f. fire alarm and electrical contractors.

1.4 It is assumed that those using this SHTM will be competent to do so. A person will be considered competent where they have sufficient technical training and actual experience or technical knowledge and other qualities, both to understand fully the dangers involved, and to undertake properly the statutory and Firecode provisions referred to in this document.

Relationship to BS 5839: Part 1

1.5 The British Standard for the design and installation of fire detection and alarm systems in buildings is BS 5839: Part 1. It is a code of practice containing general recommendations covering a wide range of building types. Although applicable, it does not provide recommendations specific to hospitals. Neither does it recommend whether or not a fire alarm system should be installed in any given premises. It also points out that, because of the many different systems it covers, simply referring to BS 5839: Part 1 without further qualification will have little meaning.

1.6 This SHTM has been prepared to satisfy the need for more specific guidance. SHTM 82 is intended to supplement BS 5839: Part 1 by:

a. applying the recommendations of the British Standard to hospitals;

b. amplifying and interpreting specific clauses of the standard in the light of the above;

c. providing additional recommendations over and above those in BS 5839: Part 1.

1.7 In view of this, it is important to note that SHTM 82 must be read in conjunction with BS 5839: Part 1, and that the guidance in this SHTM does not represent any lowering of standards in relation to fire alarm systems.

1.8 Contracts for fire detection and alarm systems for hospitals should require compliance with BS 5839: Part 1 and SHTM 82. However, both BS 5839: Part 1 and SHTM 82 contain only recommendations; neither are specifications. It is therefore recommended that contracts should also include appropriate technical specifications interpreting these recommendations to suit the particular site circumstances.

1.9 No additional recommendations relating to user responsibilities over and above those in BS 5839: Part 1 are contained in this SHTM. Those responsible for supervising fire alarm systems in hospitals should therefore refer to BS 5839: Part 1 for recommendations on procedures, training, servicing and prevention of false alarms.

Additional guidance on post-commissioning documentation for alarm and detection systems is contained in Scottish Hospital Technical Note 1.

Function of fire alarms in hospitals

1.10 The function of fire alarms in hospitals is to give warning to staff in the event of fire so that an early call to the fire brigade, first aid fire-fighting and evacuation may be carried out. In contrast with most other types of building, in hospital wards and certain patient areas it may not be necessary or even desirable to give warning to all occupants. The extent to which this is necessary will depend largely on the overall fire safety strategy for the hospital.

Consultation

1.11 In planning a fire alarm system, it is important to establish at an early stage the design and operational requirements for the system. These must take into account the hospital's overall fire safety strategy and its specific evacuation procedures. The specifier/designer of the system should therefore consult all those concerned with the design and operation of the system, for example:

a. managers;

b. fire safety advisers;

c. estates and facilities management staff;

d. building control officers/local authority fire officers (as appropriate);

e. relevant hospital staff (especially those who have a role in responding to alarms);

f. Health Boards (for private hospitals);

g. insurers (where appropriate);

h. installing contractors and equipment suppliers.

Where practicable, this should be carried out before awarding the contract for the system.

Other NHS in Scotland Firecode documents

1.12 SHTM 82 is referred to in other documents in Firecode, some of which contain recommendations on fire detection and alarm systems. This document should therefore be read in conjunction with the latest revisions of other relevant Firecode documents and any other applicable Firecode guidance as and when it is published.

Certification of products and services

1.13 Firms involved in the manufacture, supply and installation of fire alarm systems for hospitals should preferably be certificated to the appropriate part of the Quality Standard BS EN ISO 9000.

1.14 It is also recommended that preference be given to systems and components that have been independently tested for conformity against a relevant product standard. Similarly, installers should also, preferably, have been independently assessed.

1.15 A number of third-party certification schemes now exist for fire alarm products and services. For example, the LPCB1 operates schemes for installers (LPS 1014) and alarm monitoring centres ("central stations") (LPS 1020). These schemes have been adopted by BAFE2.

1 Loss Prevention Certification Board.

2 The British Approvals for Fire Equipment (BAFE) is a national approvals body set up to promote the use of certificated fire protection equipment, installation and maintenance services. BAFE adopts as National Schemes those run by certification bodies accredited by the United Kingdom Accreditation Service, and owns and controls quality markings for use in conjunction with such schemes.

2.0 Glossary of terms

2.1 For the purpose of this document, the following terms are defined:

- **ancillary service:** a device, facility or system which is required to operate when a fire alarm signal occurs;
- **automatic door release:** a device for retaining a fire door in the open position and releasing it so that it closes when a fire alarm occurs;
- **central station:** a continuously manned remote centre in which the information concerning the state of alarm systems is displayed and/or recorded;
- **circulation space:** the communication routes both within a department/ management unit and giving access to other parts of the hospital, and to all necessary fire escape exits;
- **compartment:** a building or part of a building, comprising one or more rooms, spaces or storeys, constructed to prevent the spread of fire to or from another part of the same building, or an adjoining building;
- **escape route:** a circulation space or dedicated fire exit route, including a stairway and the hospital street;
- **fire hazard room:** rooms or other areas which, because of their function and/or contents, present a greater hazard of fire occurring and developing than elsewhere (see Appendix 2);
- **hazard departments:** departments/management units which contain high fire loads and/or significant ignition sources (see Appendix 2);
- **hospital street:** the main route of ingress and egress for staff, patients, visitors, supplies and services and constructed as a compartment;
- **multi-criteria detector:** a detector monitoring more than one physical and/or chemical phenomenon associated with fire;
- **notional noise level:** the noise level which is exceeded for 10% of the noisiest period (for example daytime in wards) (L10 noise level);
- **patient access areas:** those areas of the hospital to which patients have reasonable access either with or without supervision;
- **phased evacuation:** evacuation of different parts of the hospital in a controlled sequence of phases, with those parts expected to be at greatest risk being evacuated first;
- **pre-alarm warning:** an early warning of conditions which might (or might not) represent a fire;
- **progressive horizontal evacuation:** evacuation of patients away from a fire into a fire-free compartment or sub-compartment on the same level;
- **protection:** the presence of one or more detector(s) able to initiate actions needed for the safety of life or property in the event of a fire;

- **radio-linked system:** a fire alarm system in which some or all of the interconnections between components are made by radio links;
- **remote centre:** premises remote from those in which the alarm systems are fitted where the information concerning the state of alarm systems is collected for display or for onward transmission;
- **search distance:** the distance which has to be travelled by a searcher within a zone in order to determine visually the position of a fire;
- **soak time:** a period after a fire alarm system has been commissioned, but prior to handover, during which the system's performance in relation to false alarms and faults is monitored;
- **staff alarm:** a restricted alarm following the operation of an automatic detector given to certain staff to permit investigation prior to evacuation;
- **sub-compartment:** areas into which the building can be divided to reduce travel distance and which provide 30 minutes resistance to fire;
- **system type:** a designation in BS 5839: Part 1 to describe the function of the system. Type L systems are automatic detection systems intended for the protection of life. They are further subdivided into type L1, L2 and L3 systems. Type L1 refers to systems installed throughout the protected building. Type M systems are manual alarm systems, and have no further subdivision;
- **time-related system:** a system in which the response or sensitivity of detectors is changed with the time of day;
- **two-stage alarm:** an arrangement in which the system gives an "evacuate" signal in the compartment or sub-compartment of alarm origin and an "alert" signal in neighbouring compartments/sub-compartments and/or other defined areas (for example basements);
- **zone:** a geographical sub-division of the protected premises in which a function may be carried out separately from any other sub-division. The function may, for instance, be:
  (i) the indication of the occurrence of a fire (detection zone);
  (ii) the giving of a fire alarm (alarm zone).

