



BSI Standards Publication

Fire detection and fire alarm systems

Part 32: Planning, design, installation, commissioning, use and maintenance of voice alarm systems

National foreword

This Published Document is the UK implementation of CEN/TS 54-32:2015.

Voice alarm systems are installed in many large buildings in Europe where large numbers of people who may not be trained to evacuate (normally members of the public) are present. These buildings include sports arenas, stadiums, galleries, theatres, cinemas and other places of entertainment. They also include transport hubs such as railway stations, airports and ports.

Most European countries do not have specific guidance on the planning, design, installation, commissioning, use and maintenance of voice alarm systems. CEN/TS 54-32 has been written to provide guidance for these countries whilst avoiding conflict with existing national installation guidance documents such as BS 5839-8:2013 and BS 7827:2011 in the UK.

CEN/TS 54-32 will be useful in the UK to give guidance when variations from the recommendations of BS 5839-8:2013 (see Clause 7) and the recommendations of BS 7827:2011 (see Clause 18) are needed because it contains up-to-date information, especially on measuring intelligibility, on the use of auxiliary mains power supplies such as UPS and generators, and on transmission paths and networking.

The UK participation in its preparation was entrusted by Technical Committee FSH/12, Fire detection and alarm systems, to Subcommittee FSH/12/5, Alarm devices, voice alarm evacuation sub-systems and emergency voice communications.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

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

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**Fire detection and fire alarm systems - Part 32: Planning, design,
installation, commissioning, use and maintenance of voice alarm
systems**

Systèmes de détection et d'alarme incendie - Partie 32 :
Planification, conception, installation, mise en service,
utilisation et maintenance des systèmes d'alarme vocale

Brandemeldanlagen - Teil 32: Projektierung, Montage,
Inbetriebnahme, Betrieb und Instandhaltung von
Sprachalarmsystemen

This Technical Specification (CEN/TS) was approved by CEN on 14 March 2015 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (CEN/TS 54-32:2015) has been prepared by Technical Committee CEN/TC 72 “Fire detection and fire alarm systems”, the secretariat of which is held by BSI.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this Technical Specification: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Guidelines covering sound systems for use during an emergency are published by different organizations within Europe. The intention of this Technical Specification is to draw together these documents and provide up-to-date guidelines for planning, design, installation, commissioning, use, maintenance and modification of emergency sound systems throughout Europe.

Sound systems for use in emergency, whether automatically triggered, manually triggered, or both, are commonly called voice alarm systems.

It is not intended that this Technical Specification should override existing local, regional or national regulations. It is expected for a considerable (and as yet unspecified) period that these guidelines will coexist with other codes. However, it is hoped that the availability of a common set of guidelines will assist in the harmonization of practice and standards for voice alarm systems throughout Europe.

This document gives recommendations. These recommendations can be made mandatory by being specified within other document(s). For example, an authority having jurisdiction empowered under local, regional or national legislation can require compliance with this document. Equally a contract between a purchaser and a supplier can specify compliance that may then become mandatory under contract law.

The purpose of a voice alarm system is to provide intelligible warning to person(s) within, or in the vicinity of, a building in which an emergency has occurred and to enable such person(s) to take appropriate measures according to an emergency management plan.

Voice alarm systems are often used instead of alarm sounders (see EN 54-3) because the meaning of an alarm signal may not be clear to untrained building occupants and so time may be spent deciding what it means and then further time may be spent deciding what to do.

This document contains specific recommendations for the design, installation, commissioning, use, and maintenance of voice alarm systems and is based on the format used in CEN/TS 54-14.

The main principles on which the guidelines are based are given in the body of this Technical Specification. Detailed recommendations by which these principles may be satisfied are given in annexes.

1 Scope

This Technical Specification provides guidelines for the planning, design, installation, commissioning, use, maintenance and modification of voice alarm systems in and around buildings that broadcast information for the protection of lives in a fire emergency. See EN 54-1:2011, Figure 1, item C and item M.

These guidelines cover voice alarm systems that are triggered automatically by a fire detection and fire alarm system or that are manually triggered, or both.

This Technical Specification does not apply to fire detection and fire alarm systems that only use voice sounders, bells or sounders or a combination of these.

NOTE 1 CEN/TS 54-14 provides guidelines for these systems.

This Technical Specification does not exclude the use of voice alarm systems for emergency purposes other than fire emergency.

NOTE 2 When used for emergencies other than those due to fire, it might be appropriate to modify the guidance in this Technical Specification.

This Technical Specification does not exclude the use of voice alarm systems for non-emergency purposes.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 54-1:2011, *Fire detection and fire alarm systems - Part 1: Introduction*

3 Terms and definitions, symbols and abbreviations

For the purposes of this document, the definitions, symbols and abbreviations given in EN 54-1:2011 and the following apply.

3.1 Terms and definitions

3.1.1

acceptance

decision that the installed system meets the requirements of a previously agreed specification

3.1.2

acoustically different area

ADA

subdivision of a voice alarm zone, which may be an enclosed or otherwise physically defined space, characterized by an individual reverberation time and/or ambient noise level

Note 1 to entry: ADA is also known as an acoustically distinguishable area.

3.1.3

alarm signal

visual, audible or tactile indication of a fire or other emergency

EXAMPLES Fire, bomb alert, industrial accident, civil commotion, terrorist attack.

