



BSI Standards Publication

Fire detection and fire alarm systems for buildings

Part 1: Code of practice for design, installation, commissioning
and maintenance of systems in non-domestic premises

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Summary of pages

This document comprises a front cover, and inside front cover, pages i to viii, pages 1 to 172, an inside back cover and a back cover.

Foreword

Publishing information

This part of BS 5839 is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 August 2017. It was prepared by Technical Subcommittee FSH/12/1, *Installation and servicing*, under the authority of Technical Committee FSH/12, *Fire detection and fire alarm systems*. A list of organizations represented on these committees can be obtained on request to its secretary.

Supersession

This part of BS 5839 supersedes BS 5839:2013, which is withdrawn.

Information about this document

This is a full revision of the standard, and introduces the following principal changes:

- a) In [Clause 2](#):
- 1) BS 8591, *Remote centres receiving signals from alarm systems – Code of practice* replaces the reference to BS 5979, which has been withdrawn; and
 - 2) references have been added to:
 - BS EN 54-21, *Fire detection and fire alarm systems – Part 21: Alarm transmission and fault warning routing equipment*;
 - BS EN 54-29, *Fire detection and fire alarm systems – Multi-sensor fire detectors – Point detectors using a combination of smoke and heat sensors*;
 - BS EN 54-30, *Fire detection and fire alarm systems – Multi-sensor fire detectors – Point detectors using a combination of carbon monoxide and heat sensors*; and
 - BS EN 54-31, *Fire detection and fire alarm system – Part 31: Multi-sensor fire detectors – Point detectors using a combination of smoke, carbon monoxide and optionally heat sensors*.
- b) In [Clause 3](#), the definition of “critical signal path” has been expanded to include transmission equipment for the routing signals to alarm receiving centres and the definition of ‘false alarm’ has been changed to refer to ‘environmental false alarms’.
- c) In [Section 3](#) a new definition of “unwanted fire signal (UwFS)” has been added, taking into account the effect on the fire and rescue service.
- d) In [8.2](#) the multi-sensor detectors are now considered as one of the detection options for Categories L3 and L4 systems and in escape routes for Category L1 systems. An informative note explains the process of designing Category L2 systems.
- e) In [11.2](#) and [20.2b](#)), it is now recommended that a protective cover is fitted to a Type A manual call point to help prevent false alarms.
- f) [11.2](#) now recommends that alarm transmission and fault warning routing equipment should conform to the requirements specified in BS EN 54-21.
- g) [15.2](#) now recommends that alarm receiving centres to which fire alarm signals are relayed should conform to BS 8591 and have in place an agreement with the appropriate fire and rescue service to pass on fire signals from fire alarm systems at the monitored property.

- h) [15.2](#) also includes a new recommendation that, where fire alarm signals are routed via the routing equipment of an intruder alarm system, the standby power supplies for the routing equipment should conform to [25.4](#).
- i) In [19.2.2](#), it is acknowledged that, in premises, other than residential care homes, that generate a high number of unwanted fire alarm signals, automatic transmission of a signal to an alarm receiving centre may be delayed pending investigation of alarm signals from these devices.
- j) A new subclause, [21.1.7](#) has been introduced specifically addressing video fire detectors, re- grouping text which was in different subclauses in the 2013 edition of the code.
- k) New text in [21.1.8](#) commentary explains detection principle choices involving single sensor detectors and multi-sensor detectors.
- l) Attention is drawn in [Clause 22](#) to the need to consider field testing of hard-to-access detectors when designing the system.
- m) In [22.9](#) and [Table 3](#), it is now recommended that the limits specified for ceiling heights should only be used as guidance for vertical or flue-like structures, such as lift shafts and stairwells.
- n) In [25.2](#), the recommendation to provide double pole isolation has been replaced with a recommendation to provide local safe isolation. An informative note explains what is meant by “special tool”.
- o) In [26.2](#), the recommendations for cables, wiring and other interconnections have been updated to reflect the currently available standards: BS EN 60702-1, BS EN 60702-2, BS 7629-1 and BS 7846. In addition, the duration of survival of cables has been referred to the tests in BS EN 50200 and BS 8434-2.
- p) The heading of [Clause 29](#), “Electrical safety”, has been replaced by the new heading “Electrical Earthing”.
- q) [Section 3](#) has been expanded and introduces the concept of “unwanted fire alarm signals”. To minimize the risk of false alarms and unwanted fire alarm signals, it recommends that manual call points should be fitted with protective covers and that systems that incorporate connection to an alarm receiving centre should have this connection disabled during the soak period.
- r) In [Clause 45](#), recommendations have been added for:
 - 1) measuring the battery voltage;
 - 2) testing of multi-sensor fire detectors;
 - 3) for using different types of devices when carrying system tests; and
 - 4) checking whether a suitable zone plan has been provided.
- s) There is a new [Annex E](#) (informative), which gives advice regarding selection and application of fire detectors.
- t) [Annex F](#) in the 2013 edition, which gave guidance on visual alarm device illumination characteristics, has been removed as it duplicated the information in the referenced code: LPS CoP 0001 [1].

National building regulations [[2](#), [3](#), [4](#)] require fire detection and fire alarm systems to be installed in many buildings at the time of construction. In addition, legislation requires that, where necessary to safeguard relevant persons in case of fire, existing premises are equipped with “appropriate fire detection and fire alarm systems”.

Although this standard makes recommendations for the provision of fire detection and fire alarm systems in a wide variety of premises, reference to particular types of premises in [Annex A](#) does not

necessarily mean that all such premises are required by law to have such systems installed. In certain small premises, word of mouth or mechanical devices, such as rotary gongs, might constitute an adequate means of giving warning to occupants in the event of fire. The need for a fire detection and fire alarm system, and the nature of the system, is often determined by a fire risk assessment.

The fire and rescue authority can advise on the fire legislation that applies to any building. If a fire detection and fire alarm system is to be installed, or modified, to satisfy the requirements of legislation, early consultation with the authority or authorities responsible for enforcement of the legislation might be appropriate.

The protection of property with a fire detection and fire alarm system could result in an insurance company being prepared to offer a reduced premium, provided that the system is acceptable. Early consultation with the insurer is thus advisable.

Fire protection is not to be confused with fire prevention or other fire precautions, and the provision of a fire detection and fire alarm system can never be regarded as giving complete protection against fire. A fire detection and fire alarm system is, however, likely to form an important component in defence against fire, and can form part of a fire engineering solution. Advice on the likely need for a fire detection and fire alarm system in certain premises is given in BS 9999. For advice on fire engineering solutions, reference can be made to BS 7974 and PD 7974-4.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and competent people, for whose use it has been produced.

Text introduced or altered by Corrigendum No. 1 is indicated in the text by tags C1 C1. Minor editorial corrections are not tagged.

Use of this document

As a code of practice, this British Standard takes the form of guidance and recommendations.

It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).

The word “should” is used to express recommendations of this standard. The word “may” is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word “can” is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this standard. Notes give references and additional information that are important but do not form part of the recommendations.

Commentaries give background information.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Section 1: General

1 Scope

This part of BS 5839 provides recommendations for the planning, design, installation, commissioning and maintenance of fire detection and fire alarm systems in and around buildings, other than domestic premises. It does not recommend whether or not a fire detection and fire alarm system should be installed in any given premises. Recommendations for fire detection and fire alarm systems in domestic premises are given in BS 5839-6.

The term fire detection and fire alarm systems, in the context of this part of BS 5839, includes systems that range from those comprising only one or two manual call points and sounders to complex networked systems that incorporate a large number of automatic fire detectors, manual call points and sounders, connected to numerous inter-communicating control and indicating panels.

The term also includes systems that are capable of providing signals to initiate the operation of other fire protection systems and equipment (such as fire extinguishing systems, smoke control systems or automatic door release equipment) or safety measures (such as shutdown of air handling systems, closing of oil or gas valves or grounding of lifts). It does not apply to the other systems and equipment themselves, or the ancillary circuits to interface with them. Recommendations for the planning, installation and servicing of facilities for operation of certain fire protection systems by the systems addressed within this part of BS 5839 are given in BS 7273 (all parts).

This part of BS 5839 does not cover systems whose primary function is to extinguish or control fire, such as sprinkler or automatic extinguishing systems, even though they might have a secondary alarm function; it does, however, cover the use of a signal from an automatic extinguishing system as one initiating element of a fire alarm system (e.g. by use of a pressure or flow switch).

This part of BS 5839 does not cover voice alarm systems. Recommendations for voice alarm systems and voice sounders are given in BS 5839-8.

This part of BS 5839 does not cover systems combining fire alarm functions with other non-fire related functions. Recommendations for such integrated systems are given in DD CLC/TS 50398.

This part of BS 5839 does not cover the 999 (or 112) public emergency call system, or manually or mechanically operated sounders.

This part of BS 5839 does not cover audible or visual way-guidance systems which are designed to complement fire alarm systems.

Recommendations for fire detection and fire alarm systems in electronic data processing installations and similar critical electronic equipment rooms are given in BS 6266, which provides recommendations over and above those given in this part of BS 5839.

Recommendations for fire detection and fire alarm systems in hospitals are given in the NHS Estates publications HTM 05-03 Part B [N1] (in England and Wales) or SHTM 82 [N2] (in Scotland).

This part of BS 5839 applies to extensions and alterations to existing systems, at least in respect of the design, installation, commissioning and certification of the new work, albeit that the extended or altered system might not, overall, conform to the recommendations of this standard.

2 Normative references

The following documents are referred to in the text in such a way that some of all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 476, *(relevant parts), Fire tests on building materials and structures*

BS 4678-4, *Cable trunking — Part 4: Specification for cable trunking made of insulating material*

BS 5839-8, *Fire detection and fire alarm systems for buildings — Part 8: Code of practice for the design, installation, commissioning and maintenance of voice alarm systems*

BS 5839-9, *Fire detection and alarm systems for buildings — Part 9: Code of practice for the design, installation commissioning and maintenance of emergency voice communication systems*

BS 7273 (all parts), *Code of practice for the operation of fire protection measures*

BS 7629-1, *Electric cables — Specification for 300/500 V fire resistant screened, fixed installation cables having low emission of smoke and corrosive gases when affected by fire — Part 1: Multicore cables*

BS 7671, *Requirements for Electrical Installations — IET Wiring Regulations (Seventeenth edition)*¹⁾

BS 7846, *Electric cables — Thermosetting insulated, armoured fire-resistant cables of rated voltage 600/1 000 V fixed insulation, having low emission of smoke and corrosive gases when affected by fire — Specification*

BS 8434-2, *Methods of test for assessment of the fire integrity of electric cables — Part 2: Test for unprotected small cables for use in emergency circuits — BS EN 50200 with a 930°C flame and with water spray*

BS 8591, *Remote centres receiving signals from alarm systems — Code of practice*

BS 9999, *Fire safety in the design, management and use of buildings – Code of practice*

BS EN 54-2:1997+A1:2006, *Fire detection and fire alarm systems — Part 2: Control and indicating equipment*

BS EN 54-3, *Fire detection and fire alarm systems — Part 3: Fire alarm devices — Sounders*

BS EN 54-4, *Fire detection and fire alarm systems — Part 4: Power supply equipment*

BS EN 54-5, *Fire detection and fire alarm systems — Part 5: Heat detectors — Point heat detectors*

BS EN 54-7, *Fire detection and fire alarm systems — Part 7: Smoke detectors — Point detectors using scattered light, transmitted light or ionization*

BS EN 54-10, *Fire detection and fire alarm systems — Part 10: Flame detectors — Point detectors*

BS EN 54-11, *Fire detection and fire alarm systems — Part 11: Manual call points*

BS EN 54-12, *Fire detection and fire alarm systems — Part 12: Smoke detectors — Line detectors using an optical beam*

BS EN 54-20, *Fire detection and fire alarm systems — Part 20: Aspirating smoke detectors*

BS EN 54-21, *Fire detection and fire alarm systems — Part 21: Alarm transmission and fault warning routing equipment*

BS EN 54-23, *Fire detection and fire alarm systems — Part 23: Fire alarm devices — Visual alarm devices*

BS EN 54-25:2008, *Fire detection and fire alarm systems — Part 25: Components using radio links*

¹⁾ This part of BS 5839 also gives informative references to BS 7671:2008+A3:2015.

BS EN 54-26, *Fire detection and fire alarm systems — Part 26: Carbon monoxide detectors — Point detectors*

BS EN 54-29, *Fire detection and fire alarm systems — Part 29: Multi-sensor fire detectors — Point detectors using a combination of smoke and heat sensors*

BS EN 54-30, *Fire detection and fire alarm systems — Part 30: Multi-sensor fire detectors — Point detectors using a combination of carbon monoxide and heat sensors*

BS EN 54-31, *Fire detection and fire alarm system — Part 31: Multi-sensor fire detectors — Point detectors using a combination of smoke, carbon monoxide and optionally heat sensors*

BS EN 50200:2015, *Method of test for resistance to fire of unprotected small cables for use in emergency circuits*

BS EN 60079-14, *Explosive atmospheres — Part 14: Electrical installations design, selection and erection*

BS EN 60702-1, *Mineral insulated cables and their terminations with a rated voltage not exceeding 750 V — Part 1: Cables*

BS EN 60702-2, *IEC 60702-2, Mineral insulated cables and their terminations with a rated voltage not exceeding 750 V — Part 2: Terminations*

BS EN 61386 (all parts), *Conduit systems for cable management*²⁾

BS EN 60079-14, *Explosive atmospheres — Part 14: Electrical installations design, selection and erection*³⁾

BS EN 60079-17, *Electrical apparatus for use in the presence of combustible dust — Part 17: Inspection and maintenance of electrical installations in hazardous areas (other than mines)*³⁾

BS EN ISO 13943, *Fire safety — Vocabulary*

BS ISO 7240-8, *Fire detection and alarm systems — Part 8: Point-type fire detectors using a carbon monoxide sensor in combination with a heat sensor*

BS ISO 7240-15, *Fire detection and alarm systems — Part 15: Point-type fire detectors using smoke and heat sensors*

[N1] *Health Technical Memorandum 05-03: Operational provisions, Part B, Fire detection and alarm systems*. Department of Health. 2006. London: The Stationery Office

[N2] *Scottish Health Technical Memorandum 82, Fire alarm and detection systems*. NHS National Services Scotland. 2013. London: The Stationery Office

3 Terms and definitions

For the purpose of this part of BS 5839, the terms and definitions in BS EN ISO 13943 and the following apply.