3.0 System technology

3.1 Addressable fire alarm systems (see Appendix 1), in which signals from each detector and each call point are individually identified at the control panel, are of particular benefit in hospitals and are preferred over conventional systems (see Appendix 1). Rapid identification of the source of an alarm can aid evacuation and first-aid fire-fighting. In the event of a false alarm, it can reduce the period of disruption. However, this is of less benefit in small hospitals, particularly if there are few rooms and mainly open-plan wards. It may also be less appropriate for isolated buildings on a hospital site, for example boiler houses.

3.2 In large hospitals in particular, fire alarm systems using analogue detectors (see Appendix 1) are preferred because of their potential to reduce false alarms. This is particularly the case if the systems' controlling software uses algorithms to filter out false alarms. However, even simple multi-state detectors capable of giving a pre-alarm warning can be beneficial.

3.3 In future, the use of multi-criteria detectors (see Appendix 1) may enable further reductions in the rate of false alarms (see paragraph 5.19).

3.4 Where additions to an existing system are necessary, or a fire alarm system is installed in an extension or alteration to a hospital (for example a new adjoining building or a commercial enterprise within the hospital), compatible system technology should be employed. This may require equipment of the same manufacture to be used, unless addressable systems of different manufacture can be fully interconnected. It is also accepted that this may not always be possible with older systems, as compatible components may no longer be manufactured. If it is not possible to fully interconnect a new analogue or addressable system with an existing system, the new system should have its own control and indicator panel but be suitably interfaced with the existing system's panel. This will enable replacement of the existing system to be undertaken later as finances permit.

3.5 It is possible to integrate fire alarm and detection systems with other types of system (such as intruder alarms, building management systems and access control systems) in order to share common facilities e.g. signal cables and information display equipment. This is often achieved by having several sub-systems linked to a central processor. There are both advantages and limitations in integrating systems in this way, and it is vital that the reliability of the fire alarm system is not reduced by such integration. It is therefore not normally considered appropriate for a fire alarm system in a hospital to be integrated with other systems, other than to enable the status of the fire alarm system to be monitored remotely or on common display equipment. The fire alarm system should not be dependent on another "sub-system" or common central processor to carry out control over ancillary services.

Requirement

3.6 The system technology employed should be in accordance with the following guidance:

a. up to 50 devices (that is, detectors/call points), the system may be of the conventional type;

b. over 50 but no more than 100 devices, the system should at least be addressable;

c. over 100 devices, the system should be analogue or multi-state addressable.

3.7 To ensure that the fire alarm system functions in a fully integrated manner, compatible system technology should be used throughout a hospital site, with the possible exception of isolated buildings:

a. requiring no more than 50 detectors/call points; or

b. requiring more detectors but functioning entirely separately from the hospital (for example nurses' home) and not dependent on staff in the hospital to respond to alarms (other than summoning the fire brigade).

Networked cables should be one of the following types:

mineral insulated copper sheathed cable complying with BS 6207: Part 1;

cable complying with BS 6387 (meeting at least the requirements for categories AWX or SWX) and provided with mechanical protection (e.g. an armoured cable or cable run in conduit, trunking or ducting).

3.8 Where a system comprises a number of separate but interconnected control or data gathering panels (a "networked system"), the entire networked system should comply with all recommendations of BS 5839: Part 1. In particular, the cable used for the network should be of a type suitable for prolonged operation during a fire.

3.9 Fire alarm systems may be integrated with other systems (for example security and building management systems) provided that the fire alarm system can operate as a "stand-alone" system and is not dependent on a common central processor or any other system to carry out control over ancillary services. Integrated systems should comply with BS 7807.

4.0 Design philosophy

Protection

4.1 Fire detection and alarm systems in hospitals are primarily intended to protect life, but they also have a role in protecting property. Early warning of fire can also be of benefit in minimising disruption to the functioning of the hospital and in ensuring prompt resumption of service.

4.2 The extent of protection will depend on the particular local site circumstances. While in some cases it will be appropriate for all parts of a hospital to be protected, in others it may be appropriate to omit detectors from certain low-risk areas if an assessment of fire risk determines that they are not required.

In this context "assessment of fire risk" does not mean an SHTM 86 fire risk assessment.

4.3 In assessing fire risk, account should be taken of the economic consequences of a fire. Also, a fire in a non-patient access area may seriously affect patient care by:

a. spreading to a patient access area;

b. disrupting a service or function upon which patient care depends, for example heating, power and pharmacy;

c. causing prolonged vacation of parts of the building due to fire-fighting operations and subsequent building restoration;

d. destroying critical records;

e. damaging or destroying reserve and back-up life-saving equipment in storage, for example neo-natal, theatre or intensive care apparatus.

4.4 Detectors may only be omitted from an area that:

a. is under continuous surveillance by staff; or

b. has neither a high fire load nor significant ignition sources; and in which all of the following conditions are satisfied:

c. the area is not a patient access area;

d. the area does not contain contents of high value;

e. there is adequate fire separation between the area and adjoining patient access areas.

4.5 Examples of areas where detectors may possibly be omitted are as follows:

- administration offices (other than in-patient access areas);
- telephone switchboards.

Requirement

4.6 A type M and L1 system should be provided throughout all parts of the hospital. However, detectors need not normally be provided in the following areas:

- bath/shower rooms;
- toilets in staff areas;
- small cupboards (less than $1m^2$);
- voids and roof spaces which contain only:
  - (i) mineral insulated wiring or wiring laid on metal trays or in metal conduits; and/or
  - (ii) metal pipes or plastic pipes used for water supply or drainage; and/or
  - (iii) non-combustible ductwork.

4.7 Detectors should only be omitted from other areas on the basis of an assessment of fire risk. However, the following areas should always be protected:

- all patient access areas;
- fire hazard rooms and areas;
- rooms or departments below patient access areas from which fire can spread vertically to affect patient access areas;
- hazard departments;
- stairways, lobbies, and corridors used as means of escape where not in frequent use;
- patient hotels;
- commercial enterprises;
- atria;
- mechanical and electrical services plantrooms (other than water tank rooms);
- toilets intended for use by the public.

