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BSI Standards Publication

Fire detection and fire alarm systems for buildings

Part 9: Code of practice for the design, installation, commissioning and maintenance of emergency voice communication systems

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Foreword

Publishing information

This part of BS 5839 is published by BSI and came into effect on 31 January 2011. It was prepared by Subcommittee FSH/12/5, *Alarm devices, voice alarm evacuation sub-systems and emergency voice communications*, under the authority of Technical Committee FSH/12, *Fire detection and alarm systems*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This part of BS 5839 supersedes BS 5839-9:2003, which is withdrawn.

Information about this document

This is a full revision of BS 5839-9, and introduces the following principal changes.

- A clause on wireless-linked EVC systems has been included.
- A subclause on the use of audio frequency induction loop systems at EVC outstations has been included.

Use of this document

As a code of practice, this part of BS 5839 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 part of BS 5839 is expected to be able to justify any course of action that deviates from its recommendations.

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

Presentational conventions

The provisions in 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.

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.

Introduction

Emergency voice communication (EVC) systems allow firefighters and others to communicate with one another during emergency situations in and around buildings and at sports and similar venues, such as entertainment centres. They also allow communication with disabled persons. Emergency voice communication systems, as later defined in this part of BS 5839, are used in connection with life safety and need, therefore, to be subject to high standards of design, manufacture, installation, commissioning and maintenance, similar to those covering fire detection and fire alarm systems and voice alarm systems.

This part of BS 5839 has been prepared to:

a) give guidance to those who specify, design, manufacture, install, commission, maintain and use such emergency voice communication systems;

b) ensure that high standards of reliability, safety and security are achieved, together with acceptable standards of performance.

Section 1: General

1 Scope

This part of BS 5839 provides recommendations for the planning, design, installation, commissioning and maintenance of emergency voice communication systems in and around buildings and at sports, entertainment and similar venues. It does not recommend whether or not an emergency voice communication system should be installed in a given premises.

This part of BS 5839 primarily relates to the use of emergency voice communication (EVC) in assisting both firefighters and those responsible for evacuating buildings or sports stadiums in fire emergency situations, including evacuation of disabled persons. Use, other than in fire emergency situations, by disabled persons and others, although not precluded, is not addressed in detail.

Other than in exceptional circumstances, EVC systems are not intended as the means of raising a fire alarm, in lieu of manual call points. Refer to BS 5839-1 for guidance on fire detection and alarm systems.

This part of BS 5839 covers systems with components linked by wires, wirelessly, or a combination of both.

This part of BS 5839 covers emergency voice communication systems and is therefore not intended to cover general-purpose intercom systems, lift intercom systems, local (internal) telephone systems for general use, or any external communication systems, such as the public switched telephone network and cellular telephone networks.

Voice alarm systems are primarily intended for the automatic broadcasting of evacuation messages; they are covered by BS 5839-8 and are therefore excluded from this part of BS 5839.

2 Normative references

The following referenced documents are indispensable for the application 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 5499-1, *Graphical symbols and signs – Safety signs, including fire safety signs – Part 1: Specification for geometric shapes, colours and layout*

BS 5839-1:2002+A2:2008, *Fire detection and alarm systems for buildings – Part 1: Code of practice for system design, installation, commissioning and maintenance*

BS 7671, *Requirements for electrical installations – IEE Wiring Regulations – Seventeenth edition*

BS 9999:2008, *Code of practice for fire safety in the design, management and use of buildings*

BS EN 54-2:1998+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 54-4:1998+A2:2006, *Fire detection and fire alarm systems – Part 4: Power supply equipment*

BS EN 54-16:2008, *Fire detection and fire alarm systems – Part 16: Voice alarm control and indicating equipment*

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

BS EN 60529, *Specification for degrees of protection provided by enclosures (IP code)*

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

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

BS EN 60118-4, *Electroacoustics – Hearing aids – Part 4: Induction loop systems for hearing aid purposes – Magnetic field strength*

BS EN 61672-1, *Electroacoustics – Sound level meters – Part 1: Specifications*

[1] Approved Document B (Fire safety) – Volume 2: Buildings other than dwellinghouses (2006 edition). ISBN-13: 978 0 117 03725 0.

[2] Department for Culture, Media and Sport (DCMS). Guide to Safety at Sports Grounds. The Stationery Office, 2008. ISBN-13: 978 0 11 702074 0.

[3] Fire Safety Guide No. 3, Phased Evacuation from Office Buildings. London District Surveyors Association.

3 Terms and definitions

For the purposes of this part of BS 5839, the following terms and definitions apply.

3.1 access level
one of several states of the EVC system in which selected:

- controls can be operated,
- manual operations can be carried out,
- indications are visible and/or
- information can be obtained

NOTE Further information on access level is given in Annex A.

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

3.3 duplex operation
operation of transmitting and receiving apparatus at one location in conjunction with associated transmitting and receiving equipment at another location, the processes of transmission and reception being concurrent

3.4 emergency voice communication system
EVC system
system that allows voice communication in either direction between a central control point and a number of other points throughout a building or building complex, particularly in a fire emergency situation

3.5 evacuation lift
lift that may be used for the evacuation of disabled people in a fire under the direction of management or firefighters

3.6 EVC mode
status of a system whereby communication is taking place between type A or B outstations and a master station

NOTE If the system is used for purposes other than EVC, then their functions are to be overridden by the EVC functions.

3.7 firefighting lobby
protected lobby providing access from a firefighting stair to the accommodation area, and to any associated firefighting lift

3.8 firefighting stair
protected stairway communicating with the accommodation area only through a firefighting lobby

3.9 fire telephone system
commonly-used form of emergency voice communication system that includes telephone handsets at outstations and usually also at master stations

3.10 group call
call made from a master station to more than one outstation simultaneously

3.11 handset
part of a telephone, combining receiver and transmitter, one at each end of the handle

3.12 hook-switch
switch operated automatically by removal of a handset from, or replacement of a handset in, its rest position

3.13 intelligibility
measure of the proportion of the content of a speech message that can be correctly understood

3.14 master station
control unit located at a central control point which controls the EVC system

NOTE In large buildings or building complexes, there may be several master stations communicating with each other.

3.15 non-EVC mode
status of a system whereby communication is taking place between devices other than type A and B outstations and the master station

NOTE Non-EVC functions typically include help points, lift intercoms and accessible toilet alarms.

3.16 off-hook
status of a handset when removed from its normal rest position to initiate an outgoing call or receive an incoming call

3.17 on-hook
status of a handset when in its normal rest position, terminating a call or permitting notification of an incoming call

3.18 outstation
unit, located at a strategic point in a building or building complex, that allows two-way voice conversation with a master station

3.19 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

3.20 protected lobby/corridor
circulation area consisting of a lobby or corridor enclosed with fire-resisting construction (other than any part that is an external wall of a building)

3.21 protected stairway
stair discharging through a final exit to a place of safety (including any exit passageway between the foot of the stair and the final exit) that is enclosed with fire resisting construction

3.22 refuge
area that is enclosed with fire-resisting construction (other than any part that is an external wall of a building) and served directly by a safe route to a storey exit, evacuation lift or final exit, thus constituting a temporarily safe space for disabled people to await assistance for their evacuation

NOTE The term disabled people can also include any person who is unable to safely use an exit route, e.g. people with back or sports injuries, pregnant women and those who cannot walk unaided.

3.23 VSWR
voltage standing wave ratio
measure of how efficiently radio-frequency power is transferred to the antenna system

3.24 wireless link budget
accounting of all the gains and losses through the transmitting medium to the receiver. It accounts for the attenuation of the transmitted signal due to propagation, as well as the antenna gains, feedlines and miscellaneous losses

3.25 wireless repeater
device used to extend the coverage of a wireless-linked system

4 Need for an emergency voice communication system

*COMMENTARY ON CLAUSE **4***
An EVC system enables communication between strategic points throughout the building or site and the central control point(s). EVC systems are generally needed in the following situations:

a) In any building or sports or similar venues where there are disabled people or people who may have difficulty negotiating the evacuation route.

b) In buildings with phased evacuation and/or firefighting lifts where it facilitates secure communications for building managers, fire wardens and attending fire officers.

NOTE Installation of an EVC system might be appropriate for buildings without phased evacuation where the types, size and/or shape of the building necessitates communication between remote locations and a central control point, to facilitate evacuation or firefighting.

c) At sports venues and in similar complexes, where it will assist stewards in controlling the evacuation of the area in an emergency.

In some buildings it might be necessary to take into consideration that the EVC system will address multiple uses and the outstation design will reflect its intended use.

The need for EVC in any specific building or complex will normally be determined by the appropriate regulation and/or a fire risk assessment carried out by the owner, landlord, occupier(s), employer(s) or other responsible person, as appropriate.

The following should be consulted when determining the type and function of an EVC system:

a) Approved Document B (Fire safety) – Volume 2: Buildings other than dwellinghouses [1];

b) BS 9999;

c) Guide to Safety at Sports Grounds, Fifth edition, 2008 [2];

d) Fire Safety Guide No 3, Phased Evacuation from Office Buildings. London District Surveyors Association [3];

e) guidance documents that support fire safety legislation;

f) any authority responsible for enforcing fire safety legislation that applies to the premises.

5 Exchange of information and definition of responsibilities

*COMMENTARY ON CLAUSE **5***
*The main purpose of an EVC system is to support the fire safety strategy of the building or complex (see Clause **7**). It is therefore important that system design suitably supports the required evacuation and firefighting procedures.*

*The system requirements, including those imposed by the evacuation procedures, the configuration of the building or complex, 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. A key performance requirement to be determined in relation to EVC systems is whether there is a need for calls to be made to, as well as from, outstations. Any proposal to make outstations more secure [see **11.5**g)] needs to also be agreed with the interested parties.*

There ought also to be relevant consultation between the user or purchaser and the system designer. The design may be undertaken by the supplier, the installer, representatives of the user or purchaser, or by any combination of these parties.

The following recommendations are applicable:

a) The user or purchaser of the system should ensure that, to the extent appropriate, there is consultation at, or prior to, the system design stage with the authority enforcing legislation (e.g. the building control body, fire and rescue authority, local authority or Health and Safety Executive) and, where applicable, the police service.

   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.

b) The purchaser or user should ensure that the designer of an EVC system is adequately apprised of the objectives of the system and,

in particular, whether there is a requirement for calls to be made to, as well as from, outstations.

c) 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:

- the user or purchaser;
- the supplier of the system;
- the installer of the system;
- consultants (including architects, mechanical and electrical consultants, fire safety engineering consultants, access consultants, acoustic consultants and risk assessment consultants).

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.

d) The installer of the system should ensure that, to the extent appropriate, there is consultation with all relevant interested parties within the following list:

- the designer;
- the supplier of the system;
- consultants (including architects, mechanical and electrical consultants, fire safety engineering consultants, access consultants, acoustic consultants and risk assessment consultants).

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

- system design;
- installation;
- commissioning and certification.

6 Variations from the recommendations of this standard

*COMMENTARY ON CLAUSE **6***
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, which are based on recognized good practice in the design, installation and maintenance of EVC systems, are suitable for the majority of normal applications. There will, however, be applications in which the recommendations may be 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.

This does not, however, imply that the designer or installer ought to have freedom to ignore the recommendations of this standard under circumstances in which a user, purchaser or enforcing authority seeks compliance with it. Variations are always the subject of specific agreement amongst all interested parties and need to be clearly identified in all relevant system documentation. Some variations may arise from a fire risk assessment, or may be based upon the engineering judgement of a competent person. There might, for example, be situations where the number or siting of outstations would not conform exactly to this code of practice for reasons relating to the particular building construction.

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 may be sought, such as the user, purchaser, or enforcing authority.

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 compliance of the installation 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 outstation number or siting), they need 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 **5**).

d) All variations should be listed in the system certificate (see Clause **25**).

Section 2: Design considerations

7 Purpose

*COMMENTARY ON CLAUSE **7***
*Emergency voice communications systems, in the context of this part of BS 5839, are intended for specific types of communication. They are not, for example, designed for general use for non-emergency purposes, and the location and construction of EVC system component parts (see Clause **11** and Clause **12**) tend to illustrate this.*

Intended uses for EVC systems are as follows.

a) *Use by the management of the building or complex for its initial evacuation:*

   In the first stages of evacuation, before the fire and rescue service arrives, the EVC system may be used for communication between a person at a fire control centre with, for example, fire wardens or fire marshals on various floors of the building or with stewards at a sports venue. Typically, in the case of a building, a call would be made from an outstation on a particular floor to advise the fire control centre that the floor in question had been cleared of occupants.

b) *Use by the fire and rescue service during an evacuation:*

   After arrival in the building or at the venue, the fire and rescue service would normally take over control of evacuation, with an officer at the fire control centre communicating with other officers via the EVC system.

c) *Use by the fire and rescue service after evacuation:*

   During the course of a fire, the fire and rescue service would continue to use EVC after completion of evacuation, to assist firefighting.

d) *Use by disabled people:*

   *Particularly during a fire, but also in any other emergency situation, disabled persons in refuges (and anyone who is not able to use an exit route – see Note to **3.23**) would be able to identify their presence and communicate with a person, e.g. a control room operator, at the fire control centre, via appropriately situated outstations. Such communication arrangements would then conform to the recommendations of BS 9999:2008, **46.8** on use of refuges, which states "To address these issues there needs to be a system of two-way communication between those waiting in each refuge and the team who are organizing the evacuation of the building. These two-way communication systems need to be such that they are readily operated by, and comprehensible to, all persons likely to need to use them..", BS 9999:2008, **4.6** on inclusive design; BS 9999:2008, **17.1** on horizontal escape; BS 9999:2008, **18.8** on methods of vertical escape for disabled people and BS 9999:2008, **41.9** on communications.*

e) *Other uses:*

   1) *An EVC system may be used by designated persons within a building for non-emergency purposes; for example, someone on a security patrol could use outstations to communicate that person's location to the fire control centre (which would normally also be a security centre).*

   2) *An outstation may have a "loud speak" capability, allowing voice messages or signals arising from a master station to be broadcast over a limited area in the region of the outstation. This facility might be used to allow the operator at the master station to continue to speak to someone in distress near the outstation.*

3) Whether on- or off-hook, an outstation may also have a "listen" facility such that any sound in its immediate vicinity can be heard at the relevant master station(s). In addition to enabling the operator at the master station to listen generally for any sounds near outstations, this facility might be used to allow that operator to continue a conversation with someone in distress near an outstation.

4) Use for communication between outstations ought to be available only under the control of the master station.

NOTE When a group call is made by a master station, there may be a "conferencing" outcome, such that outstations are able to communicate with other outstations as well as with the master station. The facilities referred to in e) as "other uses" are not addressed within the scope of this standard.

5) Communication with Help Points.

*6) Communication with lift intercoms, particularly in evacuation and fire-fighting lifts (see BS 9999:2008, **46.9** on evacuation using lifts).*

7) Signals from alarm systems in accessible WCs.

The following recommendations are applicable.

a) Other than in the case of EVC systems provided in refuges, users of an EVC system should generally be restricted to appropriate staff (e.g. stewards, fire marshals and control room operators) and members of the fire and rescue service.

b) Communication should be between an outstation and a master station, not between an outstation and any other outstation, except where this is possible only because the relevant master station has performed a group call.

c) Communication should normally be initiated from the outstation. However, the facility to call an outstation from the master station might be required in some applications. This should be determined by consultation with interested parties (see Clause **5**).

d) Optional features such as the capability for "loudspeaking" and "listening" may also be provided subject to the following.