3.1 addressable system

system in which signals from detectors, manual call points or any other devices are individually identified at the control and indicating equipment

²⁾ This replaces the previously referenced standard BS EN 50086.

³⁾ These replace the previously referenced standard BS EN 50281.

3.2 alarm receiving centre ARC

continuously manned premises, remote from those in which the fire detection and fire alarm system is fitted, where the information concerning the state of the fire alarm system is displayed and/or recorded, so that the fire and rescue service can be summoned

3.3 alarm zone

geographical subdivision of the protected premises, in which the fire alarm warning can be given separately, and independently, of a fire alarm warning in any other alarm zone

3.4 aspirating smoke detection system

smoke detection system in which a sample of the atmosphere in the protected space is drawn by a fan or pump into a detector which may be remote from the protected space

3.5 audibility

property of a sound which allows it to be heard among other sounds

NOTE Audibility depends upon the relative loudness and frequency content of the sound in comparison with other sounds which are present at the same time.

3.6 automatic fire detection and fire alarm system

system (other than a single self-contained smoke or fire alarm) in which an alarm of fire can be initiated automatically

3.7 circuit

assembly of fire alarm components supplied from the same control equipment and protected against overcurrent by the same protective device(s) or current limitation arrangements

3.8 circulation area

area (including a stairway) used mainly as a means of access between a room and an exit from the building or compartment

3.9 coincidence

arrangement designed so that an output is obtained only when at least two independent input triggering signals are present at the same time

NOTE This is not to be mistaken for "double knock", which is a colloquial term often used for an arrangement whereby an output is given only when two successive signals are received from the same device.

3.10 combustion gas detector

automatic fire detector sensitive to gaseous products of combustion and/or thermal decomposition

3.11 commissioning

process by which it is determined that the installed system meets the defined requirements

3.12 competent person

person with the relevant current training and experience, and with access to the requisite tools, equipment and information, and capable of carrying out a defined task

3.13 control and indicating equipment CIE

component or components of a fire detection and fire alarm system through which other components can be supplied with power and which:

- a) are used:
 - 1) to receive signals from the connected detectors, manual call points or any other devices (e.g. input/output units);
 - 2) to determine whether these signals correspond to a fire alarm condition;
 - 3) to indicate any such fire alarm condition audibly and visually;
 - 4) to indicate the location of the danger; and
 - 5) possibly to record any of this information;
- b) are used to monitor the correct functioning of the system and give audible and visible warning of any faults (e.g. short circuit, open circuit or fault in the power supply);
- c) if necessary, are able to pass on the fire alarms signal:
 - 1) to audible or visible fire alarm devices or to a voice alarm system;
 - 2) to the fire alarm routing function to a fire ARC;
 - 3) to the control function for fire protection equipment or systems; and
 - 4) to other systems or equipment, such as a mimic panel.

3.14 critical signal path

components and interconnections between every fire alarm initiation point (manual call point or automatic fire detector) and the input terminals on, or within, each fire alarm device and (where provided) transmission equipment within the premises for routing of signals to an ARC

3.15 designer

person or organization taking responsibility for design considerations

3.16 detection zone

subdivision of the protected premises such that the occurrence of a fire within it is indicated by a fire detection and fire alarm system separately from an indication of fire in any other subdivision

NOTE A detection zone usually consists of an area protected by several manual call points and/or detectors, and is separately indicated to assist in location of the fire, evacuation of the building and firefighting.

3.17 detector

part of an automatic fire detection and fire alarm system that contains at least one sensor which constantly, or at frequent intervals, monitors at least one suitable physical and/or chemical phenomenon associated with fire, and that provides at least one corresponding signal to the CIE

NOTE The decision to give the alarm of fire or to operate automatic fire protection equipment might be made at the detector or another part of the system, for example at the CIE.

3.18 dual path alarm transmission system

alarm transmission system consisting of one primary alarm transmission system and one secondary alarm transmission system using diverse technology

3.19 false alarm

fire signal resulting from a cause(s) other than fire

NOTE False alarms can be subdivided into four categories:

- a) *unwanted alarms, in which a system has responded, either as designed or as the technology might reasonably be expected to respond, to any of the following:*
 - 1) *a fire-like phenomenon or environmental influence (e.g. smoke from a nearby bonfire, dust or insects, processes that produce smoke or flame, or environmental effects that can render certain types of detector unstable, such as rapid air flow);*
 - 2) *accidental damage;*
 - 3) *inappropriate human action (e.g. operation of a system for test or maintenance purposes without prior warning to building occupants and/or an ARC);*
- b) *equipment false alarms, in which a false alarm has resulted from a fault in the system;*
- c) *malicious false alarms, in which a person operates a manual call point or causes a fire detector to initiate a fire signal, whilst knowing that there is no fire;*
- d) *false alarms with good intent, in which a person operates a manual call point or otherwise initiates a fire signal in the belief that there is a fire, when no fire actually exists.*

3.20 fire alarm device

component of a fire detection and fire alarm system, not incorporated in the CIE, which is used to give a warning of fire

NOTE For example, a sounder or visual alarm device.

3.21 fire alarm sounder

audible fire alarm device

3.22 fire engineering solution

application of science and engineering to the achievement of one or more fire safety objectives in such a way that the objectives are achieved without following, in full, prescriptive recommendations of a recognized code of practice

3.23 fire hazard level

likelihood of fire occurring

3.24 fire-resisting construction

construction that is able to satisfy for a stated period of time some or all of the appropriate criteria given in the relevant parts of BS 476 (or equivalent International Standards)

3.25 fire risk

combination of the probability of fire occurring and the magnitude of the consequences of fire

3.26 fire signal

signal intended to indicate the occurrence of a fire

3.27 flame detector

automatic fire detector which responds to the radiation emitted by the flames from a fire

3.28 heat detector

automatic fire detector which responds to an increase in temperature

3.29 installation

work of fixing and interconnecting the components and elements of a system

NOTE Installation may be carried out by one or more parties.

3.30 installer

person or organization having responsibility for all or part of the process of installation

3.31 lantern-light

construction standing above the surface of a roof and intended to admit light to the space below

3.32 line detector

detector which responds to the phenomenon sensed in the vicinity of a continuous line

3.33 low fire risk area or room

area or room containing little or no combustible material and no ignition sources, in which any foreseeable fire is unlikely to spread such as to present any significant threat to escape by occupants or damage to property

NOTE Examples of combustible materials are furniture, fittings, storage or linings.

3.34 maintenance

work of inspection, servicing and repair necessary in order to maintain the efficient operation of the installed system

3.35 manual call point

component of a fire detection and fire alarm system which is used for the manual initiation of an alarm

3.36 manual system

system containing no automatic detectors and in which an alarm of fire can only be initiated manually

3.37 maximum alarm load

maximum load imposed on a fire alarm system power supply under fire conditions, comprising the power required for simultaneous operation of all fire alarm devices, fire signals from all automatic fire detectors and manual call points in the building, any power drawn by other systems and equipment in the alarm condition and any power required for transmission of fire signals to an ARC (if a facility for this is provided)

3.38 mimic diagram

topographic representation of the protected premises and their subdivisions, using light-emitting indicators for each subdivision such that the indications of the fire detection and fire alarm system can be rapidly related to the layout of the premises

3.39 minimum static response temperature

minimum temperature at which a heat detector would produce a fire alarm signal if subjected to a very small rate of rise of temperature

3.40 multi-sensor fire detector

fire detector that monitors more than one physical and/or chemical phenomenon associated with fire

3.41 networked system

fire detection and fire alarm system in which several items of CIE are interconnected and able to exchange information

3.42 normal supply

supply from which the fire detection and fire alarm system is expected to obtain its power under normal conditions

NOTE The normal supply is usually derived from the public electricity supply system.

3.43 phased evacuation

system of evacuation in which different parts of the premises are evacuated in a controlled sequence of phases, those parts of the premises expected to be at greatest risk being evacuated first

NOTE A phased evacuation normally requires at least a two-stage alarm system.

3.44 point detector

detector which responds to a phenomenon sensed in the vicinity of a fixed point

3.45 pre-alarm warning

early warning of conditions which might (or might not) represent a fire, but indicates an approaching alarm condition

3.46 premises management

persons having day-to-day control of the premises, the fire detection and fire alarm system(s) and implementation of the fire procedures

NOTE In large premises, a single person with specialist knowledge is often delegated the responsibility for the fire detection and fire alarm system and associated matters. In small premises, a person with specialist knowledge is unlikely to be present, but responsibility for the fire detection and fire alarm system can still be delegated to a specific person.

3.47 protection

presence of one or more automatic fire detector(s) able to initiate actions needed for the safety of life or property in the event of a fire

3.48 purchaser

person or organization taking primary responsibility for acceptance of and payment for the installed system

3.49 radio-linked system

fire detection and fire alarm system in which some or all of the interconnections between components are made by radio links

3.50 rate of rise heat detector

automatic fire detector which initiates an alarm when the rate of change of the measured phenomenon with time exceeds a certain value, for a sufficient time

NOTE For each class in BS EN 54-5, there are two subclasses: R and S. So-called rate of rise heat detectors may be taken to correspond to R, and fixed temperature detectors to S.

3.51 repair

non-routine work necessary to restore the efficient operation of the installed system

3.52 search distance

distance which has to be travelled by a searcher within a zone in order to determine visually the position of a fire

NOTE The distance is not measured between the point of entry of the zone and the location of the fire, but only between the point of entry and the location at which a person searching for the fire would first become aware of the location of the fire.

3.53 sector

subdivision of the protected premises normally containing several zones

NOTE A sector can cover more than one building.

3.54 servicing

routine process of work on the system (including cleaning, realignment, adjustment and replacement) carried out at predetermined intervals

3.55 short circuit isolators

device, which can be connected into a transmission path of a fire detection and fire alarm system, to limit the consequences of low parallel resistance faults between the lines of this transmission path

NOTE A short circuit isolating device can be a physically separate device or it can be incorporated into another device (e.g. integrated into a smoke detector or detector base).

3.56 smoke

particulate and aerosol products of combustion generated by a fire, whether this be of the smouldering or open flame type

NOTE In general, the particle diameters range from 1 nm (invisible smoke) to 10 µm (visible smoke).

3.57 smoke detector

automatic fire detector sensitive to particulate products of combustion and/or pyrolysis suspended in the atmosphere (aerosols)

3.58 soak period

period after a fire detection and 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

3.59 staff alarm

restricted alarm, following the operation of a manual call point or automatic fire detector, given to certain staff in the premises to permit investigation prior to evacuation and/or summoning of the fire and rescue service

NOTE The use of staff alarms in response to signals from manual call points is not generally acceptable (see [19.2.2](#)).

3.60 staged fire alarm

arrangement in which two or more stages of alarm can be given within a given area

NOTE 1 Examples of staged alarm systems are a two-stage system capable of giving "alert" or "evacuate" signals, or a three-stage alarm system capable of giving "staff alarm", "alert" or "evacuate" signals.

NOTE 2 The normal condition, under which no alarm is given, is not counted as a stage of alarm.

NOTE 3 In this standard, in order to avoid confusion:

- a) the term “stage” is used to describe the different stages of alarm in part, or all, of the premises;*
- b) the term “phase” is used in describing the sequence of phases of evacuation from different areas of the premises.*

NOTE 4 A pre-alarm warning (see 3.45) is not a stage of alarm.

3.61 standby supply

electricity supply, commonly from a rechargeable battery, which is automatically connected to the fire alarm system when the normal supply fails

3.62 time-related system

system in which the response or sensitivity of automatic fire detectors is changed with the time of day

3.63 unwanted fire alarm signal UFAS

false alarm from an automatic fire detection and fire alarm system that has been passed on to the fire and rescue service

3.64 user

person or organization having control of the building (or part of the building) in which the fire detection and fire alarm system is installed

3.65 visual alarm device

device which generates a flashing light to signal to the occupants of a building that a fire condition exists

[SOURCE: BS EN 54-23:2010, 3.1.10]

3.66 voice alarm system

sound distribution system that provides means for automatically broadcasting speech messages and warning signals

NOTE Voice alarm systems commonly include a facility for transmission of live voice messages, as well as automatically generated messages.

3.67 voice sounder

fire alarm sounder that contains the components necessary to generate and broadcast digitally recorded speech messages

3.68 zone plan

diagrammatic representation of a building, showing specific topographic information and the division of the building into detection zones

4 Need for a fire detection and fire alarm system and type of system

4.1 Commentary

The need for a fire detection and fire alarm system in any specific building is normally determined by the authority responsible for enforcing fire safety legislation in that building and/or by a fire risk assessment carried out by the owner, landlord, occupier(s) or employer(s), as appropriate. In general, it is appropriate to install some form of fire detection and fire alarm system in virtually all buildings,

other than very small premises that are relatively open-planned, so that any fire is quickly detected by occupants, who will then be able to warn others by word of mouth or simple mechanical devices such as hand-operated bells.

Manual fire detection and fire alarm systems are often sufficient to satisfy legislation in workplaces in which no one sleeps. Automatic fire detection is usually required by legislation to supplement the manual system in premises in which people sleep. Automatic fire detection might also be necessary to satisfy legislation under the following circumstances:

- a) where the automatic fire detection forms part of a fire engineering solution;*
- b) where fire protection systems, such as door closing facilities or smoke control systems, are to be operated automatically in the event of fire;*
- c) where the low level of occupancy of a building, or part of a building, is such as to create the potential for fire to prejudice means of escape by occupants before they are aware of the fire.*

Automatic fire detection is also commonly used to protect property by ensuring the early attendance of the fire and rescue service, in response to summoning by occupants of the building or by transmission of fire alarm signals to an ARC from where the fire and rescue service will be summoned. Automatic fire detection and fire alarm systems might, therefore, be required or recommended by the property insurers.