4.8 Omission of detectors from any area should be the subject of consultation (see paragraph 1.12).

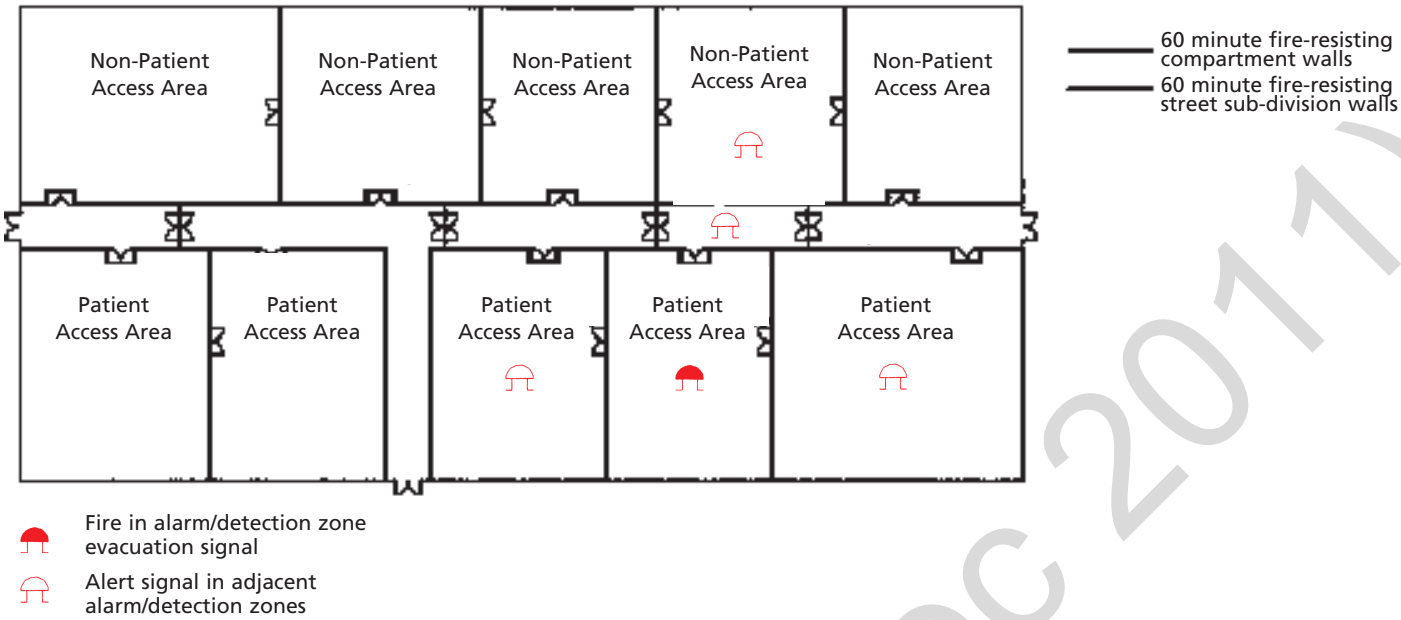
Zoning

4.9 The hospital should be divided into zones for the purpose of indicating the presence of fire (detection zones) and giving the alarm (alarm zones). Wherever possible, detection zones and alarm zones should correspond with each other. In non-patient access areas, it is permissible for an alarm zone to be made up of more than one detection zone but not vice versa (see Figure 1).

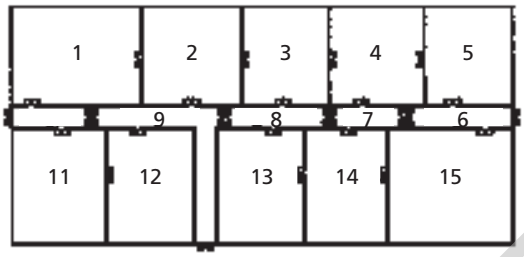
In the case of small sub-compartments, it may be appropriate to make the compartment the boundary of the alarm zone.

4.10 To facilitate progressive horizontal evacuation in patient access areas, each sub-compartment should normally be a separate zone. Hospital streets may often be extensively sub-divided by 60 minute fire-resisting construction to maintain the independence of escape routes. The alarm zone for a hospital street may, therefore, include several street sub-divisions, see Figure 1.

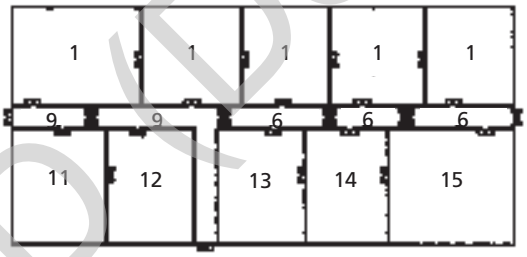
Figure 1 Zoning

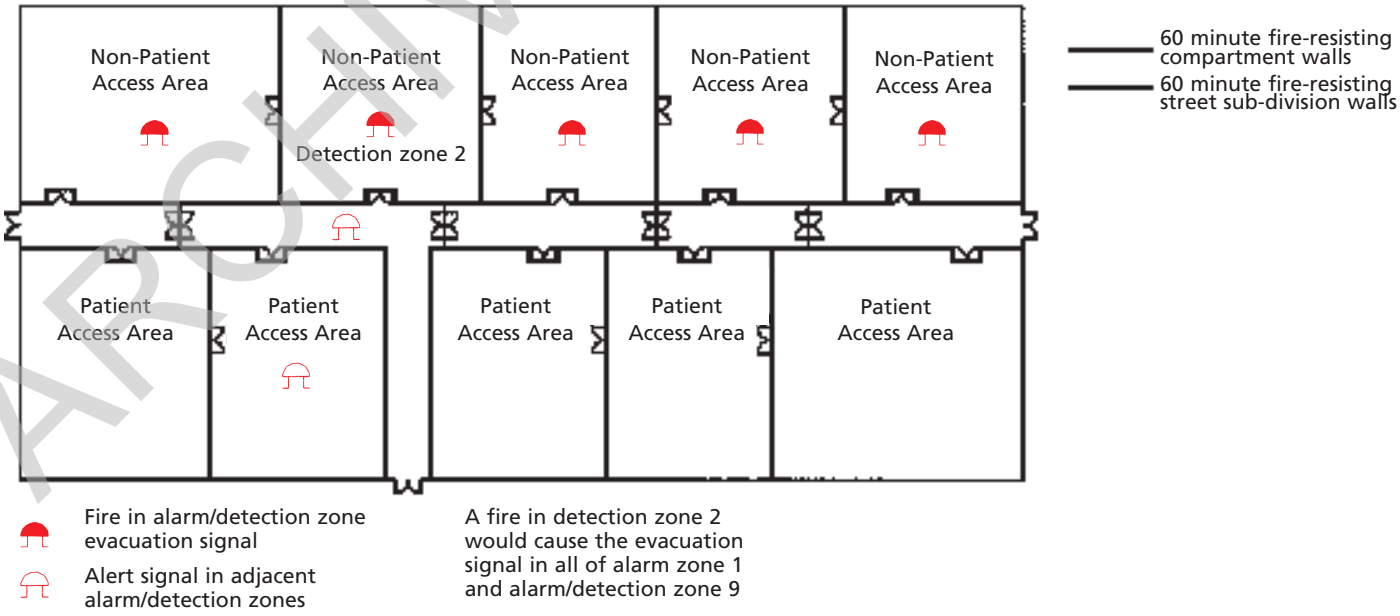


Detection zones



Alarm zones





A fire in detection zone 2 would cause the evacuation signal in all of alarm zone 1 and alarm/detection zone 9

Requirement

4.11 The hospital should be divided into detection zones in accordance with BS 5839: Part 1 (except that the search distance criterion need not apply where the system is addressable and the source of the alarm can be readily determined from the description of each device's location).

4.12 In patient access areas, alarm zones should correspond with detection zones, and, to facilitate progressive horizontal evacuation, no detection/alarm zone should extend beyond a single sub-compartment/compartment boundary (as appropriate).

4.13 In non-patient access areas, alarm zones may be made up of more than one detection zone depending upon the operational requirements for the system.

4.14 Atria, commercial enterprises and hazard departments should be separate detection/alarm zones.

Small commercial enterprises need not form separate detection zones provided the operation of detectors within the area can be readily determined at all times (for example by the use of addressable detectors or remote indicator lamps). Again, it may not be necessary for small commercial enterprises to form separate alarm zones.

Alarm

4.15 In a hospital, staff, not the patients, are the people who need to be alerted when the fire alarm operates, because generally the staff are responsible for taking initial action in fighting the fire and in moving patients away to a place of safety. It is also undesirable that patients should be disturbed unnecessarily by the noise of the fire alarm, as:

a. some may be critically ill and may be affected by the noise;

b. due to their medical state or treatment, the inability to escape may cause confusion and distress.

4.16 The above has implications for the audibility of the alarm and the extent to which the alarm is given. The audibility of the general alarm in those patient access areas where patients require assistance to evacuate (for example wards) need only be sufficient to warn staff. The extent of the alarm should initially be restricted to those areas involved in the first phase of the evacuation of the hospital.