1) Where a voice alarm is installed in the building or complex, care should be taken that voice alarm emergency broadcast is not affected adversely or overridden by use of the "loudspeaking" capability of the EVC system as described in Commentary e)2) on Clause **7**.

2) Where an outstation has the "listening" capability described in Commentary e)3) on Clause **7**, this should not interfere with the use of the EVC system for communications within the scope of this code of practice.

8 System circuitry and software

*COMMENTARY ON CLAUSE **8***

The components of EVC systems may be interconnected in various ways. A radial wiring arrangement can be used. It might, however, be more economical for cable to use a loop configuration, or multiple loops. Wireless-links, or any combination of wireless or wired links may also be used. Whichever arrangement is chosen, circuits need to be continuously monitored for faults and circuit design needs to be as resilient as possible to faults.

It is important that unauthorized persons are not able to operate the equipment and that unauthorized changes are not made to system configuration.

The following recommendations are applicable.

a) A radial-wired system may be used. In this case, if a cable fault occurs, an individual fault indication should be given, specifically related to the radial link affected. [see **10.2**a)3)iv)].

b) Alternatively, a single or multiple loop configuration may be used. In either case, for integrity in operation, each loop should be closed, such that emergency voice communication can continue to take place between any outstation and the master station, in the event of an open-circuit of the loop at any one point. Fault monitoring of the loop(s) should be as recommended in **10.2**a)3)iv).

c) A wireless-linked system may be used. In this case, if a link fails an individual fault indication should be given at the master station, specifically related to the link affected [see **10.2**a)3)vi)].

d) Where program-controlled systems are used changes to the programs should be possible only at access level 3 or 4.

NOTE Access levels are described in Annex A.

e) Master stations should be able to be operated only at access level 2.

f) Outstations for public use, such as outstations in refuges, should be at access level 1 but outstations for restricted use, such as fire telephones, should be at access level 2.

g) If a master station is supplied with power from power supply equipment contained in a separate enclosure, the connections between the equipment should be duplicated such that a single open or short-circuit in the connections does not completely remove power from that master station.

9 Audio and data signal paths

*COMMENTARY ON CLAUSE **9***
In an emergency situation, delays in voice communication need to be minimized. Conversation in an emergency needs to involve no further actions by the outstation user other than initiation, and communication quality ought to be as a normal telephone or hands-free telephone system.

Conversation needs to be as near continuous as possible. If however a technical requirement arises whereby the full duplex nature of a two way conversation is not possible, then any manual speech direction steering requirement needs to be controlled by the master station operator, and not involve any action by the outstation user. Since it is quite possible that a handset could be accidentally left off-hook (or the door of its enclosure could be left open), particularly in an emergency, it is important that this does not jeopardize the correct operation of the remainder of the EVC system.

Similarly, it is possible for a "call" button to become jammed in the "call" position. Once again, it is important that this does not affect communication between other elements of the EVC system.

Compatibility of EVC system components, both within a master station or outstation, and particularly between master station and outstation, is necessary for effective communication. A typical EVC system will be supplied as a complete set of equipment, without wiring. Outstations may be presumed to have been designed to be compatible with the master stations

supplied. However, it is important to use the correct type of interconnecting cables and for the cable links to be reliable. In the case of wireless-linked systems it is important that the signal strength of each wireless link has sufficient wireless link budget to ensure that the link is reliable.

The system designers might wish to incorporate the EVC system into other systems such as building management systems, fire detection and fire alarm, voice alarm, telephone systems, intercoms or LAN based systems. In such cases, the primary objective of the system is to ensure that it operates reliably and in the manner recommended by this code of practice.

The following recommendations are applicable.

a) Type A outstations, which use a telephone-style handset, should employ full duplex speech communication. Type B outstations, which use an intercom-style fixed microphone and adjacent loudspeaker, may be full duplex. However, they may use automatic voice level speech direction steering techniques as employed in hands free loud-speaking telephones or they may use manual steering from the master station.

b) When a call is initiated, either at an outstation or at a master station, the incoming call warning indication at the receiving end should operate within three seconds of the initiation.

c) If any outstation handset is off-hook, this should not affect communication between any other outstation on the EVC system and the master station.

d) Jamming of a "call" button or any other means of initiating a call should not affect communication between any other outstation on the EVC system and the master station.

e) Compatibility should be ensured between system components. In particular, master stations and outstations should be compatible. Generally, therefore, it is recommended that the complete equipment set for an EVC system should be purchased from one supplier, which would then have responsibility for its overall performance.

f) Interconnections should be in accordance with the recommendations of Clause **14** and should be monitored for faults as recommended in **10.1**d).

g) Where an EVC system is incorporated into another system, or where another system or systems are incorporated with an EVC system, the recommendations of this standard should take precedence. Any fault in the non-EVC system should not affect the operation of the EVC system.

10 Fault monitoring and indication

*COMMENTARY ON CLAUSE **10***
EVC needs to be a secure and reliable means of communication. Nevertheless, however good its design and installation, there is still the possibility of an EVC system developing a fault. A fault could occur within a master station, a wireless repeater or an outstation, in a power supply, or anywhere in the system wiring. Such faults need to be detected and indicated without delay, so that a service engineer may be called in to effect any necessary repairs.

10.1 Fault conditions

The master station should be capable of monitoring any of the following conditions:

a) power supply fault indications as required by BS EN 54-4;

b) rupture of any fuses or operation of automatic circuit breaker, isolator or protective devices that could prevent voice communication in an emergency;

c) failure of any transmission path including any open-or short-circuit fault up to the transducers in a handset;

d) open-circuit, and short-circuit faults on interconnecting cabling or failure of any transmission path linking any outstation to any master station including any cables between a handset and outstation enclosure;

e) any earth fault on interconnecting cabling linking any outstation to any master station, where this fault would inhibit any mandatory function of the system;

f) any failure of a wireless link from an outstation to a master station either direct or via a wireless repeater;

g) failure of any processor to correctly execute its software program, including cessation of any scanning or interrogating process, or detection of any error in memory checking procedures.

All of the above faults a) to g) should be monitored at all times, including when the system is in non-EVC mode.

10.2 Fault indications

The following recommendations are applicable.

a) The following fault indications should be given at all master stations in the system within 100 s of the occurrence of a fault regardless of whether the EVC system is in EVC mode or non-EVC mode:

1) an audible warning device, preferably within each master station. The sound level should not be less than 50 dB(A) at one metre from the master station, when measured with an instrument conforming to BS EN 61672-1, any group, either Class 1 or Class 2, with time weighting (slow);

NOTE A master station ought to be located in an area with low background noise.

However, if the background noise exceeds 47 dB $L_{Aeq,\ 5\ min}$, the level of sound from the audible warning device should be at least 3 dB above that of the background noise. An (additional) external audible warning device might then be required.

2) a visible indication by means of a separate light emitting indicator (the general fault indicator);

3) separate light emitting indicators and/or a graphic or alphanumeric display, giving the following:

i) a visible indication, common to all power supplies, of the faults described in **10.1**a);

ii) a visible indication, common to all signal paths, of the rupture of any fuse or operation of protective device, as

described in **10.1**b), if the fault is capable of adversely affecting emergency voice communication and is not otherwise indicated as a fault of a monitored function;

iii) an individual visible indication, for each outstation, of the faults described in **10.1**c), except in the event of a fault of the type described in **10.1**b), that would prevent transmission of the fault signal to the master station;

iv) in the case of radially-wired systems, an individual visible indication, for each cable connecting an outstation to the master station, of the faults described in **10.1**d). In the case of a loop-wired system, assuming the loop to be closed as recommended in Clause **8**b), an individual visible indication, for each such loop, of the faults described in **10.1**d);

v) a visible indication common to faults described in **10.1**d) and e). This indication may be the general fault indicator.

4) all fault indications should conform to the design requirements of BS EN 54-16:2008, **13.7**;

5) graphic and alphanumeric displays should conform to BS EN 54-16:2008, **13.8**, except that "the voice alarm condition" is replaced by "a call from an outstation".

b) The indication of faults that exist prior to emergency use of the system may be suppressed during emergency use, except the general fault indicator.

c) If the indication of any fault condition is suppressed during emergency voice communication, the indication should be given in accordance with the recommendations of **10.2**a) within 100 s after cessation of that communication.

10.3 Audible fault warning

The audible fault warning recommended in **10.2**a)1) should be different from the audible warning of an incoming call. This audible fault warning should sound for a minimum of 0.5 s every 5 s.

10.4 Silencing of the audible fault warning

Provision may be made for manually silencing the audible fault warning. [See **12.2**i)].

10.5 Resetting from the fault warning condition

Resetting from the fault warning condition should either be automatic when all faults are removed (non-latching fault warnings), or should be by a manual control (latching fault warnings). If the fault warning condition can be cancelled by resetting when the fault(s) still exists, then the fault warning condition should be restored within 100 s.

NOTE It is permissible for the fault warnings to latch for some types of fault and not for others.

10.6 Monitoring of software controlled equipment

The correct operation of the system software by any processor should be monitored by internal self-checking procedures and by an appropriate monitoring circuit, e.g. a watch-dog circuit, in accordance with the following recommendations.

a) The monitoring circuit and its associated indication and signalling circuits should not be prevented from determining and signalling a fault condition by the failure of any monitored processor or associated clock circuits.

b) The monitoring circuit should monitor the operation of routines associated with the functions of the main program elements; i.e. it should not be solely associated with "waiting" or other "housekeeping" routines.

c) In the event of failure by a microprocessor to execute its software correctly the monitoring circuit should, in addition to initiating an audible and visual fault warning, perform as follows:

   1) re-initialize the processor and attempt to restart the program at a suitable point within 10 s of the occurrence of the failure. The re-initialization procedure should verify that the contents of the memory, both program and data, are not corrupted;

   2) either:

      i) record that a failure has occurred using a system capable of recording a minimum of 999 failures and resettable only by an operation restricted to authorized servicing personnel; or

      ii) automatically reset the equipment and give both a visual and audible warning that an automatic reset has occurred.

10.7 System integrity

10.7.1 A fault in one circuit or wireless transmission path between an outstation and a master station, or between master stations, should not affect any other such circuit or path.

NOTE This means, for example, that where, in a wired system, a master station is radially connected to a number of outstations, an open or short circuit occurring on one radial circuit from one outstation will affect emergency voice communication to and from that outstation only.

10.7.2 In a wired system, where a master station is connected to a number of outstations via one ring (closed loop) circuit, in the event of a single open circuit or short circuit fault in that circuit, an appropriate fault indication should be given at the master station but emergency voice communication to and from all outstations on the circuit should be unaffected by the fault.

10.7.3 In a wired system, where a master station is connected to a number of outstations via one ring (closed loop) circuit, in the event of a single open circuit or short circuit fault in that circuit, an appropriate fault indication should be given at the master station but emergency voice communication to and from outstations on the circuit should be unaffected by the fault, except for those within the fire compartment in which the fault occurred.

10.7.4 In a wired system, different circuits interconnecting master stations and outstations should not be contained within a common cable sheath and, where a master station is connected to a number of outstations via one ring (closed loop) circuit, 'go' and 'return' sections of that circuit should not be contained within a common cable sheath.

NOTE For example, if a number of circuits are served by a multicore cable this will not adequately protect against loss of some or all such circuits because of fire or mechanical damage.

10.7.5 If a master station is powered by power supply equipment contained in a separate enclosure, the connections between the equipment should be duplicated such that a single open or short circuit in the connections does not completely remove power from the master station. The duplicated cables should be separated by at least 300 mm where practicable. Where a power supply unit or a standby battery is housed in a separate enclosure from the master station, any cable between that enclosure and the master station should be suitably protected against overcurrent in accordance with BS 7671.

NOTE Where the enclosure is located immediately adjacent to, and in contact with, the master station, such that cables run directly between the enclosure and the master station, the enclosure need not be regarded as separate from the master station; the recommendations of this subclause do not then apply.

11 Outstations

11.1 General

*COMMENTARY ON **11.1***
An EVC system contains a number of outstations, located at strategic points throughout a building or complex. Intercoms for disabled people may be included as forms of outstations, but there will often be several outstations specifically located for use by persons such as firefighters, during evacuation of the building or during firefighting.

Two (physical) types of outstation are covered by this code of practice. These are:

a) Type A – an outstation using a telephone-style handset for voice communication, so that the user's mouth and ear can be as close as possible to the microphone and ear-piece, respectively.

b) Type B – an outstation using an intercom-style fixed microphone and adjacent loudspeaker, normally mounted on a wall or other vertical surface.

During an evacuation or firefighting in a building or at a complex, there might be a high level of background noise. It is important that outstation design minimizes the effect of background noise upon voice communication.

An outstation needs to be of high integrity so that it may be used in an emergency with high confidence that it will operate correctly.

The following recommendations are applicable.

a) An outstation intended for evacuation or firefighting use should be type A [see Commentary a) on **11.1**]. A type B outstation [see Commentary b) on **11.1**] should be used for such purposes only where it is impractical to install a type A outstation.

b) An outstation intended for use by disabled people at refuges may be either type A or type B.

However, type B outstations should be used in situations where the outstation will be operated by members of the public.

c) When an outgoing call has been initiated, a reassurance tone, i.e. a tone similar to the ringing tone in a normal telephone system, or a reassurance message should be heard by the caller at the outstation via either the handset ear-piece or the integral loudspeaker.

11.2 Controls

*COMMENTARY ON **11.2***
Controls at outstations are for use during emergencies. It is therefore essential that operation of an outstation be as simple as possible, to avoid confusion. All controls need to be clearly labelled.

The following recommendations are applicable.

a) For operation of type A outstations, no controls should be necessary to make a call in EVC mode; i.e. lifting the handset to make a call should automatically operate the hook-switch or, alternatively, opening the door of the enclosure should initiate the call.

b) Operation of type B outstations should require only use of a single call button to initiate a call. This control should be a momentary-action pushbutton switch so that there is no need for it to be mechanically reset after use.

c) In the case of type B outstations, consideration should be given to the inclusion of means to help locate the call button. For example, a raised bezel might be fitted around the pushbutton.

d) Both type A and type B outstations should be labelled with simple instructions on how to initiate a call. Preference should be given to pictograms to describe the method of operation.

11.3 Indications

*COMMENTARY ON **11.3***
It is important for indications at an outstation to be kept to the minimum to avoid any confusion in an emergency.

For outstations intended to receive incoming calls, the incoming call needs to be indicated audibly and, where necessary, visually.

The following recommendations are applicable.

a) Where the facility for calls to, as well as from, outstations is required [see Clause **5**b)], an audible warning of an incoming call should be provided at every outstation. This warning may be given by the ear-piece of a handset, a loudspeaker, or a separate audible fault warning device. The audible warning should sound continuously or in pulsing mode (sounding for a minimum of 0.5 s every 5 s) when there is an incoming call. For a type A outstation, the sound should be cancelled when the handset is removed from its hook or the outstation's door is opened, depending on the mode of operation. In the case of a type B outstation, the audible warning should be cancelled preferably via the call button (which then acts also as a "audible warning silence" control).

b) For a type A outstation, if a handset is left off-hook or the outstation door is left open (depending upon the mode of operation) after a call has been completed, the master station should preferably still be able to initiate an audible warning at the outstation.

c) Where high background noise is unavoidably present, the audible warning signal may be external to the outstation and be supplemented by audible and/or visual indicators. Audible indicators should conform to BS EN 54-3 and visual indicators should conform to BS EN 54-23.