The early detection of fire by automatic means, and rapid summoning of the fire and rescue service in the event of fire, is also important in premises in which people cannot readily be evacuated immediately. In certain premises of this type (e.g. residential care premises), it is also important to give accurate and unambiguous information to staff regarding the location of a fire. In general, this part of BS 5839 makes no recommendations as to whether systems need to be addressable; it is possible for addressable and non-addressable systems to satisfy the recommendations of Section 2. However, where accurate and unambiguous information about the location of a fire is critical to the safety of life, it is sometimes necessary to use only an addressable system.

4.2 Recommendations

The following recommendations are applicable.

- a) Where there is uncertainty regarding the need for a fire detection and fire alarm system, or the category of system to be used (see [Clause 5](#)), the developer, potential purchaser or user should make reference to one or more of the following:
 - 1) BS 9999;
 - 2) guidance documents that support fire safety legislation;
 - 3) any authority responsible for enforcing fire safety legislation that applies to the premises;
 - 4) the property insurer;
 - 5) any relevant fire risk assessment.
- b) The purchaser or user should ensure that the designer of a fire detection and fire alarm system is adequately apprised of the objectives of the system and any relevant requirements of enforcing authorities and insurers.
- c) Where occupants of a building are likely to need assistance from staff to evacuate the building (e.g. in residential care premises and hospitals), the fire detection and fire alarm system should be addressable if the building has facilities for more than 10 people to sleep.

5 Categories of system

5.1 Commentary

5.1.1 Introduction

Fire detection and fire alarm systems can be installed in buildings to satisfy one, or both, of two principal objectives, namely protection of life and protection of property. The objectives can differ in time or place. Other possible objectives exist, such as protection against business interruption and protection of the environment; these are likely to be satisfied by the recommendations in this standard for protection of property.

Because of the great variety of applications for systems covered by this part of BS 5839, systems are divided into a number of different Categories, as described in 5.1.2, 5.1.3 and 5.1.4.

5.1.2 Category M systems

Category M systems are manual systems and, therefore, incorporate no automatic fire detectors.

5.1.3 Category L systems

Category L systems are automatic fire detection and fire alarm systems intended for the protection of life. They are further subdivided into:

- a) *Category L1: systems installed throughout all areas of the building.*

The objective of a Category L1 system is to offer the earliest possible warning of fire, so as to achieve the longest available time for escape;

- b) *Category L2: systems installed only in defined parts of the building.*

A Category L2 system ought to include the coverage necessary to satisfy the recommendations of this standard for a Category L3 system; the objective of a Category L2 system is identical to that of a Category L3 system, with the additional objective of affording early warning of fire in specified areas of high fire hazard level and/or high fire risk;

- c) *Category L3: systems designed to give a warning of fire at an early enough stage to enable all occupants, other than possibly those in the room of fire origin, to escape safely, before the escape routes are impassable owing to the presence of fire, smoke or toxic gases;*

NOTE 1 To achieve the above objective it is normally necessary to install detectors in rooms which open onto an escape route (see 8.2).

- d) *Category L4: systems installed within those parts of the escape routes comprising circulation areas and circulation spaces, such as corridors and stairways. The objective of a Category L4 system is to enhance the safety of occupants by providing warning of smoke within escape routes;*

NOTE 2 The installation of detectors in additional areas is not precluded, and the system could then still be regarded as a Category L4 system.

- e) *Category L5: systems in which the protected area(s) and/or the location of detectors is designed to satisfy a specific fire safety objective (other than that of a Category L1, L2, L3 or L4 system).*

Often, the design is based on a localized need for fire detection in only part of a building. Protection might be provided to compensate for some departure from normal guidance elsewhere or as a part of the operating system for a fire protection system. Such a system could be as simple as one that incorporates a single automatic fire detector in one room (in which outbreak of fire would create undue risk to occupants, either in the room or elsewhere in the building), but the system could comprise comprehensive detection throughout large areas of a building in which, for example, structural fire resistance is less than that normally specified for buildings of that type.

NOTE 3 The protection afforded by a Category L5 system might, or might not, incorporate that provided by a Category L2, L3 or L4 system.

5.1.4 Category P systems

Category P systems are automatic fire detection and fire alarm systems intended for the protection of property. They are further subdivided into:

- a) *Category P1: systems installed throughout all areas of the building.*

The objective of a Category P1 system is to offer the earliest possible warning of fire so as to minimize the time between ignition and the arrival of firefighters;

- b) *Category P2: systems installed only in defined parts of the building.*

The objective of a Category P2 system is to provide early warning of fire in areas of high fire hazard level, or areas in which the risk to property or business continuity from fire is high.

NOTE The defined parts of the building might be as few as one or more rooms, or as extensive as, for example, complete floors of the building.

5.1.5 Selection of category

Even in buildings with comprehensive fire detection, the provision of manual call points is still normally of great value; people in the vicinity of a fire are normally aware of the fire, and able to raise the alarm by use of a manual call point, before it is detected automatically.

If a system is intended to fulfil the objectives of more than one category of system, then the system needs to conform to the recommendations for each of the categories. For example, a system whose sole purpose is to provide property protection throughout the building (a Category P1 system) might not need to give an alarm signal of sufficient audibility to rouse all occupants who might sleep in the building. If, however, the system were also installed for the purpose of life safety (a Category L system), sufficient fire alarm sounders to rouse sleeping occupants would be necessary.

This part of BS 5839 does not recommend which category of system needs to be installed in any given premises. The various system categories are to be regarded as a “menu”, from which purchasers, users, specifiers, enforcing authorities, insurers or system designers can select a suitable system for any building. However, [Annex A](#) provides information on the Categories of systems that are typically installed in various types of premises.

Because of the wide range of systems covered by the recommendations of this part of BS 5839, the specification of requirements for a system, by a purchaser, user, enforcing authority or insurer, or the description of a system by a designer or installer, by reference to this standard, without a reference to system category, has little meaning.

The category of system to be installed always needs to be included in the specification. Similarly, the specification of any category of system, other than Category L1, M or P1, always needs to include details of those areas of the building that are to be protected.

In some cases, there is little distinction between, for example, a Category P1 system with variations (see Clause 7) and a Category P2 system. In such cases, either description could be used; the designated system category is to be regarded as a shorthand form of description, rather than a rigid form of prescription. Where a choice exists, however, the description needs to be based on the specified objective of the system.

5.2 Recommendations

The following recommendations are applicable.

- a) Any statutory requirements imposed by enforcing authorities, and any requirements imposed by property insurers, for a fire detection and fire alarm system should clearly state the category of system required.
- b) The purchaser of the system or their agent should inform the system designer as to the category of system that is required (e.g. in purchase or tender specifications).
- c) If the designer is not informed as to the category of system required, the designer should make clear, to the purchaser or their agent, the category of system that is proposed, prior to an order for the system being placed.
- d) In each of the situations described in a), b) and c), the description of the system should be further amplified by adequate information on the areas of the building that are to be protected, except in the case of a Category L1 or P1 system, for which such further information might not be necessary.
- e) Category L1, L2, L3 and L4 systems should also satisfy the recommendations of this standard for a Category M system.
- f) Where the recommendations of this standard for a Category M system are to be satisfied in conjunction with the recommendations for a Category P1, P2 or L5 system, the combined system should be described as a Category P1/M, P2/M or L5/M system respectively.
- g) Where the objectives of more than one type of system are to be satisfied, the system should be described as a Category X/Y system (e.g. L2/P2 or L3/P2).
- h) The system design certificate (see [Clause 41](#)) should clearly state the category of system that has been designed and should, except in the case of a Category M, L1 or P1 system, provide a brief description of the areas of the building that are protected by automatic fire detection.

6 Exchange of information and definition of responsibilities

6.1 Commentary

The purpose of a fire detection and fire alarm system is to support the fire safety strategy for the building. It is, in particular, important that system design suitably supports the required fire evacuation procedures, rather than those procedures being designed around a predetermined system design. To a large extent, the design of the fire detection and fire alarm system depends on the actions required after the alarm has been given. Particular care is necessary in the case of a system that is to be capable of giving a two (or more) stage alarm (see [Clause 19](#)).

If a building contains alarm systems associated with hazards other than fire, the various hazard alarms need to be properly coordinated and be distinct from each other. In these buildings, the relative priorities need to be carefully assessed, and the system arranged so that a higher priority alarm cannot be prevented or obscured by one of a lower priority. Although, in general, fire has the highest priority, there are buildings in which other hazards can have higher priorities than fire.

The system requirements, including those imposed by the evacuation procedures, the configuration of the building, and the use to which the building is put, need to be ascertained as accurately as possible by consultation between the user or purchaser and other interested parties, such as the enforcing authority or fire insurer.

It is advisable that there also be relevant consultation between the user or purchaser and the system designer. In a small, simple building, the extent to which such consultation is necessary might be

minimal; the user or purchaser might have little knowledge of fire safety principles, and system design can involve little more than determination of the appropriate locations of manual call points and fire alarm devices. In complex premises, there is a need for extensive consultation between the user or purchaser, the enforcing authority, the system designer and, possibly, specialist consultants.

The design may be undertaken by the supplier, the installer, representatives of the user or purchaser (including consultants), or by any combination of these parties. It is desirable that, at the contract stage, a single organization takes responsibility for the design of the system, a single organization takes responsibility for the installation work, including compliance with the design, and a single organization takes responsibility for commissioning of the system. Any two, or all three, of these parties may take the form of one single organization. The responsibility for each of these three stages needs to be clearly defined and documented. Experience shows that the responsibility for provision of a zone plan [see 23.2.2e)] is often ill-defined, leading to the absence of a suitable zone plan when an installation is handed over. It is important that this responsibility is defined at an early stage of the planning of an installation.

It is essential that, at the design stage, avoidance of the potential for false alarms and unwanted fire alarm signals are considered, as well as the effectiveness of the system to give a warning in the event of fire (see Section 3).

6.2 Recommendations

The following recommendations are applicable.

- a) The user or purchaser of the system (or an appointed representative of these parties, such as a consultant) should ensure that, to the extent appropriate, there is consultation at, or prior to, the system design stage with all relevant interested parties within the following list:

- 1) the authority responsible for enforcing fire safety legislation (e.g. the building control authority, fire and rescue authority, local authority, Health and Safety Executive);
- 2) the property insurer.

NOTE 1 Where any variations from the recommendations of this part of BS 5839 are proposed, they need to be agreed with the relevant interested parties.

NOTE 2 Some of the consultations may be undertaken by parties, such as the designer or consultants, acting on behalf of the user or purchaser.

NOTE 3 Even where none of the above is considered to be an interested party, advice is available from enforcing authorities and, in the case of Category P systems, property insurers.

- b) The designer of the system should ensure that, to the extent appropriate, there is consultation at the design stage with all relevant interested parties within the following list:

- 1) the user or purchaser;
- 2) consultants (including architects, mechanical and electrical consultants and fire engineering consultants).

- c) The installer of the system should ensure that, to the extent appropriate, there is consultation with all relevant interested parties. These might include the following:

- 1) the designer;
- 2) the user or purchaser;
- 3) the supplier of the system;
- 4) consultants (including architects, mechanical and electrical consultants and fire engineering consultants).

- d) Before an order is placed for the system, the responsibility for each of the following stages should be clearly defined and documented:

- 1) system design;
- 2) installation;
- 3) commissioning.

One of these stages should include the provision of a zone plan [see 23.2.2e)].

- e) Where a fire detection and fire alarm system is to be integrated with a voice alarm system, one organization should take responsibility for the interface connections and all necessary communications between the fire detection and fire alarm system and the voice alarm system.
- f) Where a fire detection and fire alarm system is to be interfaced with another system or facility (such as a fire extinguishing system, smoke control system or lift grounding facility) that is the responsibility of an organization other than the installer of the fire detection and fire alarm system, the responsibility of each organization should be clearly defined and documented.

7 Variations from the recommendations of this standard

7.1 Commentary

This part of BS 5839 is a code of practice and, as such, its contents take the form of recommendations, rather than requirements. The recommendations are primarily based on recognized good practice in the design, installation, commissioning and maintenance of fire detection and fire alarm systems. Accordingly, they are likely to be suitable for the majority of normal applications.

There are, however, applications in which the recommendations are unsuitable and would lead to systems that would be unnecessarily expensive, incorporating measures that could not be regarded as cost-effective, or that could be difficult to install. In extreme cases, the recommendations might even be inadequate to provide the appropriate level of protection.

In these circumstances, variations from the recommendations might be necessary, even though, in general, the user, purchaser, enforcing authority or insurer requires quite strict compliance with the standard. Prior to 2002, variations were described as “deviations” in this part of BS 5839. This term is now deprecated, since it implied shortcomings or errors in design, whereas, in reality, the term referred to aspects of design that were appropriate and intentional, albeit not compliant with one or more recommendations of the standard.

This does not, however, imply that the designer or installer has freedom to ignore the recommendations of this standard under circumstances in which a user, purchaser, enforcing authority or insurer seeks compliance with it. Variations always need to be the subject of specific agreement amongst all interested parties and need to be clearly identified in all relevant system documentation.

Some variations can arise from a fire risk assessment, in which it is determined, for example, that an area of the building might be unprotected by automatic fire detection, albeit that, in the category of system otherwise deemed necessary, protection is recommended in this standard. Other variations might be based on the engineering judgement of a competent person, who might, for example, consider that the extent of protection disabled in the event of a single cable fault can slightly exceed the limitations recommended in this standard, without any significant decrease in the integrity of the system.

It also needs to be borne in mind that, while it is necessary for certain limitations or performance levels recommended in this standard to be quantified, so that the relevant recommendations are expressed numerically, the values quoted are often arbitrary. The values are often based on well-established and proven custom and practice, or on the judgement of experts. While they are, therefore, generally

applicable, rigid adherence to them might not be appropriate in every case, nor is it the case that minor variations need necessarily have any significant effect.