4.17 In at least patient access areas, a two-stage alarm system should be operated, such that the sub-compartment/compartment from which the alarm has originated receives the "evacuate" signal and adjacent sub-compartments/compartments receive the "alert" signal (see Figure 2 for a typical two-stage alarm arrangement). However, to operate a two-stage alarm, there must be adequate acoustic separation between areas in which the "evacuate" signal will be given and areas in which the "alert" signal will be given.

4.18 Consideration should be given to providing, during the first phase, an "alert" or "evacuate" signal in other parts of the hospital from where escape may be difficult or protracted (for example basements and roof plantrooms). It is essential that there are facilities to start an "alert" or "evacuate" signal in other areas to permit subsequent phases in the evacuation of the hospital to be initiated.

4.19 To avoid unnecessary disturbance, staff elsewhere in the hospital who are required to perform particular tasks in the event of a fire should be alerted by means other than the sounding of the fire alarm (for example by pagers).

Figure 2 Typical two-stage alarm arrangement for three-storey ward block

Cause/Effect diagram

Alarm in zone / Detection zone	1	2	3	4	5	6	7	8	9
1	●	○		○					
2	○	●	○		○				
3		○	●			○			
4	○			●	○		○		
5		○		○	●	○		○	
6			○		○	●			○
7				○			●	○	
8					○		○	●	○
9						○		○	●

● Evacuate ○ Alert

Zoning

Second Floor	1	2	3
First Floor	4	5	6
Ground Floor	7	8	9

Requirement

4.20 Audible alarm devices should be provided in all areas of the hospital. There should be careful siting of alarm devices so as to warn staff without undue disturbance to patients. To achieve this, the audibility of the general alarm in areas where patients require assistance to evacuate need only be typically in the range 45–55 dB(A), or 5 dB(A) above the notional noise level, whichever is greater. Sound pressure levels in excess of this should, as far as possible, be avoided. It is preferable that a large number of quieter sounders, rather than a few very loud sounders, are used to prevent noise levels in some areas becoming too loud.

4.21 Visual alarm devices may be provided as an alternative to alarm sounders in areas where an audible alarm is unacceptable, for example very high dependency patient access areas, such as operating theatres, ITUs and special care baby units.

4.22 In areas where patients can escape unaided and in non-patient access areas, the audibility of the alarm should be in accordance with BS 5839: Part 1.

4.23 To facilitate progressive horizontal evacuation, the system should be designed for phased evacuation and a two-stage alarm as follows:

- evacuate signal in the detection/alarm zone of origin of fire;
- alert signal in horizontally adjoining alarm zones and those directly above and below.

4.24 The system should automatically extend the alert and evacuate signals if fire is detected in another sub-compartment. Manual alert/evacuate controls should also be provided for all alarm zones to allow subsequent phases of the evacuation to be controlled by staff and/or the fire brigade.

System control and display of information

4.25 Information on the existence and source of an alarm is required for the following purposes:

a. to enable the fire brigade to be summoned;

b. to allow staff to respond in accordance with the hospital's evacuation procedures;

c. to guide the fire brigade to the source of the alarm.

4.26 In addition to undertaking normal system control functions, staff or the fire brigade may also need to control the phased evacuation of the building.

4.27 The necessary control and indicating equipment, and its siting to facilitate the above, will depend on the evacuation procedures for the hospital and will therefore be determined by local site circumstances. There should at least be a control and indicator panel at a suitably

staffed location from where the fire brigade can be summoned, and also at the designated entrance at which the fire brigade attend. In addition, consideration should also be given to the security of control and indicator panels against unauthorised use.

4.28 In large hospitals in particular, repeat control and/or indicator panels may also be required at points where staff rendezvous. It may also be desirable to give information to staff not directly involved, to make them aware of the alarm and the possibility that evacuation may be necessary. This could be achieved by, for example, the use of repeat alphanumeric text displays at nurse stations.

4.29 Where the hospital consists of many buildings on a site and there is more than one fire alarm system, alarm signals should be relayed to a common 24-hour supervised location from where the fire brigade can be summoned and from where staff who perform particular tasks can be alerted.

Requirement

4.30 As a minimum, control and indicating equipment should be provided at the main entrance to the hospital (or at the entrance at which the fire brigade attend, if different). Control and indicating equipment should also be provided in a location supervised 24 hours a day (for example telephone switchboard) where present.

4.31 Additional control and indicating equipment should be provided where required by the hospital's evacuation procedures. This should be the subject of consultation (see paragraph 1.11).

4.32 Manual alert/evacuate controls for each alarm zone should at least be provided at the fire brigade entrance, but may also be required at other locations depending upon the hospital's evacuation procedures.

Ancillary services

4.33 In a hospital there are systems, devices or facilities related to the means of escape and other fire precautions that may depend on the fire alarm system for their actuation. These may include:

a. automatic door releases and door control systems;
b. access control systems;
c. ventilation and damper control systems;
d. fuel supplies;
e. lifts (see paragraph 4.43 below);
f. fixed extinguishing systems;
g. smoke control systems;
h. stairway pressurisation systems;
j. site signalling system;
k. shutters.

The design of all exits should recognise the often conflicting requirements of means of escape and security of the hospital; solutions should be agreed between enforcing authorities and the hospital management and its security advisers.

4.34 It may not always be necessary to actuate ancillary services when the fire alarm system operates. For example, electronic locks securing exit doors may not need to be released automatically if a manual means of override is present by the door. Similarly, whilst it may be prudent to return passenger lifts to the ground floor and disable them, this would not be appropriate for escape bed lifts. It is important, therefore, that the need for actuation of ancillary services is established in the light of the hospital's overall fire safety strategy.

4.35 The cause and effect logic for the actuation of ancillary services should be documented, preferably in the form of a diagram. This should be part of the specification for the system.

4.36 Where required as part of the contract for the fire alarm system, manual controls to allow the fire brigade to control ventilation plant should be sited either adjacent to the fire alarm control panel or adjacent to the department entrance.

Requirement

4.37 Ancillary services should be actuated by the fire alarm system where required by the overall fire safety strategy or by statutory requirements. This should be the subject of consultation.

4.38 The cause and effect logic for the actuation of ancillary services should be based on the following:

Automatic door releases and door control systems

4.39 For fire doors to be held open on automatic door releases, all of the following criteria should be satisfied:

a. the door release mechanism should conform to BS 5839: Part 3: 1988 and be fail-safe (that is, in the event of a fault or loss of power the release mechanism should be triggered automatically);

b. all doors fitted with automatic door releases should be linked to the alarm and detection system;

c. all automatic door releases within a compartment/sub-compartment should be triggered by all of the following:

   (i) the actuation of any automatic fire detector within the compartment/sub-compartment (see also paragraph 4.40);

   (ii) the actuation of any manual fire alarm call point within the compartment/sub-compartment (see also paragraph 4.40);

d. automatic door releases must be provided with a ready means of manual operation from a position at the door.

A short delay (for example 10 seconds) may be appropriate in some wards to allow patients to move away from doorways before the doors close

4.40 As a minimum, automatic door releases should be arranged to automatically close doors, both within and forming the boundary of, alarm zones where the "evacuate" and "alert" signals are sounded. It should also be possible to manually close all doors on automatic door releases by means of a dedicated control at the control and indicating equipment.

Access control systems

4.41 Where required, access control systems should automatically release (unlock) doors forming exits from alarm zones where the "evacuate" signal is sounded.

HVAC

4.42 Mechanical ventilation and air-conditioning systems should not normally be stopped when the fire alarm system operates. However, where there is a full or partial recirculation system in an alarm zone in which the "evacuate" signal is given, the extract should be diverted to discharge to the open air.