External wiring between the outstation and external indicators should be monitored for open- and short-circuit faults.

d) A red indicator or appropriate text on a graphic or alphanumeric display should be provided to illuminate, either steadily or in flashing mode, when there is an incoming call, except where the outstation is dedicated to use as a fire telephone.

11.4 Electrical performance

*COMMENTARY ON **11.4***
An EVC system is expected to be safe, secure and able to perform its designed functions satisfactorily. Since the main function of an EVC system is voice communication, audibility and intelligibility of conversation is very important.

The following recommendations are applicable:

a) Operating voltage should be extra low voltage, as defined in BS 7671. Guidance on wiring is provided in Clause **14**. Earthing of the housing of an outstation should also be in accordance with BS 7671.

b) Outstations should be monitored for faults [see **10.1**a)].

c) Both microphone and ear-piece or loudspeaker should have a minimum ±3 dB frequency response of 250 Hz to 4 kHz. Where a fixed microphone is used, the minimum ±3 dB frequency response should be 250 Hz to 5 kHz.

d) Any pre-amplifier or other circuitry within an outstation should have a bandwidth such as to prevent the overall audio transmission bandwidth falling below 250 Hz to 4 kHz.

11.5 Mechanical details

*COMMENTARY ON **11.5***
Outstations in an EVC system need to be secure, robust, suitable for the environment, easy to locate and readily accessible in an emergency.

The following recommendations are applicable.

a) Handsets of type A outstations should be enclosed in a housing with a door or removable front panel.

b) All parts of an outstation should be of robust construction, including, as appropriate to type, housing and/or front panel, handset, curly cord to handset, hook-switch, and push button.

c) In locations where surface-mounted outstations could obstruct or injure people, or could readily suffer damage, outstations should be flush-mounted.

d) Where an outstation is mounted outdoors, e.g. at a sports venue, it should be weatherproof, i.e. housed in an enclosure providing a degree of protection of at least IP65, as specified in BS EN 60529. If mounted indoors, the degree of protection should be at least IP3X.

NOTE 1 If an outstation could be subject to water spray or splashing, higher IP classification for the enclosure might be needed.

e) Housings on front panels of outstations provided for firefighting use should be red in colour or otherwise be indicated by means of a red sign conforming to the requirements of BS 5499-1. Housings or front panels provided for refuge communication by disabled people should be green in colour or otherwise be indicated by means of a green sign conforming to the requirements of BS 5499-1.

f) Outstations should generally be readily accessible for use at all times. Where an outstation is unavoidably mounted in an area readily accessible by the public or where it might be subject to abuse, it may be secured, provided that a reliable means of opening it in an emergency is readily available.

g) If the door to an outstation is remotely unlocked or opened under control of the fire detection and fire alarm system or other emergency warning system it should not shut or relock until the warning system is manually reset.

   If the door to an outstation is remotely unlocked or opened under control of authorized staff at the controlling master station the controls should be at access level 2. It should only relock under the control of authorized staff at the controlling master station at access level A2.

   NOTE 2 There may be a manual means of opening the door at the outstation.

   NOTE 3 Access levels are described in Annex A.

h) Where key locking is used as a method of securing the outstation, all outstations should have a common key. The user should be provided with sufficient keys for all relevant personnel.

i) Any proposal to secure an outstation should be agreed with the interested parties [see Clause **5**a)].

j) In sports venues, outstations should be key locked to avoid misuse.

   NOTE 4 Safety measures ought to ensure that management and stewards or marshals have appropriate keys and are trained to use the outstations in the event of emergencies.

k) Outstations provided for use by people at refuges should be readily available at all times and should not be secured.

11.6 Location

*COMMENTARY ON **11.6***
The preferred location of an outstation varies dependent upon its use. Outstations for use by disabled people will need to be located in designated refuges, and outstations for evacuation/firefighting purposes where they would be of most use to firefighters and persons controlling an evacuation in an emergency, (e.g. in lobbies of firefighting staircases).

Outstations need to be mounted at a height appropriate to the application.

The main purpose of an EVC is effective communication and so it is essential that background noise levels in the vicinity of outstations are kept as low as possible. Outstations have to be located in fire fighting lobbies or in refuges and, during an emergency, the background sound level may be significantly increased due to, for instance, fire alarm sounders, stair-core pressurization or extraction fans and building occupants.

The following recommendations are applicable.

a) The number and location of outstations should be as agreed with the appropriate interested parties [see Clause **5**a)].

b) The number and location of outstations should be determined on the basis of the purpose of the EVC system (see Clause **7**).

c) Within a sports or similar venue, no-one should have to travel more than 30 m to reach the nearest outstation. Outstations should also be provided at key points as recommended by the Guide to Safety at Sports Grounds [2].

d) Where an EVC system is provided in a building for use by the fire and rescue service to assist firefighting, outstations should be provided on all floors of the building served by firefighting stairs, and in the firefighting lobby to each firefighting stair. An additional outstation should be provided at each fire and rescue service access point.

e) Where an EVC system is provided in a building for use by management during an evacuation, outstations should be provided on all escape staircases on every floor of the building.

f) Each outstation should be located in a protected lobby or protected corridor, or, where there is no lobby or corridor approach to the staircase, in the protected stairway itself.

g) In a multi-storey building, to assist in locating outstations, outstations should normally be installed in the same horizontal location on each floor.

h) Because, in a building, an outstation will be located in an escape route that should be free from obstacles, it should normally be wall-mounted. In general, the outstation should be mounted at a height of 1.3 m to 1.4 m above the floor in an easily accessible, well illuminated and conspicuous position free from obstruction. Likewise, at sports and similar venues, such outstations should be mounted at a height of 1.3 m to 1.4 m above the ground in easily accessible positions free from obstruction.

i) Where possible, outstations installed in public access buildings should not be installed in areas of the building where they can be subject to abuse. Where this is unavoidable, they should be secured [see **11.5**g)].

j) Where the EVC system is provided to facilitate communication by disabled people in an emergency, outstations should be provided in all refuges and, where appropriate, an outstation should be provided adjacent to the evacuation lift on each floor. They should be mounted at a height of between 900 mm and 1.2 m above the floor in an easily accessible, well illuminated and conspicuous position free from obstruction. Likewise, if required at sports and similar venues, such outstations should be mounted at a height of 900 mm to 1.2 m above the ground in easily accessible positions free from obstruction.

k) As far as practicable, outstations in buildings should be located where background noise is normally low [preferably not more than 40 dB(A)]. Where there is a higher level of background

noise in an emergency, the installation of an acoustic hood or structure around the outstation might help to reduce this to an acceptable level. Fire alarm sounders should not be located near to outstations.

NOTE 1 The use of visual alarm devices instead of audible alarm devices may be appropriate, which may mean varying from the recommendations of BS 5839-1, in which case this should be documented.

*NOTE 2 BS 8300:2009, **9.1.2** gives advice on acoustic treatment of spaces and recommends that the recommendations of BS 8233 should be followed.*

11.7 Audio frequency induction loop systems

*COMMENTARY ON **11.7***
In order to make EVC systems more accessible to disabled people, audio frequency induction loop systems may be specified to supplement the loudspeaker at Type B outstations.

In this case it is important that the field strength is adequate and that the system is intelligible for both seated and standing users.

Where an audio frequency induction loop system is provided at an outstation, it should be installed and maintained according to the recommendations of BS 7594. The performance of the audio frequency induction loop system should meet the requirements of BS EN 60118-4 at the six locations shown in Figure 1 and Figure 2.

Figure 1 **Measuring field strength – plan view**

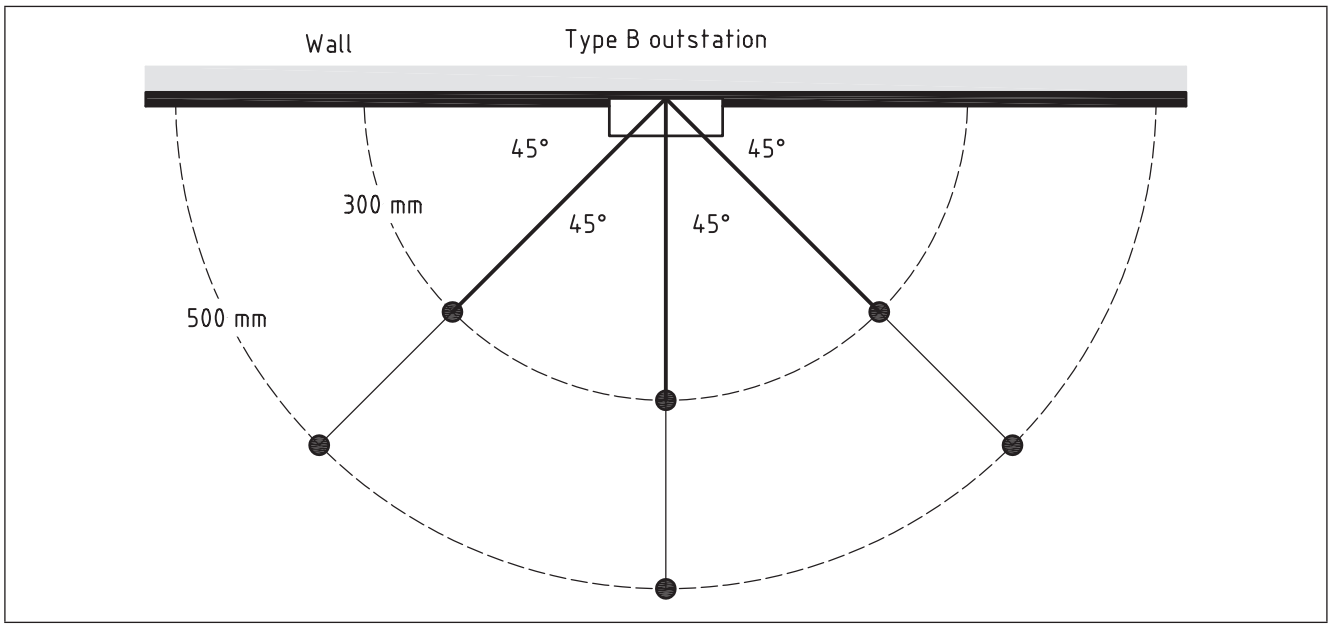
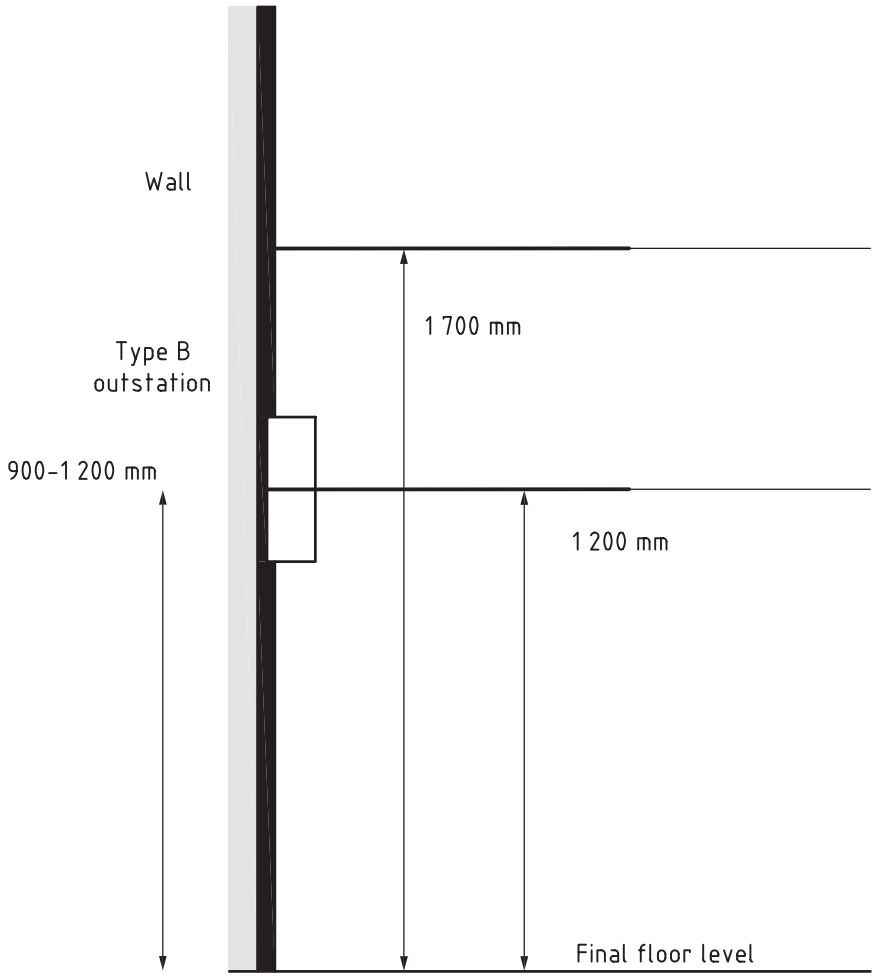


Figure 2 **Measuring field strength – side view**



NOTE The recommended installation height of Type B outstations is between 0.9 m and 1.2 m above the floor. This is in order to present the call button, microphone and loudspeaker at a practical distance from the user. The recommendations for the induction loop field strength are related only to ear height and are also designed to provide coverage at head height to a standing person.

12 Master stations

12.1 General

*COMMENTARY ON **12.1***
An EVC system will contain at least one master station. The EVC system is controlled from a master station located at a central control point such as a fire control centre or security room or, if there is no manned control centre, at the main fire and rescue service access point. A master station would be expected to be permanently manned in an emergency. In a fire emergency situation, control might be taken over by a fire officer. In a large building or complex, there may be more than one point from which evacuation or other emergency situations can be controlled. It may then be appropriate for a master station to be installed at each such location. Where more than one master station is installed in a building or complex, one master station needs to have overall control of the EVC system at any given time, the remainder of the "master stations" effectively

*becoming repeaters. A master station will communicate with a number of outstations throughout the building or complex (see Clause **11**). It needs to be powered from the normal low voltage electricity supply in the building or complex, but will also have a secondary supply consisting of a secondary battery kept fully charged (whether or not the building or complex has a standby generator (see Clause **13**).*

A master station needs to be able to receive calls from all outstations. Where required, it will also have the facility to call each individual outstation, group of outstations or all outstations. As a minimum, a master station will have a telephone-style handset or microphone and loudspeaker for voice communication purposes, controls for making calls to, and receiving calls from, outstations, indicators to identify incoming calls, and fault and status indicators. Under the control of the master station, a "conferencing" facility may be available for a limited number of outstations. In a complex of different buildings, it may be desirable to have a voice communication link between a master station in one building and master stations in other buildings.