Examples of arbitrary values include, but are not restricted to, the following:

- *maximum zone size;*
- *maximum area of protection disabled in the event of specified fault conditions;*
- *maximum size of open areas in public buildings above which duplication of sounder circuits is recommended;*
- *maximum travel distance to the nearest manual call point;*
- *maximum area of coverage of an automatic fire detector;*
- *minimum sound pressure levels;*
- *minimum duration of standby power supplies; and*
- *performance parameters for standard and enhanced fire-resisting cables, and restrictions on the use of the former type of cable.*

Thus, for example, although this standard recommends that no one be required to travel further than 45 m to reach the nearest manual call point, a competent person might judge that, in a particular building, a distance of 47 m is acceptable because, perhaps, this leads to the most appropriate locations for the manual call points. Similarly, in an office building, it might be judged that, say, sound pressure levels of 57 dB(A) could be accepted in a number of cellular offices since to achieve the 60 dB(A) recommended in this standard would necessitate a large increase in the number of sounders (and hence in cost), when the difference of 3 dB is only just perceptible to occupants.

7.2 Recommendations

The following recommendations are applicable.

- a) Any variations from the recommendations of this part of BS 5839 incorporated within a specification or design proposal should be clearly identified so that they are obvious to any party from whom approval of the specification or design proposal might be sought, such as the user, purchaser, enforcing authority or insurer.
- b) Any variations from the recommendations of this part of BS 5839 identified or proposed during installation or commissioning, but not clearly identified in the documented design, should be documented (other than in the case of errors or “snags” for which rectification is proposed), for subsequent approval.

NOTE This recommendation is not intended to imply that it is the responsibility of the installer or commissioning engineer to verify or certificate conformity of the system design with this standard. However, if variations are identified by an installer or commissioning engineer, particularly variations related to circumstances that might not have been known to the designer (e.g. structural features of the building that affect detector number or siting, or conditions in the building that might result in an unacceptably high rate of false alarms), they ought to be documented for referral to the designer, user or purchaser for agreement or action.

- c) All variations, whether of the type described in a) or b), should be agreed amongst the interested parties (see [Clause 6](#)).
- d) All variations should be listed in the relevant system certificate (see [Clause 41](#)).
- e) Major non-compliances (see [46.2](#)) that are agreed variations should be clearly recorded in the logbook so that they are readily available for future reference by maintenance companies and any other interested parties.

Section 2: Design considerations

8 Relationship between system category and protected areas

8.1 Commentary

8.1.1 General

Before fundamental system design can begin, it is essential that the system category is defined, as this governs the areas in which the manual call points and any automatic fire detectors are to be installed, along with other design parameters. The areas that are to be protected are those which enable the objective of the system to be satisfied (see 5.1).

System category is simply a shorthand means of describing whether the system is manual or automatic, and, in the case of automatic systems, the object of the automatic fire detection and fire alarm system. The appropriate extent of automatic fire detection is normally determined by a fire risk assessment, rather than a rigid application of system category to every building of a specific type or occupancy.

8.1.2 Protection of life

If the objective of the system is to protect the occupants of a building in which no one sleeps, and fire is likely to be detected by people before smoke seriously reduces visibility in escape routes, automatic fire detection might not be necessary: a Category M system might suffice. Whether there is a need for automatic fire detection and, if so, the extent to which it needs to be provided is often determined by a fire risk assessment carried out on behalf of the user; such a fire risk assessment might be required by legislation.

If there is significant probability that a fire in the building, or part of the building, could threaten escape by occupants before it is detected by people in the building, a Category M system is unlikely to be adequate, and the provision of automatic fire detection will be necessary. This could arise from the likelihood of the presence of occupants at special risk (including sleeping occupants), inadequate structural fire protection or the probability of very rapid fire development.

In some buildings, a fire risk assessment might determine that unacceptable risk to occupants can be reduced by the installation of fire detectors in only selected rooms or areas in the building. A Category L5 system might then be suitable, but it would be necessary for the purchaser or user to inform the designer of rooms or areas that are to be protected [see 5.2d)]. A Category L5 system might form part of a fire engineering solution, in which automatic fire detection is just one component of the solution.

If there is a need for a reliable means of warning of the presence of smoke in escape routes, a Category L4 system, in which smoke detectors are installed in escape routes, such as corridors and stairways, might be appropriate. For example, this can arise from the presence of lone workers in a large, generally unoccupied area of a building in which the fire hazard level is assessed to be relatively high.

In buildings in which people sleep within rooms accessed by corridors, other than short lengths of corridor, research has shown that passage of hot fire gases through a door crack can produce smoke sufficiently dense and cool for a corridor to become smoke-logged before adequate warning can be given by detectors in the corridor. In this case, a Category L3 system, in which detectors are installed in rooms that open onto the escape routes, as well as within the escape routes themselves, is likely to be appropriate. The purpose of the detectors in these rooms is to give an early enough warning to occupants, other than, possibly, the person in the room of fire origin, such that they have adequate time to escape before their escape route is impassable as a result of smoke. Accordingly, within the rooms,

the use of one or more of the following types of detectors is satisfactory: heat, smoke, combustion gas or multi-sensor detectors.

In some circumstances, even a Category L3 system might not be sufficient to achieve the life safety objective. A fire risk assessment might determine that, in addition to the protection afforded by a Category L3 system, fire detectors need to be installed in rooms or areas that would not be protected in a Category L3 system. The resulting system would then be a Category L2 system. A Category L2 system would be appropriate if a risk assessment determines that the fire risk associated with rooms other than those opening onto escape routes is unacceptable. Alternatively, there might be a need to give enhanced early warning to occupants of certain rooms, such as disabled people, of a fire in their own room. In this case, smoke or combustion gas detectors within the rooms in question are necessary; heat detectors will not respond quickly enough.

The highest possible enhancement of life safety is provided by a Category L1 system. In a Category L1 system, all areas of the building are protected by automatic fire detectors. In rooms or areas in which there is a need for automatic detection of fire in order to protect the occupants of these rooms or areas, smoke or combustion gas detectors need to be provided. In other rooms, heat detectors might be acceptable. An L1 system might be appropriate in buildings in which there is a significant number of occupants at special risk in the event of fire (e.g. hospitals and certain residential care premises), or in which, throughout the building, structural fire precautions are not of as high a standard as normally specified for buildings of that type.

A Category M system, in which there is no automatic fire detection and fire alarm system, is only likely to suffice if no one sleeps in the building and fire is likely to be detected by people before smoke seriously reduces visibility in the escape routes.

8.1.3 Protection of property

If the objective of the system is property protection, there needs to be sufficient provision of automatic fire detectors to ensure that fire is detected at an early stage, that an effective warning is given in time for firefighters to take action before unacceptable damage to property occurs and that an indication of the location of the fire is given to those responding to the alarm signal. The value of the system depends on a combination of the speed of detection, the delay before firefighters are summoned, the attendance time of trained firefighters, and the probable rate of fire spread. If the attendance time of the fire and rescue service (whether private or local authority) is incompatible with the probable rate of fire spread, adequate property protection might not be achieved purely by automatic fire detection, even if a Category P1 system is installed. The system might, however, form one component of a “package” of fire protection measures, such as compartmentation (to limit the extent of fire spread prior to the arrival of the fire and rescue service) or an automatic fire suppression system (to control or extinguish the fire prior to the arrival of the fire and rescue service).

The highest standard of property protection is provided by a Category P1 system. In a Category P1 system, automatic fire detectors are installed in all areas of the building. This category of system might be appropriate if the system is intended to satisfy the requirements of fire insurers, if the building or its contents are of high value, or if the facilities provided within the building are critical to the operations of an organization.

A lower, but often adequate, standard of property protection is provided by a Category P2 system. In a Category P2 system, automatic fire detectors are provided only in specified rooms or areas of the building. The protected areas are usually those in which the fire hazard level is high, or from which there is significant potential for fire to spread and cause damage to contents of high value. Since the determination of these factors depends on a fire risk assessment, it is important that whoever specifies a Category P2 system qualifies this description with details of the rooms or areas that are to be protected.

8.2 Recommendations

The following recommendations are applicable.

- a) System documentation, including any purchase specification, tender document, design proposal, submission to enforcing authorities or insurers for approval and the certificate issued by the designers (see [Clause 41](#)), should clearly identify the system category as well as, where appropriate, the areas to be protected and any specific proposals for the type(s) of detector to be used.
- b) Any specification or proposal for a Category L5 system should clearly identify the rooms or areas that are to be protected by automatic fire detectors.

NOTE 1 There might also be benefit in giving a simple description of the objective of the protection proposed, particularly in submissions to enforcing authorities.

NOTE 2 The standard of protection (extent of coverage) of a Category L5 system might be lower or higher than that afforded by Category L2, L3 or L4 systems.

- c) In Category L3 and L4 systems, smoke detectors, multi-sensor detectors conforming to the fire sensitivity requirements of BS EN 54-7 or a mixture of smoke and combustion gas detectors, should be provided in the following:
 - 1) all escape stairways;
 - 2) all corridors; and
 - 3) any other areas that form part of the common escape routes.

NOTE 3 Main access and egress stairways normally form part of escape routes, and ought to be treated as escape stairways.

- d) In Category L3 systems, heat, smoke, combustion gas or multi-sensor detectors should be installed in all rooms that open onto the escape routes described in c), except that rooms opening onto corridors of less than 4 m in length need not be protected, provided fire-resisting construction, including doors, separates these corridors from any other section of the escape routes.

NOTE 4 For recommendations on the siting of these detectors, see [22.3e](#)).

NOTE 5 An open-plan area of accommodation, in which occupants quickly become aware of fire, need not be protected in a Category L3 or L4 system, even though occupants within the area clearly need to pass through the area in the first stage of escape, unless it forms part of the escape route from other areas. However, in a Category L3 system a heat, smoke, combustion gas detector or multi-sensor detector ought to be installed on the accommodation side of any door that opens into an escape stairway, a corridor of more than 4 m in length or, alternatively, where stairways are approached through low fire risk lobbies, any door that opens onto the lobby.

- e) In a Category L2 system, the rooms or areas protected should conform to the recommendations in c) and d) for a Category L3 system, but, in addition, automatic fire detectors should be installed in rooms in which the fire risk (see [3.25](#)) is high enough to warrant individual protection.

NOTE 6 Any reference to a Category L2 system (e.g. in a specification, proposal or submission to an enforcing authority) needs to clearly identify the rooms or areas in which these additional detectors are to be installed and identify the type of detector (e.g. heat, smoke or combustion gas) required.

NOTE 7 The first step in designing a Category L2 system is to design a Category L3 system. Thereafter a decision is taken as to which unprotected rooms or spaces warrant further detection, or the detector type or siting needs to be modified.

- f) In a Category L1 or P1 system, automatic fire detectors should be installed in all rooms and areas of the building, but the following rooms or areas need not be protected if they are of low fire risk (see 3.33):
- 1) toilets, shower rooms and bathrooms;
NOTE 8 In some public buildings, such as hospitals and shopping centres, toilets might not be of low fire risk, owing to the potential for malicious ignition.
 - 2) stairway lobbies and toilet lobbies;
 - 3) small cupboards (typically, less than 1 m²); and
NOTE 9 A riser in which there is a fire-resisting floor and ceiling may be treated as a cupboard.
NOTE 10 If detection can be excluded from any room or area in a Category L1 system, it can also be excluded from such rooms or areas in a Category L2, L3 or L4 system.
 - 4) some shallow voids (less than 800 mm in depth) [see 22.2d)].
- g) In a Category L1 system, the detectors within escape routes should be smoke detectors, multi-sensor detectors conforming to the fire sensitivity requirements of BS EN 54-7 or a mixture of smoke and combustion gas detectors.
NOTE 11 Some smoke and multi-sensor detectors can be programmed such that they would not then meet the fire sensitivity tests of BS EN 54-7; in that operating mode, the detectors would not satisfy the recommendations of 8.2c) and g).
- h) In a Category P2 system, the rooms or areas to be protected by automatic fire detectors should be clearly identified in the specification or proposal. There should be physical barriers between protected and unprotected areas to limit the spread of smoke and hot gases in, at least, the early stages of fire.
NOTE 12 It is not necessarily the case that these physical barriers have a recognized period of fire resistance.
NOTE 13 The physical barriers described in h) might be unnecessary where detectors are installed to detect fires in specific equipment.

9 Actuation of other fire protection systems or safety facilities

9.1 Commentary

Any of the system categories defined in 5.1 may be used to actuate other fire protection systems or trigger safety facilities, whether for the purpose of life safety, property protection or a combination of the two.

If the system is to be used for the actuation of other fire protection systems or safety facilities, the recommendations of this part of BS 5839 might, or might not, be necessary or sufficient. The system might have special requirements in respect of the number, zoning and siting of detectors, provision of power supplies, control, indication or other facilities, or monitoring and fire resistance of interconnecting wiring.

It needs to be ensured that the interconnection of other systems or equipment with the fire detection and fire alarm system does not prejudice the reliability of the fire detection and fire alarm system.

9.2 Recommendations

The following recommendations are applicable in the case of systems intended to actuate other fire protection systems or safety facilities (e.g. by triggering an automatic fire extinguishing system, closing fire-resisting doors, shutting down an air handling system or grounding lifts).

- a) The system should conform to the recommendations of any applicable part of BS 7273.

- b) If no part of BS 7273 is applicable, any special requirements for system design should be identified in the purchase specification or design proposals.
- c) If operation of the fire detection and fire alarm system during routine testing would have an undesirable effect on other systems or equipment, means should be provided for disabling the automatic actuation of the system or equipment. The facility for disablement, and the indication of disablement, should conform to BS EN 54-2.
- d) The other equipment or systems should not draw power from the fire detection and fire alarm system in the non-fire state, other than for indicators and interface devices (e.g. relays). The power consumption of any such indicators and interface devices should be taken into account in the calculation of battery capacity (see [25.4](#)).

10 Systems in explosive gas or dust atmospheres

10.1 Commentary

If it is necessary to install fire alarm equipment or wiring in areas where an explosive atmosphere could result from the presence of flammable gases, vapours or mists, or the presence of combustible dusts, special protection measures are essential to ensure that the potential for ignition of the atmosphere by the fire alarm equipment or wiring is minimized.

10.2 Recommendations

The following recommendations are applicable.

- a) Any system (or part of a system) protecting an area, or with cables passing through an area, in which there might be an explosive gas, vapour or mist atmosphere should conform to BS EN 60079-14.
- b) Any system (or part of a system) protecting an area, or with cables passing through an area, in which there might be an explosive dust atmosphere should conform to BS EN 60079-14 and BS EN 60079-17.