Lifts

4.43 Where lifts discharge into alarm zones in which the "alert" or "evacuate" signal is given, they should be returned to ground level or the level of the final exit from the building, if different, and disabled. Where this alarm zone is on the ground floor, or final exit level, the lifts should be returned to the storey immediately above and disabled. Escape bed lifts should not be controlled by the fire alarm system.

Smoke control systems

4.44 Smoke control and extract systems in, for example, atria, commercial enterprises and basements, should only be actuated automatically when fire is detected in the areas they serve.

Communication with the fire brigade

4.45 It is essential that, when an alarm of fire occurs, the fire brigade is summoned immediately. As a minimum, hospital staff should summon the fire brigade using the 999 emergency service. However, it will normally also be necessary to arrange for fire alarm signals to be transmitted automatically to the fire brigade or to a remote centre from where the fire brigade can be summoned.

4.46 Remote centres may comprise:

a. NHS premises, such as an ambulance control centre or a permanently manned telephone switchboard of another hospital;

b. central stations.

Where NHS premises are used, the standards of service and facilities offered should be equivalent to those of central stations. Preference should be given to remote centres that have third party certification.

4.47 Radio networks, such as ambulance radio systems, have been used to transmit fire alarm signals from a hospital to a remote centre. However, despite the inherent benefits of radio signalling, the reliability of the radio system needs to be carefully considered. For example, it is important that dedicated channels that are specifically licensed for alarm signalling purposes are used. The transmitter and its power supplies should be monitored for faults, and the base station should

automatically "poll" the hospital on a routine basis (typically every hour) in order to test the communications path. Overall, it is recommended that the use of radio networks for automatic transmission of the fire alarm signals should only be considered if the radio system is well proven and has been designed to ensure the high level of reliability required for a life safety system.

Requirement

4.48 The fire alarm system should be connected direct to the fire brigade or a remote centre, unless it is monitored in a location that is continuously manned on a 24-hour basis by at least two persons whose duties include summoning the fire brigade, and who have immediate access to a dedicated outgoing telephone line or a direct speech circuit to the local fire brigade control room.

4.49 A direct connection to the fire brigade by, for example, the "Alarms by Carrier" (ABC) signalling system is preferred to a connection to a remote centre.

4.50 The method of transmitting alarms to the remote centre should be by a reliable continuously monitored connection such as a direct line or the British Telecom RedCARE system. Radio networks (for example ambulance radio or Paknet) should only be used if the system is designed for alarm signalling, is of proven reliability, incorporates regular monitoring of the communications path, and is capable of providing a robust signal, preferably with a diversity of routing via two or more base stations.

4.51 Remote centres should be designed and operated in accordance with BS 5979.

5.0 Technical recommendations

Manual call points

5.1 Although BS 5839: Part 1 generally permits a 30 m maximum distance of travel between any point in a building and the nearest manual call point, in patient access areas much shorter distances are usually appropriate. The reason for this is that, in these areas, if fire occurs it is essential to minimise the time between discovery of the fire and raising the alarm in order to facilitate rapid attendance by trained staff and the fire brigade; it is also important to minimise the time taken to reach the nearest call point, so that the person discovering the fire can, if appropriate, quickly return to the scene to assist in extinguishment or evacuation of patients.

5.2 Similar considerations make it appropriate in patient access areas for the manual call points to be located on the accommodation side of exits to protected stairways (usually in conjunction with fire extinguishers), rather than on the stairway landings as recommended in BS 5839: Part 1. Siting manual call points on stairways is also likely to be inappropriate because, in multi-storey patient access areas, there will normally be a two stage alarm; if people moving down the stairway operate a call point on a floor below the floor of fire origin, an evacuation signal may be given in inappropriate areas, while no evacuation signal may be given where it is actually required.

5.3 In order to ensure that the appropriate alarm signal is given in each area, and that a reasonably accurate indication of the location of the fire is given at the fire alarm indicating equipment, manual call points should also be sited on both sides of main doorways between detection zones (that is, on each direction of approach). This is particularly important in the case of main doorways between compartments and between sub-compartments.

5.4 With the above exceptions, the type, siting and location of manual call points should normally be in accordance with the recommendations of BS 5839: Part 1. However, special considerations may apply in certain mental health units, where false alarms may result from deliberate operation of call points by patients. It is likely to be necessary to seek the advice of medical specialists to determine whether such considerations are required. In such cases, deviations from the recommendations of BS 5839: Part 1 may be appropriate. For example, the use of call points that do not comply with BS 5839: Part 2 may be considered (for example models that require two actions, such as lifting a flap and breaking a frangible element). The siting of manual call points may also be such that they are not easily accessible to patients, but are readily accessible to staff. In certain circumstances where patients cause considerable problems with the operation of manual call points and where all other preventative measures have failed, the use of key-operated call points may be considered.

Requirement

5.5 In non-patient access areas, manual call points should be sited in accordance with the recommendations of BS 5839: Part 1.

5.6 In patient access areas, manual call points should be sited as follows:

a. at or close to each nurses' station;

b. at each exit to a stairway (but not normally on stairway landings);

c. on both sides of main doorways between detection zones (in close proximity to the doors).

5.7 In mental health units, manual call point type and siting may deviate from the recommendations of BS 5839: Part 1 if false alarms are likely to occur due to deliberate operation of call points by patients. In these cases, manual call points need not comply with BS 5839: Part 2, or be readily accessible to patients; however, the call points should be easily and quickly accessible to staff.

Automatic fire detectors

5.8 Normally, the use of point-type smoke detectors is appropriate in all areas in which this SHTM recommends the provision of detectors. Exceptions are areas in which the use of smoke detectors would result in constant false alarms (for example kitchens); in these areas, point-type heat detectors should be used.

5.9 Other types of fire detection are likely to be appropriate only in special circumstances. For example, beam-type smoke detectors may offer efficient, economical fire detection in a large, open-plan entrance hall. Line-type heat detectors may be suitable for use in service tunnels. Flame detectors might be considered if, for example, the materials likely to be ignited are low flashpoint flammable liquids. Aspirating smoke detection can be used for protection of critical equipment rooms (such as computer rooms).

Guidance on the disposal of ionisation smoke detectors is available in SHTM 83

5.10 In circulation spaces, such as corridors and stairways, smoke detectors should normally be of the optical type, unless use of an ionisation chamber detector is necessary in order to avoid false alarms. In other areas in which smoke detectors are installed, either ionisation chamber detectors or optical detectors may be suitable; the guidance in BS 5839: Part 1 on detector selection should generally be followed. However, choice of detector should take into account both the nature of the fire load (and hence the likely type of fire) and the importance of avoiding false alarms (see paragraphs 5.15 and 5.37). Nevertheless, effectiveness in fire detection should not be sacrificed in order to avoid occasional false alarms.

5.11 Where the fire detection system is used to actuate automatic door releases, it is essential that smoke detectors are present relatively close to the doors, on both sides of the opening. Provided detectors have not been omitted from an L1 system as part of a fire risk assessment, no additional detectors will be required. Where this is not the case, detectors should be provided on both sides of the door opening (typically 0.5 to 1.5 metres away).

Requirement

5.12 Where protection by automatic fire detection is required, point-type smoke detectors should generally be used, except in kitchens and similar areas where false alarms would result from the use of smoke detectors. In such areas, point-type heat detectors should be installed. Other forms of fire detection may be considered only if there is justification on the basis of efficiency of detection or cost-effectiveness.

5.13 In circulation spaces, including stairways and corridors, any smoke detectors should be of the optical type. In other areas, either ionisation chamber or optical detectors may be used. Detector choice should take into account both efficiency of detection and avoidance of false alarms, but priority should be afforded to the former consideration.