The following recommendations are applicable.

a) There should be at least one master station in a building or complex, located as described in **12.6**.

b) Where more than one master station is installed in a building, the EVC system should be designed so that it can be controlled from only one master station at any given time. A secure means, such as an interlocking key system or an arrangement whereby a security code (password) has to be entered at a keypad, should be provided to switch EVC control from one master station to another.

c) The power supply for a master station should conform to BS EN 54-4 and the recommendations of Clause **13** and Clause **16**b).

d) For communication with outstations, a master station should have either:

   1) a telephone-style handset; or

   2) a noise-cancelling microphone mounted on a flexible or fixed arm with in-built windshield to prevent "popping" noises whilst speaking, and a separate panel- or desk-mounted loudspeaker.

      NOTE 1 Option 2) is the less desirable option.

e) Where audio transducers are outside the master station, the interconnections should be monitored for open and short-circuit faults.

f) It should not be possible to disconnect external audio transducers without the use of tools.

g) Where master stations are not located in a sound-controlled environment, background noise levels should be kept as low as possible. The following should be considered.

   1) On the fire alarm and fire detection system, install visual alarm device(s) (VAD) instead of fire alarm sounders or voice alarm loudspeakers.

      NOTE 2 This might involve a variation to BS 5839-1.

   2) On the fire alarm and fire detection system, siting fire alarm sounders or voice alarm loudspeakers away from the master station.

3) On the fire alarm and fire detection system, isolating individual fire alarm sounders or voice alarm loudspeakers.

NOTE 3 In this case, it is important to meet the recommendations of BS 5839-1 regarding indication of isolated alarm devices.

h) If required, a headset with a boom microphone may be used to supplement either of the above.

i) A master station should have controls and indicators as recommended in **12.2** and **12.3**, respectively.

j) A master station should conform, electrically and mechanically, to the recommendations of **12.4** and **12.5**, respectively.

k) As an option, a facility may be provided for voice communication between master stations. If installed, such a facility may use the existing handset or microphone/loudspeaker (for communication with outstations) or a separate handset or microphone/loudspeaker. The interconnecting link between master stations (for control signals and audio) should be monitored for short-circuit and open-circuit faults as outlined in **10.2**b) for outstations-to-master station connections. For wireless-linked systems, the wireless link should be monitored with a failure resulting in warnings at all master stations.

12.2 Controls

*COMMENTARY ON **12.2***
Controls at master stations are for use mainly during emergencies. Operation of a master station ought therefore to be simple and straightforward, with all controls clearly labelled.

Adequate initial and continuing training is important to ensure that systems will be correctly used in an emergency.

The following recommendations are applicable.

a) An "accept call" switch should be provided to receive a call from each outstation individually or by another device fulfilling the same function e.g. scrolling graphic or alphanumeric display and accept/make call switch.

b) Where the EVC system is required to have the facility to call outstations, additional controls should be provided as follows:

1) a "make call" switch, or similar device fulfilling the same function, should be provided to initiate a call to each outstation individually;

2) as an option, an "all call" switch may be provided to allow a call to be made from the master station to all outstations connected to it;

3) as an option, "group call" switches may be provided to allow calls to be made from the master station to particular groups of outstations.

NOTE 1 For Type A outstations, the handset might have to be lifted in order to hear what is being said.

NOTE 2 Each "make call" and "accept call" switch may be combined.

c) Means should be provided to allow conversation to take place with selected outstations.

*NOTE 3 This function may be an integral part of the functions of the call switches referred to in **12.2**b).*

d) An arrangement should be provided for cancelling conversations with outstations. For example, a call to a particular outstation (or a group or all outstations) may be cancelled by a second operation of the appropriate call switch (if a pushbutton type) or by a similar "deselect" arrangement.

*NOTE 4 This cancelling operation ought not of itself to cancel the "call indication" (see **12.3**), which will be cancelled only when the relevant outstation reverts to on-hook or "enclosure door closed" condition [see **11.2**a)].*

e) A non-latching method of testing indicators should be provided When operated, it should cause all master station visual indicators to illuminate and the audible warning indicator to sound.

f) Where a "loudspeak" facility is required [see Commentary e)2) on Clause **7**], a momentary action "loud speak" switch may be provided to allow, in association with the operation of appropriate call switch(es), a local voice broadcast to be made from the outstation(s) selected.

g) Where a "listen" facility is required [see Commentary e)3) on Clause **7**], a momentary action switch should be provided to allow, in association with the operation of appropriate call switch(es), a facility whereby the operator at the master station can "listen in" for any sounds in the immediate vicinity of the outstation(s) selected.

h) Where software is used in the master station, a secure non-latching method should be provided either to:

1) reset the software execution failure recorder [see **10.6**c)2)i)]; or

2) reset the automatic reset warning [see **10.6**c)2)ii)].as appropriate.

*NOTE 5 "Secure" in **12.2**h) means operated by a key, or on entry of a security code (password) via e.g. a number of pushbutton switches.*

i) A momentary action switch may be provided to allow the audible fault warning to be silenced (without affecting any visual fault indications). When this facility is provided, and the audible fault warning has been silenced, it should be automatically reinstated in the event of a different type of fault occurring. The audible warning should also be automatically reinstated after it has been silenced for a maximum of eight hours during a continuing fault condition.

j) A momentary action switch may be provided to reset any fault conditions. (See **10.5**.)

k) Any further controls associated with voice communication that are outside of the scope of this code of practice should be clearly separate from the EVC controls and their functions should be overridden by use of the master station(s) as recommended in this code of practice.

*NOTE 6 The controls referred to in **12.2**a) to k) may take the form of keys of a keypad, associated with a graphic or alphanumeric display. In large EVC systems, they may take the form of icons on a visual display unit, selected by, e.g., mouse pointer, light pen or touch.*

l) All controls should be clearly labelled.

m) Staff should receive operational training prior to system handover and management should ensure that this training is repeated whenever new staff are employed and at least once a year for all staff who might use the system.

12.3 Indicators

*COMMENTARY ON **12.3***
Indicators are needed at a master station for identification of outgoing and incoming calls, for identification of faults in the EVC system, to confirm that the system is operational and possibly to confirm that certain optional functions have been selected.

If indicators are not clearly labelled and consistent throughout the building there is a risk that operators will misunderstand or misinterpret them.

The following recommendations are applicable.

a) Where the facility to call outstations is required, a visual indicator should be provided at each "make call", "all call" or "group call" switch [see **12.2**b)]. The appropriate indicator should be red in colour, preferably in pulsing mode (lighting for a minimum of 0.5 s every 5 s), when an outgoing call is initiated via the "make call" switch. The indication should preferably change from red to green (pulsing) when the outstation(s) called becomes off-hook. Cancellation of the call at the master station should cause each appropriate indication to revert to flashing red mode until the outstation called becomes on-hook, when it should extinguish. [See **12.2**d)].

b) A visual indicator should be provided at each "accept call" switch [see **12.2**a)]. The appropriate indicator should be red in colour, preferably in pulsing mode (lighting for a minimum of 0.5 s every 5 s), when there is an incoming call. The indication should preferably change from red to green (pulsing) when the appropriate "accept call" switch is operated. Cancellation of the call at the master station should cause each appropriate indication to revert to flashing red mode until the outstation called becomes on-hook, when it should extinguish. [See **12.2**d)].

   *NOTE Each "make call" and "accept call" visual indicator may be combined. [See Note to **12.2**b)].*

c) A common audible warning of an incoming call should be provided, preferably within the master station. The sound level should not be less than 50 dB(A) at one metre from the master station, when measured with an instrument conforming to BS EN 61672-1, any group, either Class 1 or Class 2, with time weighting (slow). However if the background noise exceeds 47 dB(A), the level of sound from the audible fault warning device should be at least 3 dB higher than that of the background noise. An additional external audible fault warning device might then be required. The type of sound from this audible fault warning device should be markedly different from that of the audible fault warning devicereferred to in **10.3**.

d) When a "loudspeak" facility [see **12.2**f)] is provided, a green visual indicator should be provided at the appropriate switch. This indicator should illuminate while the "loudspeak facility" is operational.

e) When a "listen in" facility [see **12.2**g)] is provided, a green visual indicator should be provided at the "listen in" switch. This indicator should illuminate while the "listen in" switch is operated.

f) All the fault indicators referred to in **10.2** should be provided. Each visual indicator should be yellow.

g) All indicators should be clearly labelled.

h) Some or all of the indicators referred to in **12.2**a), and d) to g) may take the form of one or more graphic or alphanumeric displays, instead of, for example, individual LEDs. All the indications referred to in **12.2** should be displayed when required, and readily distinguishable as to their functions, e.g. "make call", "accept call", outstation off-hook, etc. The graphic or alphanumeric display(s) may then indicate such functions by appropriate text and/or numerals. Where graphic or alphanumeric displays are proposed to be used at the master station(s) of an EVC system, prior to installation of the system discussions should be held with appropriate persons, including the user and system designer, to ensure that the form and functioning of these displays are acceptable to all parties.

i) All master stations throughout the building should have consistent display types and colours.

12.4 Electrical performance

*COMMENTARY ON **12.4***
An EVC system is expected to be safe, secure and able to perform its designed functions satisfactorily. Since the main function of an EVC system is voice communication, audibility and intelligibility of conversation is very important.

The following recommendations are applicable.

a) The recommendations of **13.1** apply for the primary power supply to the EVC system. These recommendations will therefore apply to the master station if the primary (mains) supply is fed directly into it. As in the case of the outstations, the operating voltage (derived from the mains supply) should be extra low voltage, as defined in BS 7671. Earthing of the housing of a master station should also be in accordance with BS 7671.

b) The master station should be monitored for faults [see **10.1**c)].

c) The path of audio through the master station (either from incoming audio from an outstation to the ear-piece piece or loudspeaker, or from the microphone to the outputs to the outstations) should have a minimum ±3 dB frequency response of 250 Hz to 4 kHz. Where a fixed microphone and loudspeaker arrangement is used at the master station, the minimum ±3 dB frequency response should be 250 Hz to 5 kHz for the microphone and for the loudspeaker.

NOTE The upper frequency limit of 4 kHz is to allow for an overall upper audio transmission limit of about 3.4 kHz, traditionally used for telephone communication. That overall limit ought to be acceptable for communication via a telephone-style handset, where coupling to ear and mouth is fairly close, with consequent reduction of the effect of background noise on voice communication. Where a handset is not used, audio transmission of wider bandwidth is desirable to counter the effect of background noise.

12.5 Mechanical construction

*COMMENTARY ON **12.5***
Master stations in an EVC system need to be secure, robust and suitable for the environment.

The following recommendations are applicable.

a) Where, in a building, there is no central control room and therefore the master station is located, for example, at a fire and rescue service access point, it will probably need to be wall-mounted, because of space restriction. In such a case, the master station should be locked, i.e. with a locked front door or with a key-operated switch to enable/disable all controls. A reliable means of manually opening it in an emergency should be available, local to the master station.

b) To allow for mounting in a common area, in the absence of a suitable control room, a master station should be of robust construction, including in particular its exposed parts, such as the housing, front panel, handset, curly cord to handset, control switches, etc.

c) In locations where a surface-mounted master station could obstruct or injure people, or could readily suffer damage, it should be flush-mounted.

12.6 Location

*COMMENTARY ON **12.6***
To assist the operator of a master station in controlling an evacuation, or during firefighting, a master station ought to be located close to a fire panel or repeater fire panel. To minimize the likelihood of unauthorized use or abuse, a master station will preferably be installed at a supervised location. Such a location would have additional advantages in that it would normally have a low background noise level and it would probably allow the master station to be desk-mounted. Where a master station has to be mounted in a common area because of the absence of a suitable control room, it needs to be installed at an appropriate height above the floor.

It is important that the background noise levels in the area of master stations are low so that the person operating the system can hear the users and can be clearly heard by the users. For this reason it is preferable for master stations to be located in dedicated control rooms where background noise levels are low. However, it is accepted that, regardless of the normal sound levels, background noise may increase during an emergency.

Where master stations are located in an uncontrolled environment, it is even more important to minimize the effects of background noise, for instance by minimizing room reverberation and by controlling the level of sound from fire alarm sounders or voice alarm loudspeakers in the vicinity of the master station.

In both cases, the ability of the microphone at the master station to pick up the operator's voice clearly whilst rejecting unwanted sounds is important.

The following recommendations are applicable.

a) EVC system master station(s) should be located:

   1) close to the main fire alarm panel or a repeater fire panel.

   2) preferably in a manned control or security room.

   3) in an area of low fire risk.

   4) in an area with low background noise, particularly during an emergency.

NOTE 1 Background noise can be minimized during an emergency by, for instance, providing the facility to mute audible alarms from within easy reach of the master station.

b) Where there is no suitable control room in a building or complex, a master station should be installed close to the fire and rescue service access point to the building. However, to avoid distraction of the operator of the master station by evacuating occupants, where possible the master station should not be installed in an escape route.

NOTE 2 If the installation of the master station in an escape route is unavoidable then arrangements should be made to minimize distraction of the operator by, for instance, physical separation.

c) If a master station is to be used by a standing operator, the vertical centre of the panel controls and handset, if used, should normally be between 1.4 m and 1.5 m above the floor. In a control room, the master station controls and handset, if used, should be within easy reach from the operator's normal position.

d) In a building, where it is not possible to install the master station in a low-noise control room, it should, if possible, be located where background noise is normally low, preferably not more than 40 dB(A). Where there is a higher level of background noise, the installation of an acoustic hood or structure around the master station might help to reduce the effect of background noise to an acceptable level.

*NOTE 3 BS 8300:2009, **9.1.2** gives advice on acoustic treatment of spaces and recommends that the recommendations of BS 8233 should be followed.*

e) Fire alarm sounders should not be located near to master stations.

NOTE 4 The use of visual alarm devices instead of audible alarm devices may be appropriate.

13 Power supplies

*COMMENTARY ON CLAUSE **13***

The primary supply for the EVC system will normally be derived from the low voltage mains supply in the building, transformed or modified as necessary. The mains supply would be expected to be reliable and capable of supplying the largest load that can be placed on it under normal and fault conditions. In order to minimize the potential for failures, the design of the mains supply to the system ought to be such that it is unlikely to be affected by faults on other circuits or equipment, or by isolation of supplies in the building for maintenance or economy in consumption of electricity.

It is likely that the mains supply will fail at some time during the lifetime of the EVC system whether through failure of the mains supply to the building or failure of the final circuit serving the EVC system. Accordingly, the mains supply needs to be backed up by a secondary supply, usually consisting of a battery under continuous charge, that is able to support the system while the fault in the mains supply is corrected. The secondary supply is expected to be reliable, and transfer between the two supplies is not expected to affect the operation of the system.

The duration of the secondary supply needs to be sufficient to allow for more than the maximum likely single-period failure time of the public electricity supply. Failure of the primary supply might, however, arise because of failure of the final normal supply circuit serving the EVC system. During any failure of the primary supply, there is need for

sufficient standby battery capacity to allow typical emergency use of the EVC system for a reasonable period.

The presence of the mains supply needs to be indicated by a visual indicator at the master station(s) to enable mains failure to be identified by the user. This indication would be particularly useful when the building or complex was reoccupied after a period of non-occupation of longer than the maximum duration of the secondary supply. The loss of primary power needs to be reported at the master stations

If the premises are provided with an automatically started standby generator, the capacity of the standby battery may be reduced, provided the circuits served by the generator include that of the EVC system.

13.1 Recommendations for mains power supplies

The following recommendations are applicable to the low voltage mains supply to the system.