11 System components

11.1 Commentary

The reliability of the system to perform its functions on demand is, to a significant degree, governed by the reliability of individual components. Under the Construction Products Regulations 2013 [5], many components, such as manual call points, detectors, CIE and fire alarm devices, are required to conform to relevant harmonized European Standards, and need to have undergone type testing to these standards. It is advisable to use components having certification under a recognized product certification scheme (comprising third-party certification of product conformity against a relevant standard, based on testing and continuing surveillance, together with assessment of the manufacturer's quality assurance systems against BS EN ISO 9000).

Where there is no relevant British, European or International Standard, it is advisable that care is taken to ensure, as far as possible, that the components are fit for their purpose. Third-party approval against an appropriate test standard can provide assurance of this.

Conformity of an individual component to a recognized standard does not necessarily ensure that it will operate satisfactorily in conjunction with another component that conforms to the relevant standard for that component. It is essential that compatibility between components is taken into account by the designer of the system. BS EN 54-13 can be used to confirm system compatibility.

11.2 Recommendations

The following recommendations are applicable.

- a) Manual call points should conform to the requirements of BS EN 54-11 for Type A (“single action”) manual call points.

NOTE 1 This part of BS 5839 recommends that a protective cover is fitted to a Type A manual call point, see 20.2b).

- b) Point heat detectors should conform to the requirements of BS EN 54-5 for Class A1 or A2 detectors, unless the foreseeable maximum ambient temperature in the protected area is 40 °C or above, in which case a Class B-G detector should be used as appropriate (see [Section 3](#) of this standard).
- c) Point smoke detectors should conform to BS EN 54-7.
- d) Flame detectors should conform to BS EN 54-10.
- e) Optical beam smoke detectors should conform to BS EN 54-12.
- f) Aspirating smoke detectors should conform to BS EN 54-20.
- g) Components and systems using radio links should conform to BS EN 54-25.
- h) Multi-sensor, optical and heat detectors should conform to either:
 - 1) BS ISO 7240-15;
 - 2) BS EN 54-29; or
 - 3) BS EN 54-5 and BS EN 54-7.
- i) Multi-sensor, carbon monoxide and heat detectors should conform to BS ISO 7240-8 or BS EN 54-30.
- j) Multi-sensor detectors combining smoke, carbon dioxide and heat sensors should conform to BS EN 54-31.
- k) If there is a facility in a multi-sensor detector to disable sensors leaving a single active sensor, the multi-sensor detector should also meet the performance requirements of the appropriate part of BS EN 54 relevant to that single active sensor.
- l) Carbon monoxide fire detectors should conform to BS EN 54-26.
- m) CIE should conform to BS EN 54-2.

NOTE 2 BS EN 54-2 contains optional performance characteristics which are not necessarily provided in all CIE, even if third-party certificated against BS EN 54-2. It needs to be ensured that the CIE provided has appropriate facilities to enable conformity to all the recommendations of this British Standard and the project specification.
- n) Audible fire alarm devices should conform to BS EN 54-3.
- o) Visual alarm devices should conform to BS EN 54-23.

NOTE 3 Wireless audible and visual alarm devices are outside the scope of BS EN 54-3 and BS EN 54-23 respectively, but this does not preclude their use in a system that conforms to this part of BS 5839, provided the devices satisfy the relevant performance requirements of these standards.
- p) Power supply equipment should conform to BS EN 54-4.
- q) Cables should conform to the recommendations of [Clause 26](#).

- r) Those functions of the system that are recommended in this part of BS 5839, for which the storage of programs and data are necessary to control the fire detection and fire alarm system, should conform to the additional design requirements for software controlled CIE in BS EN 54-2.
- s) Where a PC or similar IT equipment is used as a user interface, e.g. in networked systems, it should be considered as a supplementary interface and there should be CIE conforming to BS EN 54-2 mounted nearby, as it is unlikely that a PC would conform to BS EN 54-2.
- t) Radiopaging transmitters and receivers should conform to the relevant British or harmonized European Standards applicable.
- u) Alarm transmission and fault warning routing equipment should conform to the product requirements (but not the installation requirements) specified in BS EN 54-21.

NOTE 4 Some elements of a) to r) may be combined to form a single device.

12 Monitoring, integrity and reliability of circuits external to control equipment

12.1 Commentary

External circuits need to be arranged such that the probability of faults that could prevent the system from giving a fire warning is minimized. However, such faults occur occasionally. Work on the system, for the purpose of modification, repair or routine attention, can also cause an impairment of the system to operate as designed in the event of fire.

Measures are incorporated within this standard to limit the probability of impairments, whether as a result of faults or work on the system, and to limit the duration of any impairment. The wiring of all critical signal paths is protected against mechanical damage and damage by fire. Critical signal paths are monitored, so that faults are identified quickly. Compliance with the recommendations for maintenance arrangements ensures that any such fault is quickly repaired. The probability that a fault would exist at the time of a fire is, therefore, considered to be extremely low. In the event of fire, fire damage to wiring during the period required for evacuation is unlikely to occur in view of the recommendations of this standard for the fire resistance of cables.

As a result of the above considerations, duplication of, or redundancy in, external circuits is not normally necessary. However, in the case of circuits serving fire alarm devices, special measures need to be taken to ensure that, during, or following, evacuation, damage to any wiring, with resultant loss of the evacuation signal, does not imply to occupants of the building that it is safe to remain in, or reoccupy, the building.

This can be achieved by ensuring that, in the event of a short circuit developing on any fire alarm device circuit during a fire (e.g. at a cable termination), a minimum of one audible fire alarm device continues to sound as a reminder that the system has not been silenced or reset. Normally, this sounder is located close to the CIE as this equipment is sited in a suitable area (e.g. a reception area, security control room or main entrance foyer) at which the reminder needs to be given.

Note that duplication of sounder circuits throughout a building is not generally necessary and can even fail to achieve the objective outlined above. In this case, if fire damages one circuit, it is also likely to damage any other circuit in the same area. However, in a large building with multiple sounder circuits, each serving a different area of the building, the above objective is satisfied. In a smaller building, which could be served by a single sounder circuit, additional measures are necessary to ensure that, if this single circuit fails during a fire, at least one sounder (e.g. on a second circuit) continues to operate.

However, in buildings designed to accommodate the general public in large numbers, typically within a single space, the threat to life in the event of a fire might be such that additional fire alarm device circuits, over and above those described above, is justified; this then addresses the remote possibility of

failure or impairment of a single circuit serving a large public space at the time of a fire. Frequently, such buildings are served by a voice alarm system. In the case of such systems, BS 5839-8 recommends additional loudspeaker circuits in large, uncompartmented public spaces of public buildings such as transport terminals, shopping malls, places of entertainment, large department stores and leisure centres. The size of the uncompartmented public space above which additional loudspeaker circuits are recommended by BS 5839-8 is entirely arbitrary but, for consistency, if such a large public space is protected by audible fire alarm devices, duplicated and evenly distributed fire alarm device circuits need to be installed within the space. Such duplication is, however, not necessary in other parts of the building.

System design needs to be arranged to limit the extent of impairments, whether as a result of faults or work on the system. A fault (but not fire) signal needs to be given at the CIE in the event of any failure in the critical signal path (see 3.14).

Care needs to be taken in the use of multicore cable for the wiring of more than one circuit. It needs to be assumed that any fault that affects a multicore cable affects all conductors of the cable; this precludes the use of multicore cable for certain applications in which the failure of more than one circuit as a result of a single fault is precluded by the recommendations of this standard.

12.2 Recommendations

12.2.1 Fault monitoring

The following recommendations are applicable.

- a) A fault indication should be given at the CIE within 100 s of the occurrence of any of the following conditions:
 - 1) short circuit or open circuit in any circuits serving manual call points or fire detectors;
 - 2) the removal of a manual call point or a fire detector that is designed to be detachable;
 - 3) short circuit or open circuit of any circuits serving fire alarm devices;
 - 4) short circuit or open circuit of any wiring between any power supply that is in a separate enclosure and the equipment to which it supplies power;
 - 5) any earth fault that is capable of preventing the system from performing in accordance with the recommendations of this part of BS 5839;
 - 6) the rupture of any fuse, or the operation of any other protective device, that affects the ability of the system to perform as recommended in this part of BS 5839;
 - 7) a short circuit or open circuit in the wiring between separate control and/or indicating equipment that is provided in order to satisfy the recommendations of this part of BS 5839;
 - 8) a short circuit or open circuit in the wiring between main and any repeat control and/or indicating equipment (such as a mimic diagram) that is provided in order to satisfy the recommendations of this part of BS 5839;
 - 9) a short circuit or open circuit in the wiring between control equipment and any separate enclosure of equipment used for transmission of alarm signals to an ARC [see 15.2I)];
 - 10) removal from its circuit of a fire alarm device that is designed to be detachable.
- b) A fault indication should be given, within the times indicated below, in the event of any of the following:
 - 1) failure of the main power supply to any part of the system (within 30 min of occurrence);
 - 2) failure of the standby power supply (within 15 min of occurrence);

- 3) failure of the battery charger (within 30 min of occurrence);
 - 4) reduction of the battery voltage to less than the voltage specified in BS EN 54-4 at which a fault warning should be given (within 30 min of occurrence).
 - c) Visual indications of the faults identified in a)3) and a)9) should continue to be given at the CIE during a fire alarm condition. Other fault indications may be suppressed during the fire alarm condition.
- NOTE The recommendations of a), b) and c) can be satisfied by the use of CIE and power supply equipment conforming to BS EN 54-2 and BS EN 54-4, respectively, provided the system installation complies with the recommendations of the manufacturer, on which conformity with BS EN 54-2 and BS EN 54-4 might be reliant.*
- d) Where any standby power supply comprises a number of batteries connected in parallel, a fault indication should be given in the event of disconnection of any one battery (within 15 min of occurrence).
 - e) If the system incorporates a separate voice alarm system or fire warning system for people who are Deaf and hard of hearing, any short circuit or disconnection of the communicating link between the fire detection and fire alarm system and the other system should be indicated at the fire detection and fire alarm system CIE within 100 s.
 - f) If the system is used to actuate other fire protection systems or safety facilities (see [Clause 9](#)), reference should be made to BS 7273 (all parts) or other applicable codes of practice for recommendations on monitoring connections between the fire detection and fire alarm system and the other systems or equipment.
 - g) Where tactile fire alarm devices provided for people who are Deaf and hard of hearing are installed, the system should conform to [Annex C](#) and indicate the failure to receive a monitoring signal correctly [see **18.2.1b**].

12.2.2 System integrity

The following recommendations are applicable.

- a) A fault on one circuit containing manual call points, fire detectors or fire alarm devices, or a combination of them, should not affect any other circuit.
- b) A single short circuit or open circuit fault on an automatic fire detector circuit should neither disable protection within an area of more than 2 000 m², nor on more than one floor of the building plus a maximum of five devices (automatic detection, manual call points, sounders or a combination of these) on the floor immediately above and five devices on the floor immediately below that floor.
- c) Two simultaneous faults on a manual call point or fire detector circuit should not disable protection within an area greater than 10 000 m².

NOTE 1 The areas quoted in b) and c) are relatively arbitrary; in the case of b), the recommendation is based on custom and practice in non-addressable fire detection and fire alarm systems over many years. Engineering judgement might determine that, in a given system, minor increases in the areas quoted do not significantly impede the system integrity, but this ought then to be regarded as a variation from the recommendations of this standard.

- d) For software controlled CIE that has more than 512 detectors and/or manual call points connected, reference should be made to the manufacturer's instructions regarding the means by which conformity with BS EN 54-2 is to be achieved.

- e) Where detectors are designed to be detachable from their bases for the purpose of routine maintenance of the system:
- 1) removal of any detector(s) from the circuit should not affect the operation of any manual call point, regardless of whether locking devices are used to secure the detectors within their bases;

NOTE 2 This recommendation applies even if all fire detectors in the system are removed from circuit.

- 2) during the design stage, the possibility of malicious removal of detectors should be taken into account. If malicious removal is considered likely, detectors of a type that can be removed only by the use of a special tool or special technique should be used.

NOTE 3 A special tool in this context is a tool not likely to be carried by a member of the general public. Slot-headed screws would not be acceptable, since various articles can be used as screwdrivers.

- f) Any facility specifically provided for deliberate disablement of manual call point or detector circuits should be such that it is possible to disable protection throughout one zone of the system without disabling protection in other zones. Use of such facilities should not prevent evacuation of the building by use of an evacuate control on, or close to, the CIE.
- g) Removal of any manual call point or detector from its circuit should not affect the ability of any fire alarm device to respond to an alarm signal other than in the case of fire alarm devices and detectors that are combined at a single fixing position.
- h) Fire alarm devices should be capable of being removed only by the use of a special tool.
- i) In the event of a single open circuit or short circuit fault on any circuit that serves fire alarm sounders, at least one single fire alarm sounder, normally located in the vicinity of the CIE, should still sound correctly if a fire alarm condition occurs anywhere within the building. This fire alarm sounder should have an identical sound to the general fire alarm sounders in the building [see also 15.2c)].

NOTE 4 It is possible to comply with this recommendation by at least the following two arrangements, although other arrangements are not precluded:

- wiring all fire alarm sounders within the building on a single sounder circuit, with the additional provision of a second, independent sounder circuit, to which only a single sounder, located in the vicinity of the CIE is connected [see [Figure 1a](#)]);
- wiring all fire alarm sounders on a ring circuit capable of transmitting signals in either direction; the first (or last) three devices on the circuit would then comprise a short circuit isolator, capable of isolating the circuit in the event of detection of a short circuit, a sounder and a further short circuit isolator [see [Figure 1b](#)]].

NOTE 5 The sounder that continues to operate normally comprises one of the general alarm sounders in the area in which the CIE is housed. In a building without phased evacuation, the alarm sounder gives an "Evacuate" signal until silenced. In a building with multiphase evacuation, the sounder may give an "Evacuate" signal or "Alert" signal until silenced, according to the location(s) from which the fire alarm signal originates and the phase of the evacuation at the time in question.