5.14 If an L1 system has deviations (that is, detectors omitted due to fire risk assessment) in the immediate area of any automatic door release mechanism, optical smoke detectors should be sited on both sides of that door (typically 0.5 to 1.5 metres away).

False alarms

5.15 In any occupancy, false alarms can result in disruption and loss of confidence in the fire alarm system. In hospitals, the disruption can affect patient care. Since immediate and appropriate response in the event of fire is essential to safety of patients, any loss of confidence in the system can ultimately result in a lowering in the standard of fire safety. It is therefore essential that the installation design be such as to avoid, as far as reasonably practicable, false alarms. However, avoidance of false alarms should never take precedence over the need for effective detection and early warning in the event of fire.

5.16 Hospitals are often considered to be a major source of false alarms to which fire brigades are summoned. This does not necessarily reflect on the standards of fire alarm systems in hospitals, nor on the standards of maintenance and control that exist. The NHS is one of the major users of automatic fire detection in the UK, and there are many very large systems in hospitals. Statistically, the greater the number of detectors that exist, the greater will be the number of false alarms. Moreover, hospitals are occupied 24 hours a day, and there is therefore greater scope for activities to create false alarms than in many other occupancies. Also, the strictly disciplined fire procedures in hospitals probably result in the fire brigade being made aware of a greater-than-average proportion of false alarms.

5.17 Most false alarms that occur in hospitals are initiated by smoke detectors. The most common cause is response by the detector to either some fire-like phenomenon (such as steam, smoke from external bonfires, fumes from kitchens) or to a non-fire-like phenomenon to which the detector is sensitive (such as dust, insects, aerosols, sources of electromagnetic interference, etc). In certain rural areas, frequent false alarms are sometimes caused during the summer months by insects (cereal thrips). Other significant causes are believed to be people working on the system and accidental damage to the system. In psychiatric hospitals, a further significant cause of false alarms is operation of manual call points by patients. Faulty equipment does probably result in a significant, albeit unquantified, proportion of false

alarms, but is not considered to be the main cause. This suggests that a significant impact on false alarms can be made by the use of newer technology systems with decision-making algorithms that are designed to filter out false alarms, careful selection of detector type, care in the siting of detectors, proper control over work carried out on the system, and use of good-quality equipment.

5.18 Except in the case of small systems (see Chapter 3), all systems installed in accordance with this SHTM should be of the analogue type (see Appendix 1), which are likely to produce a lower rate of false alarms than conventional systems. However, experience has shown that some poorer analogue systems can give rise to constant problems, including false alarms. Some systems, both conventional and analogue, are also particularly poor in their sensitivity to electromagnetic interference, such as that generated by two-way radios and cellular telephones (see paragraphs 5.49–5.53). Therefore, it is important that all systems, whether analogue or conventional, are well proven in the field and, preferably, third-party certificated against a product standard (see paragraph 1.14).

5.19 In the future, it is likely that the use of certain multi-criteria fire detectors will be even more effective in reducing false alarms (see Appendix 1). A small number of systems using such detectors are commercially available, and it is likely that further systems will become available. The use of these should be considered in the future for systems in which the potential for false alarms is considered to be high.

5.20 In order to minimise the number of false alarms, installation design should take the following guidance into account in conjunction with that given in BS 5839: Part 1:

a. optical smoke detectors are particularly responsive to steam. They are also more responsive than ionisation chamber detectors to tobacco smoke, dust, and clouds of small insects, such as thrips;

b. ionisation chamber detectors are particularly responsive to fumes generated during certain cooking processes, including toasting of bread. They are also more responsive than optical detectors to vehicle exhaust fumes, and may become unstable if subject to rapid air velocities;

c. rate-of-rise heat detectors can produce false alarms if located close to ovens.

5.21 Proper management of the system and all work carried out on it is important. It is also important that, when any work is carried out in the building, particularly work that generates dust or that involves the use of welding or other sources of heat or smoke, measures are taken to avoid false alarms. In order to facilitate effective system management, there should be suitable facilities for isolation or disablement of parts of the system. These facilities should be such as to enable isolation or disablement of small sections, so that loss of protection is minimised.

5.22 In some systems, the potential for false alarms in certain areas, particularly from smoke detectors, may be higher at some times of the day, when an area is occupied, but much lower at others. In these cases, the use of a time-related system may be considered. For example, if monitoring of the area during the day can be guaranteed, smoke detection may be isolated automatically, perhaps in favour of heat

detection, during these hours. Similarly, the smoke detection could instead be used to initiate only a staff alarm during normal working hours.

5.23 Time related systems should only be used in circumstances where it is not envisaged that an acceptable rate of false alarms could be ensured by other means. If the use of a time-related system is based on the availability of staff to detect, or respond to, a fire, it must be ensured that sufficient staff will always be present (for example including lunch breaks, etc) when the system is in the less sensitive mode of operation. It will not normally be appropriate for the time-related mode of operation to apply to widespread areas of the hospital, but only to limited areas in which there is significant potential for false alarms, in conjunction with reliable surveillance or availability of staff, during only certain times of day.

5.24 It must be accepted that all fire detection and alarm systems are likely to produce false alarms at some times during their operational lifetime. Occasional false alarms must be accepted in order to obtain the substantial benefits in protection afforded by automatic detection. However, when a new system is installed, it is essential that careful attention is given to false alarms, so that any shortcomings in design or other problems can be identified before the credibility of alarm signals is seriously threatened. For new systems installed in existing hospitals, there should preferably be a defined "soak time" during which the performance of the system should be carefully monitored. Ideally, formal handover of the system to the user should not occur until the "soak time" has elapsed. Thereafter, if during the life of the system the rate of false alarms becomes unacceptable, there should be an early inspection of the problems by the installation contractor or maintenance organisation.

Requirement

5.25 In order to minimise false alarms, suitable system technology should be utilised. The systems used should be well proven. Equipment should preferably be third-party certificated against a product standard (see also paragraph 1.14). If there is potential for a large number of false alarms (for example due to the number of detectors required), consideration should be given to the use of multi-criteria fire detectors.

5.26 Smoke detectors should not generally be installed in dusty environments. If smoke detection is necessary in such an area, detectors should be cleaned regularly, and ionisation chamber detectors should be used in preference to optical detectors.

5.27 Smoke detectors should not be sited in close proximity to windows that are likely to be opened during normal circumstances.

5.28 Optical smoke detectors should not be installed in close proximity to showers, bathrooms or other sources of steam.

5.29 In rural areas, if thrips are likely to cause false alarms in summer months, the detector manufacturer should be required to confirm the suitability of detectors for the installation. Particular assurances should be obtained in respect of optical smoke detectors.

5.30 If a smoke detector is installed in a room in which people are likely to smoke, ionisation chamber smoke detectors should be used unless the ceiling height and/or ventilation rate is such as to avoid the transport of sufficient amounts of tobacco smoke to the detectors to cause false alarms.

5.31 Ionisation chamber detectors should not be installed in close proximity to kitchens, or equipment such as toasters, that may generate products that would cause false alarms.

5.32 In kitchens and other areas in which rapid fluctuations of temperature are likely, any heat detectors should be of the fixed temperature type.

5.33 The requirements specified in paragraphs 5.25–5.32 do not apply if it can be shown that the system technology is capable of filtering out false alarms from the sources in question.

5.34 All systems should be provided with facilities for disablement of fire detectors without isolation of manual call points.
The maximum area throughout which smoke detectors need to be disabled simultaneously should not exceed one of the fire detection zones into which the building is sub-divided. In conventional systems, the facilities may take the form of zonal isolate controls.
In addressable systems, there should be facilities to disable any individual detector on the system.