*NOTE 1 This supply ought to be regarded as an integral part of the EVC system, particularly for the purpose of certification of the system (see Clause **25**), regardless of whether it is provided by the organization responsible for installation of the EVC system.*

a) For reasons of electrical safety, the mains supply to all parts of the EVC system should be supplied, via an isolating protective device (such as a circuit-breaker), from the load ("dead") side of the main isolating device for the building or complex.

b) The mains supply circuit(s) to all parts of the EVC system except outstations should be dedicated solely to the EVC system, and should serve no other systems or equipment. The circuit(s) should be derived from a point in the building's electrical distribution system close to the main isolating device for the building.

c) All power supplies providing power to any part of the system should indicate any faults at the master station.

d) To facilitate local isolation during maintenance, the low voltage supply circuit for the main power supply and master station(s) should supply the EVC system via double pole isolation facilities located adjacent to the equipment.

e) Subject to conformity with **13.1**a) to c), the number of isolating devices between the incoming power supply to the building and the EVC system power supply unit should be kept to the minimum practicable for conformity to BS 7671.

NOTE 2 For example, the supply may comprise a dedicated circuit emanating from the first electrical distribution board in the building's electrical distribution system.

f) Every isolator and protective device that can isolate the supply to the EVC system, other than the main isolator for the building, should be labelled either:

"EMERGENCY VOICE COMMUNICATION SYSTEM", in the case of a protective device that serves only the EVC circuit, but incorporates no switch; or

"EMERGENCY VOICE COMMUNICATION SYSTEM. DO NOT SWITCH OFF", in the case of a switch (whether incorporating a protective device or not) that serves only the EVC circuit; or

"WARNING. THIS SWITCH ALSO CONTROLS THE SUPPLY TO THE EMERGENCY VOICE COMMUNICATION SYSTEM", in the case of

any switch that disconnects the mains supply to both the EVC system and to other circuits.

g) Every isolator, switch and protective device that is capable of disconnecting the mains supply to the EVC system should be situated in a position inaccessible to unauthorized persons or be protected against unauthorized operation.

h) The circuit supplying the EVC system should not be protected by a residual current device unless this is necessary to conform to the requirements of BS 7671. Where a residual current device is necessary for electrical safety, a fault on any other circuit or equipment in the building should not be capable of resulting in isolation of the supply to the EVC system.

i) Irrespective of the condition of any standby battery (e.g. disconnected or fully discharged), the mains power supply should be capable of supplying the maximum operating load of the system, i.e. the load applying when, for example, continuous attention-drawing signals are being sent from the master station(s) to all outstations.

13.2 Recommendations for EVC system power supply units

The following recommendations apply to every power supply unit that forms part of the EVC system.

a) Transition between the primary supply and the secondary supply, and vice versa, should not cause any interruption to voice communication via the system.

b) A fault in the primary supply should not affect the secondary supply or vice versa. The operation of a single protective device should not result in failure of both the primary and the secondary supply.

c) The condition of the primary supply should be indicated by a green lamp, lit when the primary supply is healthy, located in a position that makes it readily obvious to any person responsible for monitoring faults on the EVC system (e.g. mounted on every master station).

d) Primary and secondary supplies should each be independently capable of supplying the maximum operating load of the system, irrespective of the condition of the other supply.

e) The secondary supply should comprise a secondary (rechargeable) battery with an automatic charger, to which the following recommendations apply.

   1) The battery should be of a type having a life of at least four years under the conditions of use likely to be experienced in the EVC system. An automotive battery (of the type used for starting car engines) should not be used.

   2) A label should be fixed to the battery indicating its date of installation. The label should be so sited that it can be read without disturbing the battery.

   3) The charging rate of the battery should be such that, having been discharged to its final voltage, the battery can be charged sufficiently to conform to the recommendations of **13.2**i) after a charging period of 24 h.

4) The recommended capacity of the battery is as follows.

   i) In the event of failure of the primary supply, where the building or complex does not have an automatically started standby generator to provide power to the EVC system, the capacity of the battery should be sufficient to maintain the system in a quiescent state of operation for at least 24 h, after which sufficient capacity should remain to allow the system to be used for voice communication in an emergency situation for at least 3 h.

   ii) In the event of failure of the primary supply, where the building or complex has an automatically started standby generator to provide power to the EVC system, the capacity of the battery should be sufficient to maintain the system in a quiescent state of operation for at least 3 h, after which sufficient capacity should remain to allow the system to be used for voice communication in an emergency situation for at least 3 h.

14 Cables, wiring and other interconnections

*COMMENTARY ON CLAUSE **14***

The components of most EVC systems are connected by cables and wiring, but it is possible to connect them by other means, such as wireless-links or fibre optics. Where fibre optic connections are used, they are expected to provide equivalent integrity and reliability to other cables that could be used for the same purpose. It is essential that all interconnections are ready to operate correctly at the start of a fire and that they will continue to do so for as long as possible during the fire. This is to ensure that voice communication will be possible during evacuation and, as far as possible, during firefighting. Interconnecting cables therefore need to have long-term resistance to fire.

The integrity of the mains supply to the system is also regarded as essential; even though the system has a secondary power supply, its reliability might not be as high as that of the primary mains supply. Accordingly, mains supply circuits need to be adequately protected against the effects of fire.

*BS 5839-1:2002+A2:2008, Clause **26** defines two levels of fire performance of fire resisting cables, termed "standard" and "enhanced". It is important that the selection of the level of fire resistance for cables used in EVC systems is suitable for the required evacuation and fire-fighting procedures for the building.*

EVC systems in buildings generally need to operate correctly during a fire for periods in excess of those normally required for single phase evacuation of a building, and often in excess of normal fire and rescue service attendance times. Therefore, cables used for EVC systems generally need to have "enhanced" fire performance. This would be the case, for instance, in EVC systems installed for use by the fire and rescue service and EVC systems for use in disabled refuges, in unsprinklered buildings with evacuation in four or more phases and (unsprinklered) buildings greater than 30 m in height.

Nonetheless, the use of cables with standard fire resistance performance in an EVC system may be acceptable where the system is intended for use only in disabled refuges and not for fire-fighting or similar purposes by the fire and rescue service and where such cables would be capable of operating correctly during the period specified by the evacuation strategy for the building.

In sports and similar venues, underground sections of cable may not need to have "enhanced" fire performance but they will require appropriate mechanical protection. Mineral insulated copper sheathed cables normally provide both "enhanced" fire performance and mechanical protection The probability of disablement of any part of the EVC system as a result of mechanical damage to cables can be reduced by the use of sufficiently robust cables, careful selection of cable routes and by the provision of mechanical protection in areas where cables are susceptible to mechanical damage. Monitoring of circuits does not ensure that cable faults will not occur, but is essential to minimize the time between occurrence and identification (and hence repair) of the fault. Monitoring of circuits and protection of cables against damage are, therefore, complementary precautions, rather then alternatives.

It is the responsibility of the designer to ensure that the electrical characteristics of the cables, including current carrying capacity and voltage drop, are suitable for the system. The choice of cable and routes selected ought to take into account the need to avoid electromagnetic interference from other cables and sources of electromagnetic radiation, particularly in the case of systems in which cables are used for transmission of serial data. In the latter case, the cable selected needs also to be suitable for the characteristics of the data transmission.

EVC circuits need to be segregated from the cables of other circuits to minimize any potential for other circuits to cause malfunction of an EVC system arising from:

- *breakdown of cable insulation of other circuits;*
- *a fire caused by a fault on another circuit;*
- *electromagnetic interference to any EVC circuit as a result of the proximity of another circuit;*
- *damage resulting from the need for other circuits to be installed in, or removed from, conduit, ducts or trunking containing an EVC circuit.*

The use of cables conforming to BS EN 60702-1, BS EN 60702-2, BS 7629-1 or BS 7846 (see BS 5839-1), together with corresponding terminations, is sufficient to achieve segregation of the EVC cables from those of other services for the purpose of protecting the integrity of the EVC system against failures in the insulation of other cables and fires involving those cables.

EVC cables ought to be colour coded or otherwise marked, e.g. by labels, so that the possible need for appropriate segregation can be identified. There will also be less likelihood of inadvertent manual interference with the circuits of EVC systems (e.g. during work on other electrical circuits).

The following recommendations are applicable.

a) The electrical characteristics of all cables, such as voltage drop, current carrying capacity and impedance, should be suitable for the system.

b) Except for applications listed in c), cables used for all interconnections between components of an EVC system and for the low voltage mains supply to the system, should be of enhanced resistance to fire [see BS 5839-1:2002+A2:2008, **26.2**e)].

c) Standard fire resisting cables [see BS 5839-1:2002+A2:2008, **26.2**d)] should be considered to provide sufficient resistance to the effects of fire with appropriate methods of support and jointing [see BS 5839-1:2002+A2:2008, **26.2**g)] for:

1) EVC systems for use in disabled refuges but not for fire-fighting or similar purposes by, e.g. the fire and rescue service, in:

   i) sprinklered buildings;

   ii) unsprinklered buildings less than 30 m in height, provided that evacuation takes place in three or fewer phases.

2) underground sections of cabling at sports and similar venues.

d) Methods of cable support should be non-combustible and such that circuit integrity will not be reduced below that afforded by the cable used, and should withstand a similar temperature, duration and water application to that of the cable, while maintaining adequate support.

NOTE 1 In effect, the recommendation precludes the use of plastic cable clips, cable ties or trunking, where these products are the sole means of cable support.

NOTE 2 Experience has shown that collapse of cables, supported only by plastic cable trunking, can create a serious hazard for firefighters, who could become entangled in the cables.

e) Cables should be installed without external joints wherever practicable. Any such joints should be enclosed in junction boxes, labelled with the words "EMERGENCY VOICE COMMUNICATION SYSTEM", and should be constructed of materials that will withstand a similar temperature, duration and water application to that of the cable whilst maintaining integrity of the joint.

f) Except in particularly arduous conditions, mineral insulated copper sheathed cables and steel wire armoured cables may be used throughout all parts of the installation without additional mechanical protection. Cables conforming to BS 7629 should be given mechanical protection in any areas in which physical damage or rodent attack is likely. In particular, mechanical protection should be given to all areas that are less than two metres above floor level, other than in relatively benign environments (e.g. offices, shops and similar premises) in which the cable is clipped directly to robust construction. Conduit should conform to the relevant part of BS EN 50086 and non-metallic trunking should conform to BS 4678-4.

NOTE 3 Protection may be provided by laying cable on tray, burying in the structure of the building, or by installation in conduit, ducting or trunking.

g) All conductors should have a nominal cross-sectional area of at least 1 mm^2, other than in the case of twisted-pair cables, in which individual conductor size should be at least 0.5 mm^2.

h) EVC cables should be segregated from LV and HV cables of other services but may be run together with other fire services, such as voice alarm and fire detection.

i) Where multi-core cable is used for interconnection of EVC circuits, none of the conductors should be used for circuits other than those of the EVC system.

*NOTE 4 This recommendation does not preclude the multiplexing of signals of other systems with those of the EVC system. Guidance on such integrated systems is given in Clause **9**.*

j) EVC system cables carrying electric current at a voltage in excess of extra-low voltage should be segregated from extra-low voltage EVC circuits. In particular, the mains supply cable to any master station should not enter the equipment through the same cable entry as cables carrying extra-low voltage. Within the equipment, low voltage and extra-low voltage cables should be kept separate to the extent practicable.

k) Where practicable, all EVC cables should be of a single, common colour, that is not used for cables of general electrical services in the building, to enable these cables to be distinguished from those of other circuits. This colour should be the same as for the fire alarm and fire detection system.

NOTE 5 The colour red is preferred.

15 Wireless-linked EVC systems

*COMMENTARY ON CLAUSE **15***
Some of the recommendations of this standard, applicable to wired systems, are unsuitable for, or cannot be applied to, wireless-linked systems. These include, in particular, those relating to power supplies and fault monitoring. Additional recommendations apply to wireless-linked systems in order to address the integrity and performance of the wireless communications link between master stations, wireless repeaters and outstations.

In practice, no systems can have total reliability, but one of the objectives of good system design is to minimize the probability of the system being inoperative in the area of a fire once a fire has started. Great care needs to be taken when assessing a site and choosing the technology to use, as neither the wireless nor hardwired system is singularly suitable for every site.

Components of an EVC system interconnected by wireless-links can include master stations, outstations, wireless repeaters, as well as ancillary components.

Wireless communications may also be used to link a number of components to what is essentially a wired system. The recommendations of this standard apply equally to such wireless-linked systems.

Due to the constraints of commonly-used wireless technologies and the restrictions placed by licensing authorities on channel occupancy, Push-To-Talk (PTT) techniques for speech steering might be appropriate for wireless-linked EVC systems.

If a user of a PTT outstation encounters difficulties in understanding that they need to press a button in order to speak, it is expected that the operator of the master station will prompt them accordingly.

An alternative method of speech steering is for control to be solely from the master station even if this results in providing the outstation user with fixed periods of transmission (talk) time.

Where a wireless system relies on a single operating frequency or pair of operating frequencies, the system ought to ensure that equipment misuse or fault does not allow a single transmitting device to block a wireless frequency and prevent communication between other elements of the EVC system.

Portable devices may be used to supplement the EVC system as receivers or transceivers. Receivers enable EVC system communications to be monitored by authorized persons. Transceivers enable two-way communications with outstations and the master station from locations

around the building and even outside of the building. However the following operational constraints are relevant.

a) As the portable device could be used in any location within the building, it is important that full building coverage is validated before the devices are relied upon operationally.

b) Battery life is finite and the users need to ensure that batteries are regularly charged and that low battery warnings are heeded. With modern battery technologies the operational time between re-charges is expected to exceed a day and battery capacity is not expected to be affected by recharging when only partially discharged.

The following recommendations are applicable.

a) Wireless-linked systems should conform to all recommendations of this standard except that:

1) outstations should be supplied from at least two independent power supplies; possible arrangements are as follows.

i) The primary mains supply plus a reserve battery (primary or continuously-charged secondary); or

ii) a primary battery plus a second primary battery; or

iii) a primary battery plus a secondary battery.

NOTE Where a secondary battery is specified, capacitors with an appropriate specification may be used as an alternative.

2) components, other than master stations and wireless repeaters, may utilize a battery, or some form of alternative energy supply, to provide the primary power supply;

3) power supplies incorporating a battery should give at least 30 days' warning of impending battery failure. This should be indicated as a low battery warning condition at the master station;

4) at the point at which the primary battery can maintain the component for no more than seven days in the standby state plus 30 min in the active state, a fault warning should be given at the master station;

5) a primary battery should have a minimum, normal operational life of three years over the temperature range of +15 °C to +35 °C before the low power condition is signalled;

6) any fault giving rise to loss of communication with a radio linked component should be indicated at the master stations within two hours of the occurrence of the fault;

7) a wireless-linked EVC system should be able to operate with attenuation of the transmitted signal by at least 10 dB.

b) Cables of antennas that are external to, but connected to, master stations and radio repeaters should normally satisfy the recommendations of **26.2**. However, cables that do not conform to **26.2** may be used provided they are routed through areas with automatic fire detection or areas of low fire risk, or are protected against exposure to fire by burial in at least 12 mm of plaster or by separation from any fire risk by materials that would afford a fire resistance of at least 30 min if tested in accordance with the relevant part of BS 476. These cables and the associated antennas should be continuously monitored for their VSWR at the system's

operating frequency. Any change which will adversely affect the reliability of the wireless signal link should be displayed at the master station within 100 s.

c) Antennas should be so arranged that special tools are required for their disconnection or removal.

d) When using a wireless technology, consideration should be given to interference sources and the security of the system from those sources such that the system is as reliable as is practicable. Radio-linked EVC systems should operate on a radio frequency allocated by the regulatory authority to minimize the potential for co-channel interference.

e) A fault indication should be given within 100 s at the master station if no valid transmissions are received from all of the wireless-linked components for two hours.

f) After 30 s of continuous interference to the transmitted signal that may compromise the performance of the EVC system, a fault indication should be given at the master station within a further 100 s.

g) Wireless systems that utilize single or dual frequency working should automatically ensure that a single device (outstation, master station or portable) cannot block the frequency by either transmitting on at the same time as another device or transmitting continuously.