- j) In buildings designed to accommodate the general public in large numbers (e.g. transport terminals, shopping centres, places of public entertainment, department stores and leisure centres), at least two sounder circuits should be provided in every uncompartmented public space if the space is either:
- 1) greater than 4 000 m² in area; or
 - 2) is designed to accommodate more than 500 members of the public.

This should be achieved either:

- i) by means of at least two sounder circuits, which are evenly distributed and interleaved such that adjacent sounders are on different circuits; or
- ii) by means (e.g. a protected loop circuit) such that not more than 50% of sounders in that area are lost in the event of a single open or short circuit fault.

NOTE 6 The figures of 4 000 m² and 500 members of the public are arbitrary, but are the criteria for duplication of loudspeaker circuits of voice alarm systems conforming to BS 5839-8. Engineering judgement might determine that, in a given system, a single sounder circuit can be used to protect a public space that slightly exceeds these criteria without undue increase in risk to occupants. This would then be regarded as a variation from the recommendations of this standard.

NOTE 7 It is not intended that this recommendation would be applied to small cellular spaces or non-public areas of the buildings in question.

- k) Where two (or more) sounder circuits are necessary in order to satisfy the recommendations of i) or j), the circuits should not be contained within a common cable sheath. For example, two circuits intended to satisfy these recommendations should not be served by a common four core cable, as this would not adequately protect against the simultaneous loss of both circuits.

NOTE 8 This recommendation does not apply to those sounder circuits that need not be independent to satisfy the recommendations of this standard (e.g. that are provided purely as a result of electrical engineering considerations).

- l) If the CIE is supplied with power from power supply equipment contained in a separate enclosure, the cables between the equipment should be duplicated such that a single open or short circuit in the connections does not completely remove power from the CIE. The duplicate cables should be separated by at least 300 mm where practical.

Where a power supply unit or a standby battery(ies) is housed in a separate enclosure from the CIE, any cable between that enclosure and the CIE should be suitably protected against overcurrent in accordance with BS 7671.

NOTE 9 Where the enclosure is located immediately adjacent to, and in contact with, the CIE, such that cables run directly between the enclosure and the CIE, the enclosure need not be regarded as separate from the CIE; the recommendations of 12.2.2l) do not then apply.

Figure 1 — Sounder circuits

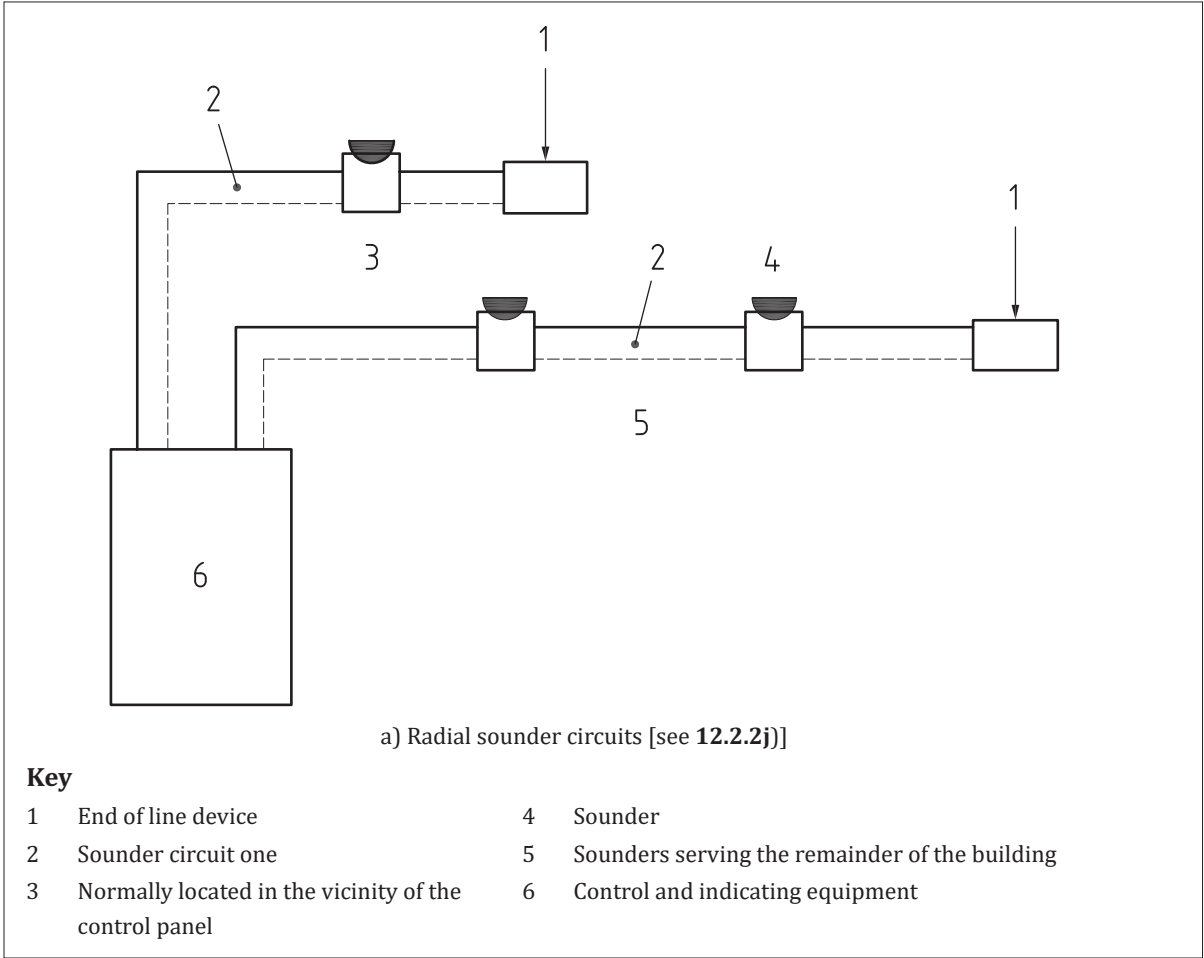
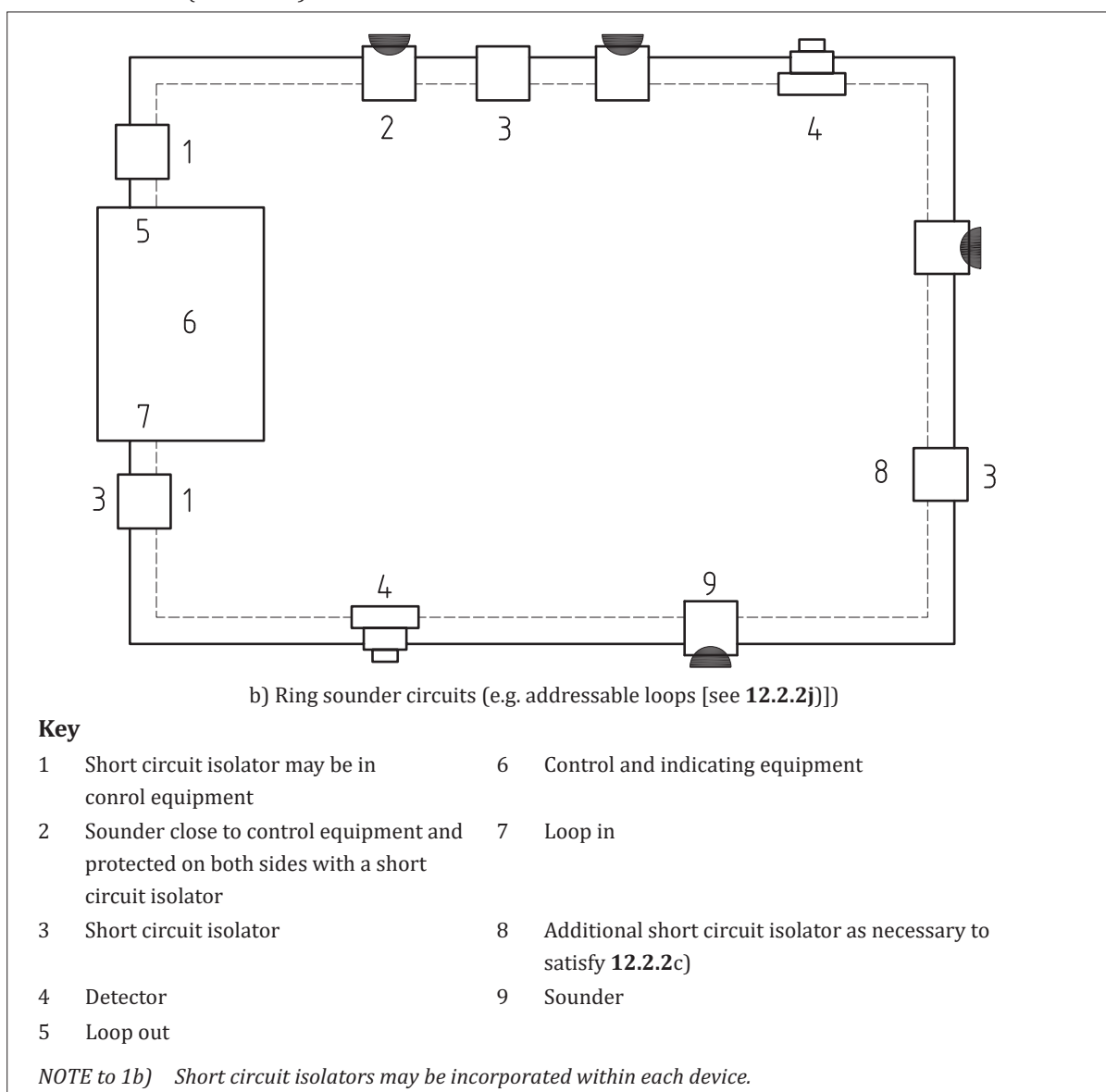


Figure 1 — *Sounder circuits (continued)*

13 Detection zones

13.1 Commentary

In order to direct those responding to a fire alarm signal, particularly the fire and rescue service, to the area of a fire, all buildings, other than very small buildings, need to be divided into detection zones (see 3.16). Detection zones need to be small enough for a fire to be located quickly.

Even if the system is addressable (see 3.1), detection zone indication needs to be provided, as this often provides a quicker, albeit less specific, indication of the location of a fire than typical addressable text displays. Zone indicators also provide a simple “at a glance” overview of the extent of fire or smoke spread.

If the alarm is raised by a manual call point, as opposed to an automatic detector, detection zone indication might be misleading; on discovery of a fire a person might operate a manual call point that is a considerable distance from the fire. The benefits of zoning in a Category M system are, therefore, less significant.

If a detector is concealed in a relatively inaccessible area (such as a floor or ceiling void), it is normally desirable to provide a remote indication of its operation. In an addressable system, the provision of an individual remote indicator might not be necessary provided that the location of each fire detector is clearly indicated at the CIE.

13.2 Recommendations

13.2.1 Recommendations applicable to all detection zones

The following recommendations are applicable.

- a) If manual call points are located on the landings of an enclosed stairway [see **20.2d**], the manual call point on each level, other than a final exit level from the stairway, should be incorporated within the zone that serves the adjacent accommodation on that level. A manual call point located within the stairwell at a final exit to open air may be incorporated within the detection zone serving the stairwell [see **13.2.3c**].
- b) If the total floor area of the building is greater than 300 m², each zone should be restricted to a single storey.
- c) If the total floor area of the building is less than 300 m² a zone may cover more than a single storey.
- d) For voids above or below the floor area of a room, these may be included within the same zone of the room, provided that the voids and the room constitute a single fire compartment.

13.2.2 Additional recommendations applicable to detection zones that contain only manual call points

The floor area of a single zone should not exceed 2 000 m², other than in the case of a zone comprising mainly a single, open-plan area (e.g. an unpartitioned warehouse), which should not exceed 10 000 m² in area.

13.2.3 Additional recommendations applicable to detection zones that contain non-addressable automatic fire detectors

The following recommendations are applicable.

- a) The floor area of a single zone should not exceed 2 000 m².
- b) The search distance (see **3.52**) should not exceed 60 m.

NOTE 1 Having entered the zone, the person responding to the alarm signal need not reach the seat of the fire within the recommended search distance; it is only necessary to become aware of the location of the fire.

*NOTE 2 In measuring search distance, the worst case, in which the fire is located at the furthest concealed area from any likely point of entry to the zone, ought to be considered (see **Figure 2**).*

- c) Automatic fire detectors within any enclosed stairwell, lift well or other enclosed flue-like structure should be considered as a separate detection zone. Manual call points located at final exits to open air from stairwells may be incorporated within these detection zones [but may, alternatively, be incorporated within the detection zone described in **13.2.1a**].

13.2.4 Additional recommendations applicable to detection zones containing addressable automatic fire detectors

The following recommendations are applicable.

- a) Zone indication should be given at the CIE even if addressable text information is also available (see **23.2.2**).

- b) The recommendations of [13.2.3](#) apply, except that [13.2.3b\)](#) does not apply if:
- 1) clear addressable text display of the location of, at least, the first detector to respond to a fire is available at the CIE, without manual intervention; and
 - 2) the display, if necessary in conjunction with other information on, or adjacent to, the CIE, would enable firefighters, unfamiliar with the building, to proceed to the location of the fire.

NOTE For example, the CIE might provide a text indication of room number, and a plan adjacent to the CIE might show the location of the room.