5.35 All systems should be provided with facilities to disable fire alarm sounders to minimise disruption during maintenance. Such facilities should be designed to minimise the extent of the area throughout which sounders are disabled and should be accessible only at access level 3 (as defined in BS 5839: Part 4). In conventional (non-addressable) sounder circuits, it should be possible to disable a single sounder circuit without disabling other circuits.

5.36 A time-related system should be used only if there is potential for a high rate of false alarms that cannot be avoided by other means. The use of a time-related system may then be considered in an area in which continuous surveillance, or rapid response, by staff can be reliably ensured at certain times of day. However, on receipt of an alarm signal, time-related systems should always alert someone in the hospital and not result in any delay in summoning of the fire brigade on receipt of an alarm signal.

5.37 For new systems installed in existing hospitals, there should be a "soak time" during which the system's performance is monitored prior to handover. The required "soak time" should be agreed with the installer prior to awarding the contract for the system. The period should be related to the size and complexity of the system, but should not normally be less than one week. In the case of large or complex systems, a period of one month may be appropriate. During the "soak time", any false alarm (or other fault) should be thoroughly investigated by suitably qualified staff of the hospital or the contractor. At the end of the "soak time", any false alarms (or other faults) should be formally reviewed by the installation contractor and, where appropriate, suitable modifications to the installation should be implemented before final acceptance of the system by the user.

Audible and visual alarms

5.38 The devices used to produce the audible alarm may be bells or electronic sounders. Electronic sounders having an adjustable sound output may be more beneficial in some circumstances. However, it is important that there is a common sound and therefore, only one type of device should be used.

5.39 As it is only staff who need to be alerted in many patient access areas, there is little benefit to be gained from generating spoken messages through a voice alarm system. However, there may be some benefit in the installation of voice alarm systems in areas where large numbers of the public congregate, for example out-patients and reception areas. A British Standard for the design of such systems is currently in the course of preparation. Until the standard is published, voice alarm systems should be designed and installed in accordance with a code of practice produced by the BFPSA.

Requirement

5.40 The same type of audible alarm device should be used throughout the hospital (that is, either bells or electronic sounders). Voice alarm systems provided in only part of the hospital may be used to give the fire alarm provided that any messages are preceded by an alarm sound identical to that generated by the audible alarm devices used elsewhere in the hospital.

5.41 Visual alarm devices should comprise flashing lights and should normally incorporate a sounder of low sound output (for example 50dB(A) at 1 m).

Radio linked systems

5.42 Radio linked systems are available and can comply with BS 5839: Part 1. In some of these systems, alarm sounders may also be linked to the control equipment by radio. This arrangement would not comply with the current recommendations of BS 5839: Part 1, because this feature was not available when BS 5839: Part 1 was drafted.

5.43 A well designed and engineered radio linked system could offer a number of advantages, such as ease of installation etc, most of which are discussed in BS 5839: Part 1. Their main disadvantage is the need for periodic replacement of batteries, which may prove expensive and inconvenient. It is also known that systems have been produced that complied with the specific recommendations of BS 5839: Part 1 relating to radio linked systems, but not necessarily with the spirit of other recommendations in the standard.

5.44 Subject to compliance with BS 5839: Part 1 and this document, radio linked systems may be used to provide temporary protection in hospitals. Such protection may be of value during contractors' operations in, for example, an area under refurbishment, where the normal system may not be operational, or during the construction of a new building. Temporary cover may also be useful during replacement of an existing fire alarm system, perhaps before the new system is fully operational.

Requirement

5.45 Radio linked alarm and detection systems should only be used in hospital buildings to provide temporary protection during refurbishments, construction of new buildings, or the replacement of an existing alarm system.

Electromagnetic interference

5.46 As indicated in BS 5839: Part 1, fire alarm systems may be affected by various sources of electromagnetic interference, such as transmissions from radios or cellular telephones, voltage transients, etc. Such interference may result in false alarms, system faults, malfunction of processors or other forms of malfunction. In hospitals, there are often numerous sources of interference, either in use by the public (for example cellular telephones) or in use for treatment of patients (for example, diathermy equipment).

5.47 Experience has shown that some fire alarm systems are more immune to the effects of electromagnetic interference than others. It is also known that installation parameters, such as the type of cable used, the method of termination, and even the material from which items such as junction boxes are manufactured, may have an effect on the immunity or otherwise of an installation, as opposed to the immunity of the equipment in isolation. If adequate care is not taken, mutual interference can also occur between fire alarm circuits (for example, "crosstalk" between loops in an addressable system).

Requirement

5.48 All systems should comply with the requirements of the EMC Directive (EC Directive 89/336/EEC as amended by EC Directives 91/236/EEC and 92/31/EEC).

5.49 Installation design and installation practices should be such as to minimise the susceptibility of the installation to electromagnetic interference. Particular care should be taken in the selection of cable, the continuity and equipotential of screens along their length, the bonding of metal parts, such as the door of a control panel and the panel's enclosure, and the termination of cables.

5.50 Account should be taken of the guidance contained in SHTM 2014 – 'Abatement of electrical interference'.

Power supplies

5.51 The reliability and integrity of both the main and standby power supplies to the fire detection and alarm system should be of a high standard. It should not be assumed that the presence of two supplies (main and standby) is any justification for the reliability of either supply to be reduced.

Requirement

5.52 The mains supply to the fire detection and alarm system should be derived from the hospital's essential services (automatically started standby generator-backed) supply.

5.53 The number of isolating devices between the incoming supply to the hospital and the fire alarm control and indicating equipment should be kept to the minimum practicable.

5.54 From the point at which the power supply circuit is first dedicated to the fire detection and alarm system (that is, from the point at which the supply is provided with the dedicated isolating-protective device described in BS 5839: Part 1), the circuit should be treated as a Category 3 circuit as defined by BS 7671 (IEE Regulations). Accordingly, the circuit should be suitably segregated from other circuits.

5.55 The circuits described in paragraph 5.54 should be treated as circuits requiring prolonged operation during a fire for the purpose of BS 5839: Part 1, and should therefore be protected against fire, either by physical protection or, preferably, by the use of fire-resisting cable.

5.56 Standby battery supplies for any part of the system should be capable of maintaining the system in normal operation for at least 24 hours, after which there should be sufficient capacity to operate all sounders in the evacuation mode for at least 30 minutes.

Appendix 1 – Available system technology

Conventional systems

1. Up until the early 1980s, when new technology addressable systems (see below) were introduced into the UK, all fire detection and alarm systems employed similar methods of transmitting signals between fire detectors and control equipment. Basically, any zone of detectors comprises a single (usually two-wire) circuit. Each manual call point and fire detector within that zone is connected in parallel across the circuit.

2. In electrical terms, each device on the zone circuit simply acts as a normally open switch. When a manual call point is operated on such a system, or when a detector detects the presence of a fire, the "switch" closes, resulting in virtually a short circuit (that is, a low impedance) across the pair of wires. The low impedance on the circuit is sensed by the control equipment, which recognises this as a fire signal from one of the devices on the zone.

3. Electrically each zone is, therefore, a radial circuit, which terminates in the field at an "end of line" device, such as a resistor. The resistor permits a small monitoring current to flow at all times. If a break occurs in the cable (an "open circuit" fault), the monitoring current can no longer flow, and a fault warning is given at the control and indicating equipment. If a true short circuit occurs, this is also detected as a fault because the impedance is even lower than occurs when a detector or manual call point operates. Thus the system can detect, and distinguish between, an open circuit fault (very high impedance), a fire signal (low impedance) and a short circuit fault (very low impedance).