    1) Before commencing transmission the device should listen to check that no other transmission is already taking place and should inhibit transmission if the frequency is in use.

    2) If the device successfully commences transmission, it should time out after a pre-set period of 25 s and return to receive.

    3) If a user continuously holds down the PTT, the time out period in item h)2) should operate and, in order to prevent immediate repeated transmission an additional timer should inhibit transmission for 5 s to enable another device to take the channel.

h) If portable devices are connected to the EVC system they should:

    1) not be used in lieu of a master station. It is recommended that a master station be only operated during an evacuation by a trained operative.

    2) only be considered as an extension to the EVC system and not be relied upon as a primary means of communication.

    3) only be used in environments where comprehensive wireless coverage surveys have been completed and wireless coverage to portable devices has been established throughout the building. Where direct wireless links from outstations to the master station have been proven, the use of an in-building wireless repeater should still be considered to provide effective portable coverage.

    4) only be provided to trained personnel who understand the EVC system and the operation of the master station.

5) operate with a power source comprising rechargeable batteries normally kept in a fully charged state by a dedicated and suitable charger.

NOTE It is preferable to use batteries that do not suffer from degraded performance when charged intermittently or continuously.

6) have a battery capacity that exceeds one day with a duty cycle of 1 hour of talk time and 23 hours of standby.

7) display the identity of the outstation or master station that is being received.

i) Where an outstation uses PTT for voice steering adequate signage and labelling should be displayed to explain to the user how the equipment should be operated.

j) Installation of a wireless-linked EVC system should only take place only after a comprehensive survey has been undertaken to ascertain the following:

1) there are no other sources of wireless transmission that could interfere with, or block communication between the master station and other components of the system;

2) there is adequate signal strength for communication both to and from components as appropriate in all areas of the building(s) in which wireless-linked components are to be located. This should take into account the minimum acceptable signal level defined by the manufacturer in respect of the level of background "noise" at the time of the survey and the site attenuation level specified in item a)7). This should be established by the use of calibrated field strength measuring equipment at each receiving component of the system and recording the measurements made for future reference.

k) Where the system is networked, it should be established that the communication conditions described in g)2) are achieved throughout the network.

l) Only survey test equipment that has been approved by the manufacturer and regularly calibrated should be used to carry out the survey. A record of the date of calibration and the date when the next calibration is due should be marked on the survey equipment.

m) To meet the audio bandwidth recommendations of this standard (see **12.4**) on FM radio systems, an RF channel spacing of 25 kHz is necessary. Where the licensing authority cannot allocate a suitable RF bandwidth the audio bandwidth might be restricted. If the audio bandwidth that is achieved is lower than is recommended by this standard this should be agreed as a variation.

16 Environmental conditions

*COMMENTARY ON CLAUSE **16***
The design of an EVC system needs to allow it to operate in accordance with this part of BS 5839, over a reasonable range of ambient conditions, such as temperature and humidity. Parts of an EVC system may be installed out-of-doors, particularly in sports and similar venues.

The following recommendations are applicable.

a) For applications in buildings, the equipment used in an EVC system (including master stations, power supplies and outstations) should be capable of performing all its functions in the environmental conditions expected in buildings.

b) Master stations should, in particular, when subjected to all the environmental and EMC immunity tests described in BS EN 54-2, satisfy the criteria for conformity specified in those clauses. See Annex B.

17 Electromagnetic compatibility

*COMMENTARY ON CLAUSE **17***
It is necessary to take particular care in the design and installation of the EVC system to avoid electromagnetic interference, particularly from, but also to, other equipment. Electromagnetic interference to an EVC system can result from mobile telephones, radio transmitters, other equipment used within the building, lightning and power transients.

Attention is drawn to the importance of designing and installing EVC systems so that they do not cause, and are not unduly susceptible to, electromagnetic interference, in accordance with the Electromagnetic Compatibility Regulations 1992 (as amended to date), which implement the EMC Directive 89/336/EEC (as amended).

The following recommendations are applicable.

a) In order to comply with the Regulations, there should be compliance with, at least, the following recommendations, although these might not, alone, be sufficient to ensure compliance.

   1) Every system component should satisfy the relevant requirements of the product standard for that component in respect of electromagnetic capability.

   2) Cables should be installed in accordance with the recommendations of Clause **14**.

   3) Installation workmanship should conform to the relevant recommendations of Section **3**, particularly in relation to quality of terminations and continuity of earthed screens.

18 Electrical safety

*COMMENTARY ON CLAUSE **18***
An EVC system is a special form of electrical installation, much of which operates at extra low voltage (ELV) but some of which operates at low voltage (LV) whereby the BS 7671 recommendations regarding safety and earthing are applicable.

It is important to understand that mains supplied equipment normally has a circuit protective conductor (CPC) to provide a protective earth. Some electrical equipment, e.g. double insulated, does not have a protective earth because of inherent safety built into the design but, in general, low voltage mains supplied (LV) EVC systems do require a protective earth.

EVC systems may have one or both of the following types of earth connection:

a) protective earth (PE), intended to protect from shock hazard anyone touching exposed conductive parts of the installation. In the event of a fault, the CPC is intended to conduct the fault current to earth,

causing a final circuit protective device to operate and disconnect the supply, so preventing shock hazard;

*b) functional earth (FE), an earth provided for purposes not necessarily related to safety, but primarily a screen for electromagnetic compatibility (EMC) purposes (see Clause **17**). The FE needs to have continuity throughout all relevant circuits. It needs to be connected according to the EVC system manufacturer's instructions. There may be more than one FE, each associated with, for example, a loop, a radial circuit or an interface. Unless the manufacturer advises otherwise, each FE circuit needs to be connected to the PE at one place only. The FE might not necessarily meet the requirements of a CPC.*

If, according to the manufacturer's instructions, the FE and PE are or are intended to be the same (as would normally be the case when mineral insulated copper sheathed cable is used), it is acceptable to connect the screen to the earth at more than one point.

Particular care is necessary to ensure the adequacy of earthing and of protection against shock from exposed metal parts. Expert advice (for example from the equipment manufacturers) might be necessary in complex sites in which different earth potentials exist, so that electrical safety is not compromised and circulating currents are avoided.

The designer also needs to ensure that the system can be maintained safely. The mains (LV) power supply for each equipment needs to have a double pole isolation facility nearby.

18.1 The system design should conform to BS 7671. In particular, CPCs should be adequately rated.

18.2 The EVC system manufacturer's instructions or product marking should be followed, particularly in respect of earthing arrangements.

18.3 LV and ELV circuits should be segregated throughout in accordance with Clause **14**j). In particular, if any EVC system cables share the same wiring containment with other cables, the cable insulation of such cables should be rated for the highest voltage.

18.4 Means should be provided for isolation of the mains power supply to all parts of the system [see **13.1**c)].

Section 3: Installation

*COMMENTARY ON SECTION **3***
This section of BS 5839-9 provides recommendations for the work associated with installation of the EVC system equipment. EVC systems are often used for non-EVC purposes and controls may be provided in the same location. Care is needed to ensure that access to these controls does not necessarily include access to emergency controls.

19 Responsibility of installer

The following recommendations are applicable.

a) The responsibility for installation of an EVC system should be clearly defined and documented before the start of the installation contract.

b) The installer should comply with the recommendations of Clause **5**d).

c) The installer should comply with the recommendations of Clause **6**b).

d) The installation of outstations should be in accordance with the recommendations of Clause **11**.

e) The installation of master stations should be in accordance with the recommendations of Clause **12**.

f) The installer of the mains power supplies to the master stations should ensure that the supplies conform to the recommendations of **13.1**.

g) The installer should ensure that all outstations, master stations and power supply equipment that are likely to need routine attention for maintenance are sited in readily accessible locations that facilitate safe maintenance work.

20 Installation practices and workmanship

*COMMENTARY ON CLAUSE **20***
The nature and quality of the installation work needs to be such as to maintain the integrity of the EVC system and minimize the duration and extent of disablement of the system during maintenance or modifications. Installation practices and workmanship need to meet the requirements of BS 7671. Penetrations of construction (e.g. for the passage of cables, conduit, trunking or tray) need to be made good to avoid the free passage of fire or smoke, regardless of whether the construction has a recognized degree of fire resistance.

The following recommendations are applicable.

a) The entire installation should conform to the requirements of BS 7671. In general, the recommendations of this standard supplement, but do not conflict with, these requirements; where any such conflict is considered to exist, the recommendations of BS 7671 should take precedence.

b) Surface-laid cables should be neatly run and securely fixed at suitable intervals, in accordance with the recommendations of the cable manufacturer.

NOTE Cables ought not to rely on false ceilings for their support.

c) The installer should ensure that all wiring conforms to the recommendations of Clause **14**.

d) Joints in cables, other than those contained within the enclosures of equipment, should be avoided wherever practicable.

e) Where new conduit, trunking or tray is installed, ample facilities should be provided for installation of cable.

f) Where a cable passes through an external wall, a smooth-bore sleeve of metal or other non-hygroscopic material should be sealed into the wall. It should slope downwards towards the outside and should be plugged with a suitable non-hardening waterproof compound to prevent the entry of rain, dust or vermin.

g) Where a cable passes through an internal wall, a small clearance hole should be provided. If additional mechanical protection is necessary, a smooth-bore sleeve should be sealed into the wall.

h) Care should be taken to ensure that the ends of any sleeves are free from sharp edges to guard against damage to cables during installation.

i) When a cable passes through a floor, the considerations of Clause **20**g) and h) apply, but the sleeve should extend as far above floor level as is required for protection of the cable it is to carry, and in any case not less than 300 mm.

j) Where cables, conduits, trunking or tray pass through floors, walls, partitions or ceilings, the surrounding hole should be as small as reasonably practicable and made good with fire stopping materials that ensure that the fire resistance of the construction is not materially reduced. Spaces through which fire or smoke could spread should not be left around the cable, conduit, trunking or tray.

k) If cables or conduits are installed in channels, ducts, trunking or shafts that pass through floors, walls, partitions or ceilings, barriers with the appropriate level of fire resistance should be provided within the channels, etc to prevent the spread of fire unless, in the case of ducts and shafts, the construction of the duct or shaft affords equivalent fire resistance to the structure penetrated; in the latter case, fire stopping need only be provided where cables pass into, or out of, the duct or shaft.

21 Testing of wiring

*COMMENTARY ON CLAUSE **21***
*On completion of wiring, or sections of wiring, the installer ought to carry out tests to ensure the integrity of cable insulation and adequacy of earthing. Usually, the tests on cables will be carried out with equipment disconnected and prior to completion of the entire installation. Further tests need, therefore, to be carried out on completion of the installation; these tests may form part of the commissioning process. Maximum impedance may sometimes be specified by the system manufacturer, in which case any measurements of impedance recommended by the manufacturer need also to be carried out, either by the installer on completion of installation or at commissioning (see Clause **22**).*

The following recommendations are applicable:

a) All installed cable should be subject to insulation testing at 500 V d.c. Prior to this test, cables should be disconnected from all equipment that could be damaged by the test.

b) Insulation resistance, measured in the above test, between conductors, and between each conductor and earth, should be at least 10 MΩ.

c) Earth continuity and, where appropriate, earth loop impedance, should be tested to ensure conformity to BS 7671.

d) Unless there is specific agreement that the following tests will form part of the commissioning process, the tests should be carried out on completion of the installation work:

   1) where maximum circuit resistance for any circuit is specified by the manufacturer, measurement of the resistance of every such circuit;

   2) any other tests specified by the manufacturer of the system.

e) The results of all tests should be recorded and made available to the organization responsible for commissioning the system.

Section 4: Commissioning and handover

22 Commissioning

*COMMENTARY ON CLAUSE **22***
*The process of commissioning involves thorough testing of the installed system to ensure that it operates correctly in accordance with the recommendations of this standard and with the specification. At commissioning, it ought also to be confirmed that all relevant documentation has been handed over to the user (see Clause **23**). The organization responsible for commissioning the system needed to clearly defined prior to the start of the installation work.*

*It is not, in general, the responsibility of the commissioning engineer to verify conformity of the design, or of the installation work, with this part of BS 5839 (i.e. with Section **2** and Section **3** of this standard). In general, the responsibility of the commissioning engineer is to verify that the system operates correctly in the manner designed and that the installation workmanship is generally of an adequate standard. The commissioning engineer needs to be provided with the specification for the system.*

The following recommendations are applicable.

a) The system should be commissioned by a competent person, who has access to the requirements of the designer (i.e. the system specification).

b) Any person responsible for commissioning an EVC system in accordance with the recommendations of this standard should possess, at least, a basic knowledge and understanding of Section **2** and Section **3** of this standard.

c) At commissioning, the entire system should be inspected and tested to ensure that it operates satisfactorily and in particular, that:

   1) intelligible conversation can be carried out between any outstation and the master station(s). The intelligibility check should be carried out in the presence of the approximate level of background noise anticipated to be present when the building or sports or similar venue is fully occupied and there is an emergency;

   2) all controls and indicators at outstations and master stations operate correctly;

   3) the style of outstations conforms to **11.1**;

   4) the siting of outstations conforms to **11.6**;

   5) electrical and mechanical details of all outstations conform to **11.4** and **11.5**, respectively;

   6) the location of master station(s) conforms to **12.6**.

   7) the electrical and mechanical details of master station(s) conform to **12.4** and **12.5** respectively;

   8) the mains power supplies conform to the recommendations of **13.1**.

   9) the secondary power supplies conform to the recommendations of **13.2**.

   10) as far as it is reasonably practicable to ascertain, the specified cable type has been used in all parts of the installation and the workmanship conforms to Clause **19**;

*NOTE The above recommendation is not intended to imply that it is the responsibility of the commissioning engineer to verify or certificate conformity of the installation design with this standard. However, if variations are identified by the commissioning engineer, particularly variations related to circumstances that might not have been known to the designer, they need to be documented for referral to the designer, user or purchaser for agreement or action [see Clause **6**b)].*

11) there are no other obvious shortcomings in conformity to Section **2** of this standard;

12) adequate records of insulation resistance, earth continuity and, where appropriate, earth loop impedance tests exist;

13) all relevant documentation has been provided to the user or purchaser.

d) Unless already undertaken and documented by the installer, the tests recommended in Clause **21**d) should be carried out and the results recorded.

e) Labels, visible when a battery is in its normal position, should be fixed to the battery, indicating the date of installation.

23 Documentation

*COMMENTARY ON CLAUSE **23***
On completion of the system, it is necessary that adequate records and other documentation are provided to the purchaser or user. "As fitted" drawings and operation and maintenance manuals are particularly important. Without these drawings and manuals, maintenance or future modification of the system might be difficult.