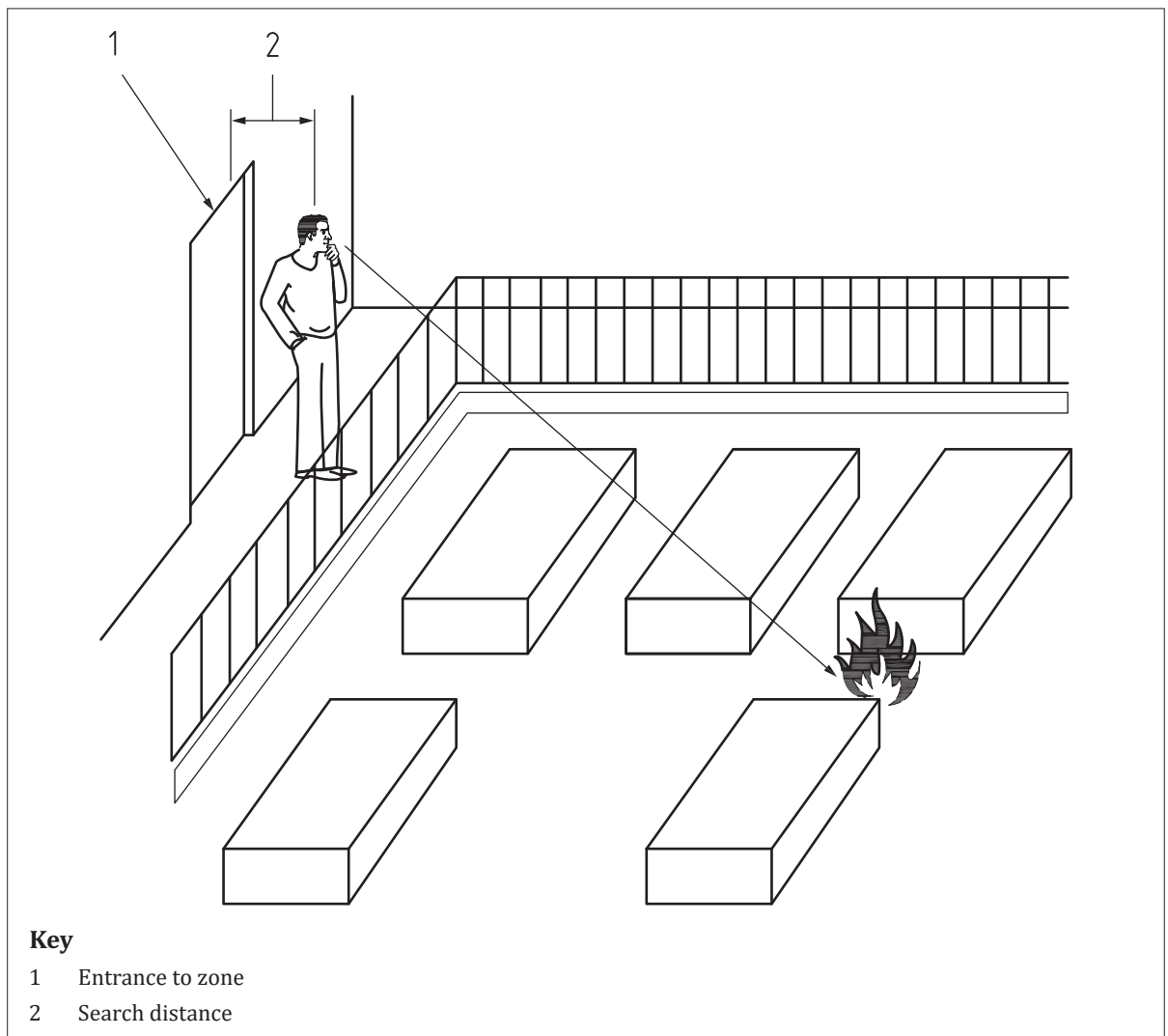
13.2.5 Remote indication of detector operation

Any remote indicators should be clearly labelled to indicate their function. They should be sited and/or labelled in such a way as to assist in determining the location of the detectors that they serve.

Any cable between a detector and a remote indicator required for conformity to this part of BS 5839 should conform to, and be installed in accordance with, the recommendations of [26.2](#).

NOTE Remote indicators might be required in a specification for areas such as inaccessible voids or locked rooms. See also [40.2](#) for the as-fitted drawing.

Figure 2 — Examples of search distances in an open area [see [13.2.3b\)](#)]



14 Alarm zones

14.1 Commentary

In many buildings, the evacuation strategy is very simple; on operation of any manual call point, or detection of fire by an automatic fire detector, fire alarm sounders operate throughout the building to indicate the need for evacuation of the entire building.

In larger, more complex buildings, the “Evacuate” signal might, in the first instance, be restricted in extent (e.g. to a single floor, a limited number of floors or a limited area of the building). In other areas, an “Alert” signal might be given to warn occupants of the alarm signal, without any requirement for those occupants to evacuate.

In order to support such arrangements, it is necessary for the building to be divided into a number of individual alarm zones, such that the operating state of fire alarm sounders in any alarm zone is independent of the operating state of fire alarm sounders in all other alarm zones. The fire alarm sounders in the building are thus grouped, so that, at any point in time, all alarm sounders within any given alarm zone are in the same state (i.e. silent, giving an “Alert” signal or giving an “Evacuate” signal).

The need for subdivision of a building into discrete alarm zones might arise for a number of reasons, including:

- *the use of phased evacuation (see Clause 19);*
- *to avoid unnecessary disruption when false alarms occur (see Section 3); and*
- *any other circumstances in which a two-stage alarm arrangement applies.*

Since it is the case that, when occupants of one alarm zone are required to evacuate, occupants of one or more alarm zones above, below or adjacent to that zone will be expected to remain in the building, every alarm zone needs to be separated from all other alarm zones by fire-resisting construction. (In some complex public buildings, such as shopping centres, alarm zones are designed to coincide with smoke control zones, which are separated from each other by smoke curtains, rather than fire-resisting construction. However, in this case, the audible signal is normally given by a voice message, rather than audible fire alarm devices.)

As the subdivision of a building into alarm zones implies that, in the early stages of a fire, occupants in certain areas will not be expected to evacuate, the configuration of alarm zones might require approval by the authority responsible for the enforcement of fire safety legislation in the building.

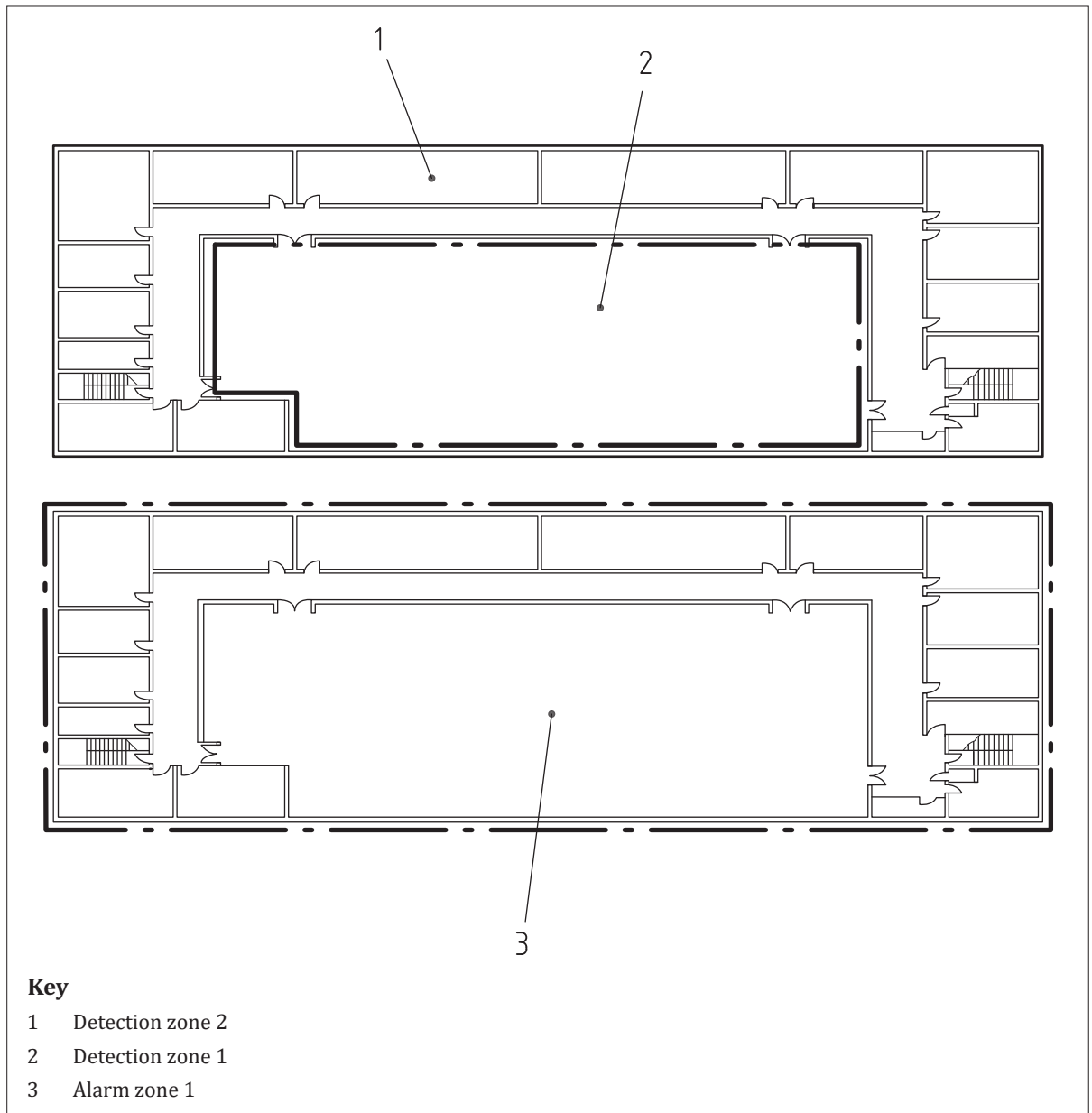
14.2 Recommendations

The following recommendations are applicable.

- a) The boundaries of every alarm zone (other than external walls) should comprise fire-resisting construction.
- b) The extent of any overlap of signals between alarm zones should not be sufficient to result in confusion of occupants in any area of the building.
- c) A common signal should be used throughout all alarm zones to convey the need for evacuation, and a (different) common signal should be used throughout all alarm zones for any alert signal that can be given by the system.
- d) While an alarm zone may incorporate more than one detection zone (but not vice versa), the boundaries of alarm zones should coincide with the boundaries of the relevant detection zones (see [Figure 3](#)).

- e) The user or purchaser should ensure that, where appropriate, the configuration of alarm zones is approved by the relevant enforcing authority or authorities.

Figure 3 — Alarm zones [see 14.2d)]



15 Communication with the fire and rescue service

15.1 Commentary

For a fire alarm and fire detection system to give the maximum benefit, the fire and rescue service needs to be summoned as quickly as possible on every occasion that it operates in the event of a fire, unless, in order to avoid false alarms being passed to the fire and rescue service, filtering arrangements are appropriate (see 35.2.7).

In occupied buildings, the primary means for summoning the fire and rescue service needs to comprise a call to the fire and rescue service by occupants, using the 999 (or 112) public emergency call system. This is the case even if there is a means for automatic transmission of alarms to an ARC, as any

automatic system can fail at the time it is required to operate. It needs to be ensured that the fire alarm sounders cannot interfere with any emergency call to the fire and rescue service.

In the case of manual fire alarm systems, automatic transmission to an ARC is usually unnecessary. When the building is unoccupied, the system does not respond to fire; when the building is occupied, the call to the fire and rescue service from occupants suffices. Automatic means for transmission is only likely to be of benefit, as a secondary means of summoning the fire and rescue service, if factors such as the size or complexity of the building, or low level of occupancy, could result in a significant delay between discovery of fire and summoning of the fire and rescue service, thereby warranting the duplication of the call to the fire and rescue service (i.e. with calls made manually from the premises and automatically via an ARC).

Since the objective of a Category L system is evacuation of occupants, rather than protection of property, manual summoning of the fire and rescue service by occupants might, again, suffice. However, if the early attendance of the fire and rescue service is likely to be essential to life safety in the event of fire (e.g. in hospitals and residential care homes), a secondary, automatic means of transmission might be warranted, unless there are adequate arrangements to ensure that there is no delay at any time in manual summoning of the fire and rescue service by occupants. In practice, automatic transmission of fire alarm signals is considered necessary in the case of residential care premises.

Even in a Category L system, if the premises are unoccupied at certain times and the system incorporates automatic fire detection throughout a significant proportion of the premises, it can represent a missed opportunity, in respect of property protection, if no means of automatic transmission of alarm signals is provided.

In a Category P system, unless the premises are continuously occupied at all times, the objective of property protection is unlikely to be satisfied unless the system incorporates means for automatic transmission of alarm signals to an ARC. Even in a Category P2 system, unless the extent of the automatic fire detection is minimal, in premises that are not continuously occupied, the absence of an automatic means of transmission of fire signals to an ARC is likely to be false economy.

In premises in multiple occupation, the responsibility for summoning the fire and rescue service on operation of the fire alarm system always needs to be clearly defined, particularly in the case of Category L or Category P systems.

If a Category L or Category P system is installed in non-domestic premises in multiple occupation, there might be a need for automatic transmission of alarm signals to an ARC. The primary means of summoning the fire and rescue service still needs, if practicable, to comprise a call to the fire and rescue service from persons on the premises. However, in some premises in multiple occupation, the reliability of this arrangement can be insufficient, and a secondary means of summoning the fire and rescue service via an ARC might be warranted.

The reliability of the means for summoning the fire and rescue service, whether by manual or automatic means, always needs to be subject to consideration. Various methods of automatic alarm transmission system to an ARC are available. Their performance, reliability and security characteristics vary, depending upon the type of technology used. BS EN 50136-1 defines ten categories of alarm transmission system (ATS): SP1 to SP6 are based on a single alarm transmission path. DP1 to DP4 add resilience by requiring a dual transmission path.

Alarm transmission systems that incorporate reporting of an alarm transmission path (ATP) failure are preferred. The reporting time period varies with the ATS category selected (32 days to 90 seconds). BS EN 50136-1 shows these performance criteria together with alarm transmission times and the ATS and ATP availability in any 7-day period.

PD 6669 gives guidance that is additional to BS EN 50136-1, with particular reference to dual path alarm transmission systems.

Regardless of whether the arrangement for summoning the fire and rescue service is manual or automatic, the effect of fire on the reliability of the arrangement needs to be considered (e.g. the effect of fire on persons tasked with summoning the fire and rescue services and on communication lines and equipment).

If the services of a commercially operated ARC are used, it needs to be ensured that the alarm receiving centre has a formal arrangement with the fire and rescue authority in whose area the protected premises are situated for rapid communication with the fire and rescue service by reliable means.