4. Each detector is a "two-state" device (sometimes described as a "digital" device) in the sense that it is either in the normal state ("switch" open) or fire state ("switch" closed). When one of the devices on a zone operates, the only information available is that there is a fire condition somewhere within the zone in question; the control panel cannot distinguish between one device operating and another device on the same zone operating, as the effect will be exactly the same.

5. Systems of the above type are still available and are now usually described as "conventional" systems, to distinguish them from "addressable" systems.

Addressable systems

6. In an addressable system, there is some form of individual communication between each detector and the control equipment. Each circuit is therefore a form of simple data communications circuit, rather than simply an electrical circuit. Communication is normally achieved by some form of "polling", whereby the control equipment interrogates each detector or manual call point in turn, and the devices respond with "replies" that inform the control equipment about their present state. The time taken for the system to poll all devices on a single circuit must be sufficiently short to ensure that the delay between, for example, operation of a call point and sounding of the alarm is sufficiently short to satisfy BS 5839: Part 1.

7. The principal difference between an addressable system and a conventional system is therefore that, when a detector or call point operates in an addressable system, the identity of the device is known at the control equipment, whereas a conventional system cannot discriminate between the operation of one device and another device on the same circuit.

8. Within the software of the addressable system, the device identity can be converted into a pre-programmed location, which is then displayed on some form of text display (such as an LCD or vacuum fluorescent display). Thus, a clear English text description of the exact location of a fire can be displayed (for example, Room 120 2nd Floor).

9. Although the exact location of the fire can be displayed, compliance with current British Standards still requires that a more crude form of zone indication is also given. However, in a conventional system each zone is defined by an individual circuit, whereas in an addressable system, the devices within many zones may be connected to a single circuit. Since, in the event of a fire signal, the exact identity of the device involved is known, detectors and call points are configured into zones within the system software. This permits greater flexibility in zoning, and allows extra zones to be created at minimal cost.

10. The wiring in most addressable systems takes the form of a ring circuit (or "loop"), which initiates and terminates at the control equipment. In the event of an open-circuit fault, a warning is given, but communication with all devices is maintained, as there is still one (instead of the original two) signal path between each device and the control equipment.

Radial circuits can be used, either wired directly from the control equipment or as "spurs" off main loops.

11. If a short circuit occurs on an addressable loop that serves many zones, this could potentially result in loss of protection in all the zones concerned. To avoid this, short-circuit isolators are employed. These isolate at least the section of the loop involved. By siting short-circuit isolators at zone interfaces, it is possible to limit the loss of protection to the area of one zone (or at least to the maximum area permitted for a zone). In some systems, short-circuit isolators are fitted to each detector base, so that no loss of protection occurs in the event of a short circuit.

12. Some addressable systems are capable of transmitting instructions to addressable devices on the loop, as well as receiving information from detectors or call points. Thus, for example, when a fire is detected an addressable relay may be instructed by the control panel to operate, so closing doors, shutting down plant, etc. In a small number of systems, alarm sounders may also be addressable – this enables economies in wiring by installing sounders on the same addressable loops as fire detectors and call points.

Types of addressable system

Two-state

13. In the simplest of addressable systems, detectors are still of the two-state type. The detectors themselves make the decision as to whether or not there is a fire. The only difference between these detectors and those in a conventional system is that, when the addressable detector generates a fire signal, it also transmits its identity. The rate of false alarms generated by a two-state addressable system should, in theory, be no different from the rate generated by a conventional system.

Analogue

14. The majority of addressable systems are not of the two-state type, but are of the analogue/addressable type. In these systems, the detectors themselves do not make any decision as to whether or not there is a fire. Instead, the detectors (often described in this case as "sensors"), simply transmit to the control equipment a signal level that represents the amount of heat, smoke or flame that is being sensed. The decision as to whether or not this signal level represents a fire condition is taken at the control equipment.

15. In the simplest analogue systems, the control equipment merely applies "fixed thresholds" to the signal level from each detector. Thus, for example, above a certain threshold a "pre-alarm warning" may be given, representing a state that requires investigation as it may be due to either a small fire or contamination of the detector by some non-fire products. At a higher threshold, a fire signal would be given. At a very low signal level, a fault signal may be given to indicate that the detector has become very insensitive. Such a system is thus four-state (Fire, Pre-Warning, Normal, Fault), compared with the two-state nature (Fire, Normal) of a conventional or simple addressable system.

16. Greater sophistication in analysis of the analogue signals is incorporated into some analogue systems in order to reject as many false alarms as possible. Analysis of the rate of rise of signal level may also enable earlier detection of fire, while eliminating certain types of false alarm.

17. Most analogue systems also have facilities to read off the current analogue values of all detectors on the system. This can enable identification of detectors that need to be cleaned or of detectors that are more prone to false alarms due to high levels of pollutants in their environment.

Multi-state

18. Such is the processing power that can be fitted to each detector head by incorporation of microprocessors, that some analysis of signal level can be carried out within the detector head, which can then transmit several different states to the control equipment, rather than just two. In such a "multi-state" system, each detector is capable of transmitting more than two different states along with its individual identity (for example, fault, normal, pre-warning, fire).

Multi-criteria

19. In the past, each detector head has been capable of sensing just one of the characteristic phenomena of fire (heat, smoke or flame) by just one technique (for example optical scattering or use of an ionisation chamber).

20. In multi-criteria detector systems, each detector head incorporates more than one sensor and so is capable of detecting more than one phenomenon. In some systems, by comparing the signals from the different sensors, it is possible to avoid certain false alarms. For example, whereas an optical detector close to a source of steam may produce false alarms, a

detector that incorporates a heat or ionisation chamber sensor may not produce a false alarm because of the absence of sufficient signal level from the heat or ionisation chamber sensor.

21. Multi-criteria detector systems are still relatively uncommon, and there are only a few commercially available systems. However, there is some experience to suggest that they can significantly reduce false alarms, particularly in "difficult" environments. A European Standard for multi-criteria systems is in the course of preparation. It is likely that these systems will become more common during the life of this SHTM.

Appendix 2 – Fire hazard rooms and areas and hazard departments

The following are examples of fire hazard rooms:

- chemical stores;
- cleaners' rooms;
- clothes storage;
- dayrooms;
- disposal rooms;
- laboratories;
- lift motor rooms;
- linen stores;
- patient bedrooms provided for:
  a. elderly people;
  b. those suffering from a mental illness;
  c. people with learning difficulties;
- staff changing and locker rooms;
- store rooms;
- ward kitchens;
- X-ray film and record stores;
- all rooms within the main laundry in which delivery, sorting, processing, packing and storing are carried out.

The following are hazard departments:

- atrium;
- boilerhouse;
- central staff change;
- central stores;
- commercial enterprises;
- central sterile supplies or hospital sterilizing and disinfecting unit;
- flammable store;
- health records;
- laundry;
- main electrical switchgear;
- main kitchens;
- main stores;
- medical gas stores;
- pathology;
- pharmaceutical (manufacturing);
- refuse collection/incineration;
- works.

References

Acts and Regulations

Registered Homes Act 1984. HMSO 1984.

British Standards

BS 5839 Fire detection and alarm systems for buildings

Part 1: 1988 Code of practice for system design, installation and servicing.

Part 2: 1983 Specification for manual call points.

Part 3: 1988 Specification for automatic release mechanisms for certain fire protection equipment.

Part 4: 1988 Specification for control and indicating equipment.

Part 8: (1998) Code of practice for the design, installation and servicing of voice alarm systems associated with fire detection systems.

BS 5979: 1993 (Work in hand) Code of practice for remote centres for alarm systems.

BS 7671: 1992 Requirements for electrical installations. IEE Wiring Regulations. Sixteenth Edition. (AMD 8215, 1/95).

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