It is recommended that the following documentation should be provided to the purchaser or user of the system.

a) Certificates for design, installation and commissioning of the system (see Clause **24**).

b) Adequate operation and maintenance manuals for the system; these should provide information regarding the following:

1) the equipment provided and its configuration;

2) the meaning of all indications and the use of all controls;

3) routine testing of the system;

4) servicing of the system.

c) "As fitted" drawings indicating at least the following:

1) the positions of all outstations;

2) the position of the master station(s);

3) the type, sizes and routes of cables.

NOTE 1 The cable routes shown need to comprise a reasonable representation of the route followed, such as to enable a competent person to locate the cable in the event of a fault or need for modification or extension of the system.

NOTE 2 In the case of extensions or alterations, existing "as fitted" drawings will need to be updated.

d) Such other records as are required by any purchase specification (e.g. insulation resistance test records or commissioning records).

24 Certification

*COMMENTARY ON CLAUSE **24***
On completion of design, installation and commissioning, a separate certificate needs to be issued for each process, confirming conformity to this standard for the stage in question (i.e. design, installation or commissioning) or identifying variations. Each process might be undertaken by one organization or different organizations. Whichever arrangement applies, three separate certificates need to be issued. An organization may issue a certificate for the process for which they are responsible, regardless of whether a certificate has been issued for either of the other processes.

It is essential that the person(s) who sign(s) these certificates is competent to verify whether the recommendations of this standard in respect of the process to which the certificate refers have, or have not, been satisfied. The purchaser or user might, subsequently, rely on the certificate as, for example, evidence of compliance with legislation. Liability could arise on the part of any organization that issues a certificate without due care in ensuring its validity.

The purchaser will be asked to complete an acceptance certificate provided by the organization bearing contractual responsibility for the system upon completion. The purpose of this certificate is to provide a record that the purchaser is satisfied that the requirements of the specification have been met. The certificate also needs to confirm that adequate documentation has been handed over to the user, that the user has been instructed in the use of the system and understands their obligations in respect of the maintenance of the system. The purchaser might wish to carry out an independent inspection of the system, or to witness certain tests (which may include any or all commissioning tests) as a pre-requisite for completion of the acceptance certificate.

For certain (usually large and/or complex) systems, the purchaser or user might wish to arrange for independent verification of conformity with this standard. If so, a verification certificate needs to be issued by the verifier.

24.1 On, or as soon as practicable after, completion of each of the following processes, a certificate should be issued by the organization responsible for the process, certifying conformity to the recommendations of this standard in respect of the process or, if variations exist, clearly identifying these variations:

a) design;

b) installation;

c) commissioning;

d) acceptance;

e) verification.

24.2 If a purchaser or user commissions an independent audit to verify, as far as practicable, conformity (see Clause **26**), the purchaser should request that the auditor issues a verification certificate.

24.3 Where modifications are carried out to a system (see **30.3**), the purchaser should request that the organization responsible for the work issues a modification certificate.

24.4 Information and statements of conformity within the certificate models for design, installation, commissioning, acceptance, verification and modification provided (see Annex C) should be included on the certificate, but the certificate may vary in format from those models.

25 Acceptance

*COMMENTARY ON CLAUSE **25***
On completion of the system, arrangements need to be made for formal handover of the system to the purchaser or user, and formal acceptance of the system by the purchaser (or representative of the purchaser).

Before accepting the handover of the system, the purchaser or a representative needs to ensure that they are satisfied with the installed system, that the user has an adequate understanding of the operation of the system and that relevant documentation has been provided. In the case of small, simple systems, or systems installed in the premises of small organizations with little relevant in-house expertise, acceptance might involve little more than a brief inspection of the system by the user, demonstration of its operation by the commissioning engineer, and handover of the relevant documents to the user. In large, complex systems, it is likely that the purchaser would wish to witness relevant tests, as part of a formal and structured acceptance procedure.

*As evidence of acceptance, an acceptance certificate needs to be signed by the purchaser (see Clause **24**).*

25.1 Acceptance procedures should be carried out in accordance with the agreed purchase specification [see Clause **5**e)], including any tests that are to be witnessed and details of the witnessing procedure.

25.2 Before accepting a system, the purchaser (or appropriate representative of the purchaser) should check that:

a) all installation work appears to be satisfactory;

b) calls can be established from outstations to master station(s);

c) intelligible two-way conversation is possible between the master station(s) and outstations in emergency conditions such as when extraction fans and fire alarm sounders or voice alarm loudspeakers are operating;

d) the system fully operates when the primary power supply is removed;

e) the following documents have been provided to the purchaser or user:

- as-fitted drawings;
- operating and maintenance instructions;
- certificates of design, installation and commissioning (see Clause **24**);
- a logbook (see Clause **32**);

f) representatives of the user have been adequately trained in the operation of the system;

g) the nominated responsible person has been advised of their responsibilities and how these might be discharged (see Clause **32**);

h) all relevant tests, defined in the purchase specification, have been witnessed.

25.3 As evidence of acceptance, the purchaser (or appropriate representative of the purchaser) should sign an acceptance certificate (see Clause **24**).

26 Verification

*COMMENTARY ON CLAUSE **26***
The purchaser or user might decide that there is a need for verification of conformity of the installed system as a result of one or more of the following:

a) the division of work elements between different organizations;

b) the evolution of the building design during construction;

c) the lack of detailed information at the time of design.

The verifying organization might be one of those involved in the design, supply, installation or commissioning processes (e.g. the system supplier or the designer) or an independent third party.

It is important that any person assigned to carry out the verification process is competent and experienced in the design of EVC systems conforming to BS 5839, and familiar with the relevant installation practices.

26.1 Where a purchaser or user considers that there is significant potential for the installed system to deviate from this standard, verification of conformity should be arranged.

NOTE In the event that the verification process identifies areas of non-conformity, the purchaser or user might request a further verification of the affected areas after correction.

26.2 Any person responsible for verification should be competent in the design of EVC systems in accordance with this standard and familiar with the relevant installation practices.

26.3 The scope and extent of the verification process should be agreed between the purchaser or user and the organization responsible for verification.

26.4 On completion, a verification certificate should be issued (see **C.5**). The verification certificate should also contain information on the scope and extent of the verification carried out or identify where this information is available (e.g. a report).

27 Training

*COMMENTARY ON CLAUSE **27***
Before accepting the handover of the system, the purchaser needs to ensure that they are satisfied with the installed system and that the user has an adequate understanding of the operation of the system. This will involve training of personnel in the operation of outstations and the use of the master station controls.

The following recommendations are applicable.

a) Before accepting a system, the purchaser (or appropriate representative of the purchaser) should ensure that sufficient representatives of the user have been properly trained in the operation of the system.

   NOTE 1 It is important to recognize that untrained users will be operating the outstations. Therefore, the master station operator needs to be trained to prompt the outstation user in the correct operation of the system. This might be particularly important in full duplex or PTT systems when the untrained user might otherwise hold the communication channel open and not be able to hear the master station operator.

b) Responsibility for provision of the training should rest with the organization bearing contractual responsibility to the purchaser for the system, albeit that the provider of the training is likely to be the supplier of the system.

NOTE 2 This is likely to necessitate a formal training course for a number of people; the requirements for such training ought to be defined in the purchase specification.

Section 5: Maintenance

28 Routine testing

*COMMENTARY ON CLAUSE **28***
Although EVC systems incorporate a high degree of monitoring so that faults are indicated automatically, it is still necessary for the responsible person nominated by the user to ensure that fault indications at the master station are identified for appropriate action. It is also important for a regular test to be carried out to ensure that there has not been any major failure of the entire system, or a significant part of the system.

28.1 Recommendations for weekly testing by the user

The following recommendations are applicable.

a) In premises in which the location of the master station is such that the audible fault warning signal could go unnoticed for longer than 24 h, a special check should be carried out each day to confirm that either the equipment indicates normal operation or that any fault indication is receiving necessary attention. This inspection need not be recorded.

b) Every week, an outstation should be operated. It should be confirmed that the call is correctly received at the master station and that a short test conversation is clear and intelligible at both master station and outstation.

c) A different outstation should be used at the time of every weekly test, so that all outstations in the building are tested in rotation. The result of the weekly test and the identity of the outstation used should be recorded.

28.2 Recommendations for monthly attention by the user

The following recommendations are applicable.

a) If an automatically started emergency generator is used as part of the secondary power supply to the EVC system, it should be started up once each month by simulation of failure of the primary power supply and operated on-load for at least one hour. The test should be carried out in accordance with the instructions of the generator manufacturer, including instructions on the load that should be operated. At the end of the test, the fuel tanks should be left filled, and the oil and coolant levels should be checked and topped up as necessary.

b) If a vented battery is used as a secondary power supply, a visual inspection of the battery and its connections should be made to ensure that it is in good condition. Action should be taken to rectify any defect, including low electrolyte level

NOTE Care needs to be taken to ensure that any person undertaking this task is competent to do so safely.

29 Inspection and servicing

*COMMENTARY ON CLAUSE **29***
It is essential that the system is subject to periodic inspection and servicing so that unrevealed faults are identified and preventive measures can be taken to ensure the continued reliability of the system. Periodic inspection and servicing needs to be carried out by a competent person with specialist knowledge of the equipment used. This will normally be an outside organization; care needs to be taken to ensure that, if, for example, in-house employees are used for this task, they have equivalent competence to the technicians of a typical servicing organization.

29.1 Recommendation for quarterly inspection of a vented battery

All vented batteries and their connections should be examined by a person competent in battery installation technology. Electrolyte levels should be checked and topped up as necessary, and the specific gravity of the electrolyte in each cell should be checked to ensure that it is correct.

NOTE In many large premises and sites, in-house maintenance personnel are competent to carry out this task.

29.2 Recommendations for six-monthly inspection and test of the system

The following work should be carried out by a competent person every six months.

a) Each outstation should be operated to check that the outstation is functioning and that speech is clear and intelligible, and that audio frequency induction loops (if fitted) meet the recommendations given in **11.7**. A visual inspection should be made to check that all outstations remain unobstructed and conspicuous.

b) Batteries and their connections should be examined and load tested, to ensure that they are in good serviceable condition and not likely to fail before the next service visit. Vented batteries should be examined to ensure that the specific gravity of each cell is correct.

c) The functions of the master station(s) should be checked.

d) All controls and visual indicators at the master station(s) should be checked for correct operation.

e) Where provided, all optional functions of the master station(s) and outstations should be tested.

f) All fault indicators should be checked, where practicable, by simulation of fault conditions.

g) All further checks and tests recommended by the manufacturer of the EVC system should be carried out.

h) On completion of the work, any outstanding defects should be reported to the responsible person and a certificate of servicing issued to the user.

i) The signal strength of wireless links should be checked to ensure they continue to exceed the minimum acceptable levels.

30 Non-routine attention

*COMMENTARY ON CLAUSE **30***
*The arrangements in Clause **29** are intended to maintain the system in operation under normal circumstances. However, from time to time, the EVC system is likely to require non-routine attention, including special maintenance. Non-routine maintenance includes:*

- *a special inspection of an existing EVC system when a new organization takes over maintenance of the system;*
- *repair of faults or damage;*
- *modification to take account of extensions, alterations or changes in occupancy;*
- *inspection and test of the system following a fire.*

30.1 On appointment of a new maintenance organization:

a) a special inspection of the existing EVC system should be commissioned, including the records (see Clause **23**) in order to produce a plan for effective maintenance of the system;

b) areas of non-conformity should be documented and identified to the responsible person and, although the degree of a non-conformity is subjective, the following non-conformities should be regarded as requiring resolution:

NOTE Not all non-conformities need to be rectified; this is a matter for the user to determine, based on the advice of the maintenance organization, the enforcing authorities, the insurer and any third-party advisers engaged by the user, as appropriate.

- calls cannot be established from outstations to master station(s);
- intelligible two-way conversation is not possible between the master station(s) and outstations;
- the system does not fully operate when the primary power supply is removed;
- secondary power supplies that fail to conform to Clause **13;**
- cabling with fire resistance that fails to conform to Clause **14**;
- monitoring for faults of circuits that fail to conform to Clause **10**;
- standards of electrical safety that fail to conform to Clause **18**;

c) if no logbook suitable for enabling conformity with Clause **32** exists, the maintenance organization should provide a suitable logbook.

30.2 For arranging repair of faults or damage:

a) where maintenance is carried out by a third party there should be an agreement for emergency call out to deal with any fault or damage that occurs to the system and this agreement should be such that, on a 24-hour basis, a technician of the maintenance organization can normally attend the premises within eight hours of a call from the user;

NOTE It is accepted that this might not be possible in very remote areas and certain offshore islands, in which case this may be regarded as a variation from the recommendations of this standard in respect of maintenance arrangements; and will need to be recorded in the system logbook.

b) the name and telephone number of any third party responsible for maintenance of the system should be prominently displayed at the master station(s), and the records and documentation as identified in Clause **23** kept updated;

c) the user should record all faults or damage in the system logbook, and arrange for repair to be carried out as soon as possible.

30.3 For modification work, regardless of whether it is carried out on site or remotely:

a) the responsibility of modifying an EVC system should rest with a person who is competent in the principles of EVC system design, and is conversant with this standard and the installed system, with access to the as-fitted drawings;

NOTE 1 This person may, for example, be the original designer, or a competent representative of the user or maintenance organization.

b) before modifying an EVC system, care should be taken to ensure that the proposed modifications do not detrimentally affect the conformity of the system to fire safety legislation;

c) the responsible person (see Clause **31**) should be aware of and agree in writing any modifications proposed for the system;

d) all components, circuits, system operations and site-specific software functions known to be affected by the modifications should be tested for correct operation following the modifications; in particular:

- if any additional load has been placed on the system, the rating of the power supply unit and the capacity of the standby battery;
- if any changes have been made to the outstation circuits;
- if software has been modified, selective testing of other aspects of the system;

NOTE 2 The nature and extent of these tests cannot be specified in this standard; this will depend on the nature and extent of the software changes and needs to be defined by the organization responsible for the software changes.

e) on completion of the modifications, all as-fitted drawings and other relevant system records should be updated as appropriate;

f) on commissioning of the work and completion of the tests, a modification certificate should be issued, confirming that the work has been carried out in accordance with the recommendations of this standard, or identifying any variations (see **C.7** for a model modification certificate);

NOTE 3 A modification certificate will generally be necessary where the system changes include addition or removal of outstations.

g) where responsibility for the conformity, or otherwise, of the modified system to the recommendations of Section **2** of this standard rests with any person other than the organization carrying out the modification, that person should sign the appropriate section of the modification certificate and make it available with the system documentation (see Clause **23**).

*COMMENTARY ON **30.3***
Modifications to the system can arise for a number of reasons, including:

- *extension of the system to cover previously uncovered or newly constructed areas of the building;*
- *changes as a consequence of changes to the evacuation strategy or other changes within the EVC system.*

It is possible, in some systems, for modification of the system configuration to be carried out remotely.

Whether modifications are undertaken on site or remotely, great care needs to be taken to ensure that they do not affect conformity with this standard, or that existing non-conformities are not exacerbated.

Although the modifications may be carried out remotely by the maintenance organization, it would be appropriate for a competent person from the maintenance organization to visit the premises before the modification is carried out, to confirm the validity of the modification and consider its effect on conformity with this standard.