If provision is made for automatic transmission of fire signals to an ARC, it is often quite simple to arrange for fault signals on the fire alarm system to be transmitted as a separately identifiable signal; this has the benefit of ensuring that faults on the fire alarm system receive attention when the premises are unoccupied.

It is now common practice for the transmission of fire alarm signals to an ARC to be routed via the alarm routing equipment of an intruder alarm system. Notwithstanding that the mains power supplies, cable types and cable routing for this alarm routing equipment might not necessarily conform to the recommendations of this part of BS 5839, this practice is regarded as acceptable and need not be regarded as a variation from the recommendations of this standard. However, standby battery capacity and any cable between the CIE and the alarm routing equipment needs to conform to the recommendations of this part of BS 5839.

15.2 Recommendations

The following recommendations are applicable.

- a) The user should ensure that there are suitable arrangements for summoning the fire and rescue service when the fire detection and fire alarm system operates. The arrangements should be such as to minimize the risk to any person responsible for summoning the fire and rescue service. Systems that automatically transmit a pre-recorded message direct to the fire and rescue service, via the public emergency call system, should not be used.
- b) In occupied buildings, the primary means of summoning the fire and rescue service should always comprise a call to the fire and rescue service by occupants, using the public emergency call system.
- c) In any area specifically designated as that from which the fire and rescue service is to be summoned in the event of fire, the fire alarm signal should not be so loud as to interfere with telephone speech.

NOTE 1 Cases have been reported in which the frequency of the alarm sounders has been such as to corrupt tone dialling systems, leading to failure of the emergency call.

- d) The designer should determine from the purchaser or user whether automatic means of transmission of alarm signals to an ARC is required by the user.
- e) If the early summoning of the fire and rescue service is considered critical to the safety of occupants (e.g. on the basis of a fire risk assessment), facilities should be provided for automatic transmission of alarm signals to an ARC, unless there are reliable arrangements for summoning the fire and rescue service by persons in the building.

NOTE 2 In the case of shopping centres and hospitals, conformity to the Technical Handbooks (see www.scotland.gov.uk/Topics/Built-Environment/Building/Building-standards/publications/pubtech)⁴ that support the Building (Scotland) Regulations 2004 [3] necessitate automatic transmission of fire alarm signals to an ARC.

- f) In residential care premises, facilities should be provided for automatic transmission of alarm signals to an ARC.

⁴ Last accessed on 31 August 2017

NOTE 3 In the case of residential care premises, conformity to the Technical Handbooks (see www.scotland.gov.uk/Topics/Built-Environment/Building/Building-standards/publications/pubtech)⁵ that support the Building (Scotland) Regulations 2004 [3] necessitates automatic transmission of fire alarm signals to an ARC.

- g) Except in the case of continuously occupied premises, Category P systems should incorporate a means for automatic transmission of fire signals to an ARC.
- h) In non-domestic premises in multiple occupation, Category L systems should incorporate an automatic means for transmission of alarm signals to an ARC, unless there are arrangements in place for summoning the fire and rescue service by occupants of the building, at all times that the premises are occupied (or partly occupied).
- i) Any ARC to which fire alarm signals are relayed should conform to the recommendations of BS 8591 and have in place an agreement with the appropriate fire and rescue service to pass on fire signals from fire alarm systems at the monitored property.

NOTE 4 An ARC that conforms to the recommendations of BS 5979 (withdrawn, superseded by BS 8591) in respect of monitoring of fire alarm signals is acceptable.

NOTE 5 Schemes exist for third-party certification of ARCs to BS 8591 and BS 5979 (withdrawn, superseded by BS 8591). However, transmission of fire alarm signals (as opposed to intruder alarm signals) is not always within the scope of the ARC's certification; if reliance is placed on third-party certification, it needs to be confirmed that monitoring of fire alarm signals is within the scope of certification.

- j) If a Category L or Category P system incorporates facilities for automatic transmission of fire signals to an ARC, any telephone switch room or frame room on which automatic transmission depends should be protected by automatic fire detection or an automatic fire extinguishing system. As far as reasonably practicable, any cables within the building (including telephone lines) on which communication depends should be:
 - 1) routed through areas of low fire risk; or
 - 2) routed through areas protected by automatic fire detection or an automatic fire extinguishing system; or
 - 3) cables of standard or enhanced fire resistance (see [Clause 26](#)).
- k) Automatic transmission of alarm signals should not be prevented by the act of silencing fire alarm sounders, nor should it depend on the state of any silencing switch.

NOTE 6 Although any ARC to which fire signals are relayed is normally operated on a commercial basis, the function could, for example, be fulfilled by a fire and rescue service control room or a continuously manned security control room on the same site as the protected premises.

- l) Where an alarm transmission device is mounted in an enclosure separate from that of the fire alarm CIE, the connection from the CIE to the alarm transmission device should be monitored and comprise cables of standard fire resistance. The CIE should conform to BS EN 54-2.

NOTE 7 Monitoring may be performed by the alarm routing equipment. For example, the connection between the CIE and the alarm routing equipment may comprise a cable from an input in the alarm routing equipment to the common fire relay in the CIE, such that an open circuit fault in the cable results in transmission of a fault signal to the ARC.

- m) Power supplies for any facility used for the transmission of fire alarm signals to an ARC should conform to [Clause 25](#).

NOTE 8 15.2m) does not apply to the mains power supplies for an intruder alarm system, to which 15.2n) applies.

⁵⁾ Last accessed on 31 August 2017

- n) Where fire alarm signals are routed via the routing equipment of an intruder alarm system, the standby power supplies for the routing equipment should conform to the recommendations in [25.4](#).

- o) If it is intended for the CIE to signal a fault from the fire alarm system to an ARC, the CIE should have a suitably monitored means of interfacing with the relevant fault routing equipment.

NOTE 9 Monitoring may be performed by the fault routing equipment. For example, the connection between the CIE and the fault routing equipment may comprise a cable from an input in the fault routing equipment to the common fault relay in the CIE, such that an open circuit fault in the cable results in transmission of a fault signal to the ARC.

NOTE 10 It is common for the alarm routing equipment and the fault routing equipment to comprise a single device.

- p) Faults in either the alarm transmission equipment or in the alarm transmission path should be displayed at the CIE.

NOTE 11 It is recognized that temporary loss of service in the alarm transmission path or service provision might occur. The risk associated with loss of communications can be mitigated by use of a dual path alarm transmission system where primary and secondary signal paths are provided. For dual path alarm transmission systems, loss of both signal paths is indicated as a fault at the CIE. However, it is not necessary to indicate loss of a single transmission path at the CIE.

- q) Where the alarm transmission path relies upon a physical TCP/IP or similar data connection, the following recommendations apply.

- 1) Final connections to the alarm routing equipment should be secured against unauthorized disconnection.
- 2) Power supplies for routing equipment within the premises on which alarm transmission depends should conform to the recommendations of [25.4e](#)).

NOTE 12 Where there is a dual path alarm transmission system, the recommendations contained in [15.2q\)2](#) need only be applied to one of the transmission systems.

- 3) The physical data network cable used for alarm transmission within the building should be differentiated from other services by colour.

NOTE 13 Where the network cable cannot conform to the recommendations of [15.2q\)3](#)), or where local data network reliability is a concern, a dual path alarm transmission system would be beneficial.

16 Audible alarm signals

16.1 Commentary

It is essential that alarm signals are sufficient in nature and extent to warn all persons for whom the alarm signals are intended. In simple buildings, the alarm produced by a Category M or Category L system needs to be capable of alerting all occupants of the building regardless of their location. If people sleep in the building, the alarm signal needs to be sufficient to rouse them from sleep.

In certain, usually more complex, buildings, a general alarm of the type described above might not be appropriate. For example, in hospitals and certain residential care premises in which occupants might need assistance to evacuate, the fire detection and fire alarm system might not be intended to rouse people from sleep, and it might only be necessary for staff to be aware of the alarm signal. In some large or complex buildings, the extent of the area in which an evacuation signal is given might be restricted, at least initially (see [Clause 19](#)).

In Category P systems, the alarm signal might not be intended to alert all occupants; it might be sufficient for the system to alert key personnel in order to ensure that firefighting action is taken.

In practice, a Category P system is usually combined with a Category M system, in which case the considerations applicable to the Category M system take precedence as these are more onerous.

In those areas in which audible alarm signals are intended to alert occupants, the sound pressure level and frequency of alarm signals need to be adequate to provide unambiguous warning of fire. Particular care needs to be taken to ensure adequate sound pressure levels in small cellular spaces, such as cellular offices, toilets and plant rooms. If the alarm signal comprises a speech message, it is also necessary to ensure that the message(s) is intelligible.

Traditionally, a sound pressure level of 65 dB(A) has been regarded as the minimum acceptable sound pressure level for fire alarm signals. However, a sound pressure level difference of 2 dB to 3 dB is only just perceptible to the human ear. It is, therefore, unnecessary to install additional fire alarm sounders if, in open areas, 65 dB(A) is generally achieved. If, at specific points of limited extent within any area, a sound pressure level of at least 60 dB(A) is achieved this is considered acceptable. It is also acceptable for the sound pressure level to be as low as 60 dB(A) in small enclosed spaces, such as cellular offices, and in stairways.

In order to prevent excessive sound pressure levels, which can cause disorientation or even damage to hearing, a larger number of quieter sounders is preferable to a few very loud sounders.

Once started, alarm signals generally need to continue until manually silenced by use of a silencing control. In large sites comprising many buildings in single ownership (e.g. industrial sites), an external fire alarm device can be of value in directing firefighters to the correct building; an external fire alarm device can also be useful in directing firefighters to the correct entrance of a large building with many entrances. It is not necessary for an external fire alarm sander to sound for a prolonged period; for it to do so is unlikely to be acceptable because of disturbance in neighbouring properties, particularly if false alarms occur when the protected premises are unoccupied.

In radio-linked systems, in which the power supply for sounders may comprise batteries, prolonged operation of sounders (e.g. as a result of a false alarm when the premises are unoccupied) can exhaust the batteries, leaving the premises without an operational fire alarm system when they are subsequently reoccupied. Since this creates greater risk than that associated with automatic silencing of alarm signals, the alarm signal may be automatically silenced in certain radio-linked systems, subject to the agreement of the enforcing authority.

16.2 Recommendations

16.2.1 Recommendations applicable to Category M and L systems (other than in hospitals and residential care premises)

The following recommendations are applicable.

- a) The sound pressure level of alarm signals should be:
 - 1) throughout all accessible areas of the building [other than as described in 15.2c) and in enclosures of less than 1 m²], not less than 65 dB(A) but, as shown in [Figure 4](#), this may be reduced to 60 dB(A) in:
 - i) stairways;
 - ii) enclosures of not more than approximately 60 m² in area (e.g. cellular offices); and
 - iii) specific points of limited extent;
 - 2) where the sound pressure level of background noise is greater than 60 dB(A), the sound pressure level of the fire alarm signal should be 5 dB above the sound pressure level of the background noise;

NOTE 1 Background noise that is unlikely to persist for longer than 30 s may be ignored.

NOTE 2 This recommendation does not apply to noise created by running water in bathrooms and shower rooms.

NOTE 3 Typical noise levels in buildings are given in [Annex B](#).

- 3) not less than 75 dB(A) at the bedhead within rooms in which the fire detection and fire alarm system is intended to rouse people from sleep;

NOTE 4 Experience has shown that this normally necessitates the provision of a fire alarm sounder within the room in question.

- 4) not greater than 120 dB(A) at any normally accessible point.

NOTE 5 All these figures are arbitrary, but are judged to be generally appropriate.

*NOTE 6 In carrying out measurements to verify compliance with these recommendations, other than in the case of **16.2.1a)3**), account need not be taken of sound pressure levels within 500 mm of any walls or partitions.*

NOTE 7 Measurements need to be made with all doors shut.

NOTE 8 An instrument conforming to BS EN 61672-1, set to slow response and A-weighting, is suitable for measuring the sound pressure level of the alarm signal.

NOTE 9 It is often necessary to measure the sound pressure level of the fire alarm signal in the presence of background noise. The sound pressure level of the fire alarm signal (in isolation) can be deemed to be 5 dB above background noise if, when the background noise is present, a sound pressure level increase of 6 dB occurs on operation of the fire alarm system.

- b) The fundamental frequency(ies) produced by fire alarm sounders should lie in the range of 500 Hz to 1 000 Hz, unless the frequency of background noise is such as to mask these frequencies, in which case the use of sounder frequencies outside this range is acceptable. The sounders should produce a continuous output, although the frequency and amplitude might vary (e.g. as in a warbling note), to indicate the need for evacuation or other immediate response.
- c) All fire alarm sounders within a building should have similar sound characteristics, unless particular conditions, such as an area of high background noise, make this impracticable. The sounders should be distinctive in sound from the sounds of other alarm systems in the building. The fire alarm sounders should be distinctive in sound.

NOTE 10 On a site where occupants move regularly between buildings, there is benefit to adopting a fire alarm signal that has similar sound characteristics throughout all buildings on the site.

- d) In premises designed for public entertainment, retail and similar premises, in which the sound pressure level of music is likely to be greater than 80 dB(A), the music should be muted automatically when a fire alarm signal is given.

NOTE 11 In premises with two (or more) stage alarm systems, consideration ought to be given as to whether the music is to be muted at the "Alert" or the "Evacuate" stage.

*NOTE 12 Where the sound pressure level of the music is likely to be between 60 dB(A) and 80 dB(A), the recommendation of **16.2.1a)2**) applies.*

- e) In parts of a building with noisy machines, in order to achieve 5 dB(A) above background noise, the fire alarm sounders ("primary sounders") may be supplemented by mains powered sounders, without a standby supply ("secondary sounders"), operated from the same final circuit(s) as the noisy machines, so that failure of the supply to the secondary sounders also results in silencing of the noisy machines. The primary sounders should still be sufficient to satisfy the recommendations of **16.2.1a)1**) when the machines are silent.
- f) In large sites with many buildings, or in the case of large buildings with many entrances, an external sounder(s) and/or visual alarm devices may be provided to direct firefighters to the