30.4 After a fire:

a) every outstation, master station and repeater that might have been affected by the fire should be inspected and tested in accordance with Clause **29**;

b) a visual examination and suitable tests should be carried out on all other parts of the system that lie within the fire area and other areas affected by corrosive smoke from the fire and that might have been damaged by the fire (e.g. power supplies, master stations and cable). Where there is evidence of damage, suitable action should be taken;

c) circuits external to the master station(s) that might have been affected by the fire should be tested for correct operation;

d) on completion of the work, any defects found should be recorded in the system logbook, and the responsible person notified accordingly;

30.5 After long periods of disconnection of the EVC system, inspection and testing should be carried out in accordance with Clause **29**.

Section 6: User responsibilities

31 Responsible person

*COMMENTARY ON CLAUSE **31***
There is a need for the user to appoint a single, named responsible person to supervise all matters pertaining to the EVC system. The role of the responsible person ought to be to ensure that the system is tested and serviced in accordance with the recommendations of this part of BS 5839, that appropriate records are kept, and that relevant occupants in the protected premises are aware of their roles and responsibilities in connection with the EVC system.

The following recommendations are applicable.

a) A single, named responsible person should be appointed to supervise all matters pertaining to the EVC system. The responsible person should be given sufficient authority to carry out the duties described in this subclause.

b) The responsible person should ensure that arrangements are in place for testing and servicing of the system in accordance with the recommendations of Section **5** of this standard.

c) The responsible person should ensure that suitable records are kept in relation to testing and servicing.

d) The responsible person should ensure that all relevant staff or occupants of the premises are instructed in the proper use of the system. Particular care should be taken to ensure they are adequately familiar with the appropriate controls and understand when and when not to use the system and how to make calls efficiently and to the point. In premises in multiple occupation, it should be ensured that sufficient representatives of each building occupier are instructed.

e) When changes are made to the system, the responsible person should ensure that record drawings are updated.

32 Logbook

*COMMENTARY ON CLAUSE **32***
A logbook is kept for the purpose of recording events that occur in respect of the system, including fault signals and work on the system. This information might be of value to the organization that maintains the system.

The following information should be recorded in the logbook:

a) the name of the responsible person;

b) details of the maintenance organization;

c) brief details of maintenance arrangements;

d) dates, times and types of all tests;

e) dates, times and types of all faults and defects;

f) dates and types of all maintenance (e.g. maintenance visit or non-routine attention).

Annex A (informative) Explanation of access level

The operation of certain manual controls ought to be limited to authorized personnel. Where this limitation is not provided on the master station(s), (for example by entering a code or by a key-operated switch), then it may be provided by restrictions to the equipment by use of a lock or its location in disciplined environment (such as a security control room), or by restriction of access to the control equipment to authorized personnel.

This standard defines access level for the indications and controls relating to the emergency functions covered. In some cases alternatives are offered (e.g. access level 1 or 2). This is because either might be appropriate in different operational circumstances. The purpose of the different access levels is not defined by this standard. However, in general, they are expected to be used as described in **A.1** to **A.4**.

A.1 Access level 1

By member(s) of the general public initiating calls in disabled refuges or persons having a general responsibility for safety supervision who might be expected to investigate and initially respond, e.g. to a fault warning.

A.2 Access level 2

By persons having a specific responsibility for safety and who are trained and authorized to operate the EVC in the:

a) quiescent condition;

b) EVC mode; and

c) fault warning condition.

A.3 Access level 3

By persons who are trained and authorized to:

a) re-configure the site specific data held within the EVC system or controlled by it (e.g. labelling, configuration); and

b) maintain the EVC system in accordance with the manufacturer's published instructions and data.

A.4 Access Level 4

By persons who are trained and authorized by the manufacturer to either repair the EVC system or alter its firmware, thereby changing its basic mode of operation.

Only access levels 1 and 2 have a strict hierarchy. Examples of special procedures for entry to access level 2 and/or to access level 3 are the use of:

a) mechanical keys;

b) a code of at least 3 manual sequential operations; or

c) access cards.

Examples of special means for entry to access level 4 are the use of:

1) mechanical keys;

2) tools; or

3) an external programming device.

It might be acceptable that the entry to access level 4 requires only a simple tool, such as a screwdriver, after access level 2 or 3 has been reached. For example, the manufacturer may declare in his documentation which parts of the EVC system are not user serviceable, and the entry to access level 4 may then be controlled by management of the user. It is also considered acceptable to use external tools to carry out certain functions at access level 3, e.g. to program site-specific data.

It might be desirable in certain circumstances that the EVC system has additional access levels within access level 2, or access level 3 (e.g. 2A and 2B), which would permit different classes of authorized user to have access to a selected group of controls or functions. This is not forbidden by this British Standard. The exact configuration will depend on the type of installation, the way the EVC system is used, and the complexity of the functions provided.

Annex B (normative) Modified subclauses from BS EN 54-2:1998

BS EN 54-2 is a specification for control and indicating equipment used in fire detection and fire alarm systems. There are therefore references in **15.1** and **15.2** of BS EN 54-2 to "c.i.e.", zones, detection circuits, and other non-EVC items. For the purposes of this code of practice only, **15.1.2** to **15.2.2.2** should be read as the following modified version:

15.1.2 Specimen configuration

The specimen configuration shall include at least two outstations of each type (type A and type B) provided by the manufacturer or supplier, appropriate transmission paths and internal circuits.

15.1.3 Mounting and orientation

Unless otherwise stated in a test procedure, the specimen shall be mounted in its normal orientation by the normal means of mounting indicated by the manufacturer.

15.1.4 Electrical connection

If a test procedure requires the specimen to be in the operating condition, it shall be connected to a power supply conforming to the requirements of BS EN 54-4. Unless otherwise required, the power supply shall be in the nominal operating condition.

All transmission paths (to communicate with outstations) shall be connected to cables and outstations or to dummy loads. Equipment other than master stations and outstations may be kept in the standard atmospheric condition during the tests.

15.2 Functional test

15.2.1 The object of the test

The object of the test is to demonstrate the operation of the equipment before, during and/or after the environmental conditioning.

15.2.2 Test schedule

A test schedule shall be drawn up, which ensures that during the functional test each type of input function and each type of output function is exercised.

This shall include as a minimum tests of signalling and audio communication between outstations and master station(s), and fault warning condition.

15.2.2.1 Signalling and audio communication between outstations and master station(s)

Initiate a call from an outstation to a master station(s). Check that the correct indications are given at the master station(s), and that an appropriate "reassurance tone" is received at the outstation ear-piece. Accept the call and check that audio can be satisfactorily transmitted and received in both directions, using microphones and ear-pieces/loudspeakers. Cancel the call and check that all indicators revert to their pre-call condition. Repeat the test using at least one different outstation.

Where the facility is provided, initiate a call from a master station to an outstation. Check that the correct indications are given at the master station(s), and that an appropriate call signal is received at the outstation, either at the ear-piece/loudspeaker or as a separate warning signal. Accept the call and check that audio can be satisfactorily transmitted and received in both directions, using microphones and ear-pieces/loudspeakers. Cancel the call and check that all indicators revert to their pre-call condition. Repeat the test by calling at least one different outstation from the master station.

15.2.2.2 Fault warning condition

Initiate and reset fault warnings corresponding at least to:

a) loss of one of the power sources;

b) short-circuit in a circuit connecting outstations to the master station(s);

c) open-circuit in a circuit connecting outstations to the master station(s).

Check that the correct indications are given at the master station(s)."

Annex C (informative) Model certificates

C.1 Design certificate

Certificate of design of the EVC system at:

Address: .....

.....

..... Postcode: .....

I/we being the competent person(s) responsible (as indicated by my/our signatures below) for the design of the EVC system, particulars of which are set below, CERTIFY that the said design for which I/we have been responsible conforms to the best of my/our knowledge and belief with BS 5839-9:2011, Section **2** except for the variations, if any, stated in this certificate.

Name (in block letters): ..... Position: .....

Signature: ..... Date: .....

For and on behalf of: .....

Address: .....

.....

..... Postcode: .....

Variations from the recommendations of BS 5839-9:2011, Section **2**:

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Extent of system covered by the certificate:

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Installation and commissioning

It is strongly recommended that installation and commissioning be undertaken in accordance with BS 5839-9:2011, Section **3** and Section **4**.

Verification

Verification that the system conforms to BS 5839-9:2011 should be carried out, on completion, in accordance with BS 5839-9:2011, Clause **26**.

Yes ☐ No ☐ To be decided by the purchaser ☐

Maintenance

It is strongly recommended that, after completion, the system is maintained in accordance with BS 5839-9:2011, Section **5**.

User responsibilities

The user should appoint a responsible person to supervise all matters pertaining to the EVC system in accordance with BS 5839-9:2011, Section **6**.

C.2 Installation certificate

Certificate of installation of the EVC system at:

Address: .....

.....

..... Postcode: .....

I/we being the competent person(s) responsible (as indicated by my/our signatures below) for the installation of the EVC system, particulars of which are set below, CERTIFY that the said installation for which I/we have been responsible conforms to the best of my/our knowledge and belief with BS 5839-9:2011, Section **3**, except for the variations, if any, stated in this certificate.

Name (in block letters): ..... Position: .....

Signature: ..... Date: .....

For and on behalf of: .....

Address: .....

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..... Postcode: .....

The extent of liability of the signatory is limited to the system described below.

Extent of system covered by the certificate:

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Specification against which the system was installed:

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Variations from the specification and/or BS 5839-9:2011, Section **3**:

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Wiring has been installed and tested in accordance with BS 5839-9:2011, Clause **14**. Test results have been recorded and are provided on the appended BS 7671 electrical installation certificate:

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Unless supplied by others, the as-fitted drawings have been supplied to the person responsible for commissioning the system [see BS 5839-9:2011, Clause **23**c)].

C.3 Commissioning certificate

Certificate of commissioning for the EVC system at:

Address: .....

.....

..... Postcode: .....

I/we being the competent person(s) responsible (as indicated by my/our signatures below) for the commissioning of the EVC system, particulars of which are set below, CERTIFY that the said installation for which I/we have been responsible conforms to the best of my/our knowledge and belief with BS 5839-9:2011, Clause **22**, except for the variations, if any, stated in this certificate.

Name (in block letters): ..... Position: .....

Signature: ..... Date: .....

For and on behalf of: .....

Address: .....

.....

..... Postcode: .....

The extent of liability of the signatory is limited to the system described below.

Extent of system covered by the certificate:

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Variations from BS 5839-9:2011, Clause **22**.

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☐ All equipment operates correctly.

☐ Installation work is, as far as can be reasonably ascertained, of an acceptable standard.

☐ The entire system has been inspected and tested in accordance with BS 5839-9:2011, Clause **22**.

☐ The system performs as required by the specification prepared by:

.....

a copy of which I/we have given.

☐ The documentation described in BS 5839-9:2011, Clause **23** has been provided to the user.

The following work should be completed before/after (delete as applicable) the system becomes operational:

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C.4 Acceptance certificate

Certificate of acceptance for the EVC system at:

Address: .....

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..... Postcode: .....

I/we being the competent person(s) responsible (as indicated by my/our signatures below) for the acceptance of the EVC system, particulars of which are set below, ACCEPT the system on behalf of:

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Name (in block letters): ..... Position: .....

Signature: ..... Date: .....

For and on behalf of: .....

Address: .....

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..... Postcode: .....

The extent of liability of the signatory is limited to the system described below.

Extent of system covered by the certificate:

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☐ All installation work appears to be satisfactory.

☐ The system is capable of providing an audible and intelligible two-way voice communication.

The following documents have been provided to the purchaser or user:

☐ As-fitted drawings.

☐ Operating and maintenance instructions.

☐ Certificate of design, installation and commissioning.

☐ A log book.

☐ Representatives of the user have been properly instructed in the use of the system, including, at least, operation of master stations and outstations and fault identification.

☐ All relevant tests, defined in the purchasing specification, have been witnessed. (Delete if not applicable.)

The following work is required before the system can be accepted:

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C.5 Verification certificate (optional)

Certificate of verification for the EVC system at:

Address: .....

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..... Postcode: .....

I/we being the competent person(s) responsible (as indicated by my/our signatures below) for the verification of the EVC system, particulars of which are set below, CERTIFY that the verification work for which I/we have been responsible conforms to the best of my/our knowledge and belief with BS 5839-9:2011, Clause **26**.

Name (in block letters): ..... Position: .....

Signature: ..... Date: .....

For and on behalf of: .....

Address: .....

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..... Postcode: .....

The extent of liability of the signatory is limited to the system described below.

Extent of system covered by the certificate:

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Scope and extent of the verification work:

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☐ In my/our opinion, as far as can reasonably be ascertained from the scope of work described above, the system conforms to, and has been commissioned in accordance with BS 5839-9, other than in respect of variations already identified in the certificates of design, installation or commissioning.

The following non-conformities with BS 5839-9 have been identified (other than those recorded as variations in the certificates of design, installation or commissioning):

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C.6 Inspection and servicing certificate

Certificate of servicing for the EVC system at:

Address: .....

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..... Postcode: .....

I/we being the competent person(s) responsible (as indicated by my/our signatures below) for the servicing of the EVC system, particulars of which are set below, CERTIFY that the said installation for which I/we have been responsible conforms to the best of my/our knowledge and belief with BS 5839-9:2011, Clause **29**, except for the variations, if any, stated in this certificate.

Name (in block letters): ..... Position: .....

Signature: ..... Date: .....

For and on behalf of: .....

Address: .....

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..... Postcode: .....

The extent of liability of the signatory is limited to the system described below.

Extent of system covered by the certificate:

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Variations from BS 5839-9:2011, Clause **21**:

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☐ Relevant details of the work carried out and faults identified have been entered in the system log book.

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C.7 Modification certificate

Certificate of modification for the EVC system at:

Address: .....

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..... Postcode: .....

I/we being the competent person(s) responsible (as indicated by my/our signatures below) for the modification of the EVC system, particulars of which are set below, CERTIFY that the said installation for which I/we have been responsible conforms to the best of my/our knowledge and belief with BS 5839-9:2011, Clause **21**, except for the variations, if any, stated in this certificate.

Name (in block letters): ..... Position: .....

Signature: ..... Date: .....

For and on behalf of: .....

Address: .....

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..... Postcode: .....

The extent of liability of the signatory is limited to the system described below.

Extent of system covered by the certificate:

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Variations from BS 5839-9:2011, Clause **21**:

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☐ Following the modifications, the system has been tested in accordance with BS 5839-9:2011, Clause **21**. Test results have been recorded and are provided on the appended BS 7671 electrical installation minor works certificate.

☐ Following the modifications, as-fitted drawings and other system records have been updated as appropriate.

I/we the undersigned confirm that the modifications have introduced no additional variations from BS 5839-9:2011 other than those recorded above:

Signed: .....

Capacity: .....

(e.g. maintenance organization, system designer, consultant or user representative)

Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

BS 7594, *Code of practice for audio-frequency induction-loop systems (AFILS)*

BS 7846, *Electric cables – 600/1 000 V armoured fire-resistant cables having thermosetting insulation and low emission of smoke and corrosive gases when affected by fire*

BS 8233, *Sound insulation and noise reduction for buildings – Code of practice*

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