3.1.4

alarm load

maximum current required to operate the voice alarm system in the voice alarm condition

3.1.5

ambient noise level

ambient sound pressure normally present in an ADA in dB, normally measured using equivalent sound pressure level, L_{eqT} but may be measured using L_{10} , depending on the nature of the noise

Note 1 to entry: The level of ambient noise is measured across all the octave bands from 125 Hz to 8 kHz. The results can be used to correct STI calculations and to assist with electro-acoustic system design.

Note 2 to entry: L_{eqT} is the A-weighted sound pressure level of noise varying over a period of time, T (normally 10 min) expressed as the amount of average energy and is the measurement method normally used when there is long-term background noise, such as from extraction fans.

Note 3 to entry: L_{10} is the sound pressure level exceeded for 10 % of the measurement period calculated by statistical analysis over a specified time period, T and is the measurement method normally used when background noise varies significantly.

Note 4 to entry: Where the ambient noise level exceeds 90 dB, satisfactory speech intelligibility becomes increasingly difficult to achieve because of the auditory-masking effect.

3.1.6

approval

agreement by a third-party that the installed system satisfies the requirements of the third-party

3.1.7

approval body

body accepted by an authority having jurisdiction or other competent organization as having the expertise necessary to assess the compliance of the installed system with this Technical Specification

3.1.8

area of coverage

area inside or outside a building where the voice alarm system should meet the recommendations of this Technical Specification

3.1.9

arithmetic mean

I_{av}

value obtained by dividing the sum of a set of quantities by the number of quantities in the set

Note 1 to entry: The arithmetic mean I_{av} is given by the following formula:

$$I_{av} = \frac{1}{N} (a_1 + a_2 + a_3 + \dots + a_N)$$

where

a_N is a real number (measurement value), and

N is the number of measurement values.

3.1.10

attention-drawing signal

tone that is broadcast to attract attention at the start of an emergency message

Note 1 to entry: The level of the attention-drawing signal is measured using the A-weighted equivalent continuous sound pressure level method, L_{AeqT} .

3.1.11

audibility

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

Note 1 to entry: The fact that a message is audible does not mean that it is intelligible.

3.1.12

auditory masking

process by which the threshold of hearing (audibility) of one sound is increased by the presence of another (masking) sound

Note 1 to entry: In the STI method, auditory masking is also referred to as the upward spread of masking.

3.1.13

authority having jurisdiction

AHJ

body having powers to approve the voice alarm system provided under local, regional, national or European legislation

3.1.14

automatic mode

mode of operation of a voice alarm system such that it can be put into the voice alarm condition by a fire detection and fire alarm system without human intervention in a way that is pre-set according to an agreed emergency management plan

3.1.15

auxiliary mains power supply

locally provided mains power supply used to provide power to a VAS so that the quiescent condition can be maintained during a mains power supply failure without compromising the duration of operation of a VAS

EXAMPLE Uninterruptable power supply, automatically started generator.

Note 1 to entry: Auxiliary mains power supplies are also called essential power supplies.

3.1.16

cabinet

housing that affords a degree of mechanical protection and robustness to its constituent parts and subassemblies

3.1.17

coded message

emergency message intended to inform trained staff of an incident without alerting untrained occupants

Note 1 to entry: Messages that are not coded, and whose meaning is therefore clear, are known as clear messages.

3.1.18

PA/VA system

voice alarm system in which emergency audio functions are combined with non-emergency audio functions

3.1.19

commissioning

process for managing the delivery of a voice alarm system by verifying that it is designed, installed, and tested to meet the project specification

3.1.20

competent person

person who, in relation to the work undertaken, has the necessary knowledge, skill and experience to complete the work satisfactorily and safely

3.1.21

control centre

location containing an emergency microphone that is occupied by trained operators during periods of risk, such as during public access times in a shopping centre or during an event in a sports venue

Note 1 to entry: If access to a control centre is restricted, the emergency microphone may be considered to be at access level 2 as defined in EN 54-2.

3.1.22

control point

location containing an emergency microphone for the use of trained operators during an emergency

3.1.23

emergency message

broadcast comprising an attention-drawing signal followed by a pre-recorded or live emergency announcement

3.1.24

emergency microphone

microphone for use by the fire service or trained operators as part of a voice alarm system

Note 1 to entry: The emergency microphone may have status indicators and manual controls for the selection and broadcast of live and/or pre-recorded announcements.

Note 2 to entry: In order to achieve the best possible intelligibility, it is essential that operators of emergency microphones are trained to use microphones correctly.

3.1.25

emergency speech level

A-weighted sound pressure level of the speech signal that will be broadcast in the voice alarm condition measured in dB

Note 1 to entry: To determine the emergency speech level the A-weighted equivalent continuous sound pressure level L_{AeqT} is measured and 6 dB added to the result (see EN 60268-16).

3.1.26

equivalent continuous sound pressure level

L_{eqT}

twenty-fold decimal logarithm of the ratio of the RMS sound pressure level for a given time interval, T, to the reference sound pressure, where the RMS sound pressure may be determined with a standardized frequency weighting

Note 1 to entry: EN 61672 (all parts) gives further information regarding the requirements for sound pressure measurements.

3.1.27

fault

equipment failure within the voice alarm system that jeopardises the correct functioning of part or all of the system

3.1.28

fire compartment

building compartment whose boundaries have a defined fire resistance

3.1.29

functional condition

condition of the VACIE characterized by its indication at the VACIE

Note 1 to entry: The functional conditions recognized in this Technical Specification are:

- the voice alarm condition, when any emergency message or fire alarm signal, recorded or live, is broadcast in at least one voice alarm zone,
- the fault warning condition, when a fault is indicated,
- the disabled condition, when the disablement of a function is indicated,
- the quiescent condition, when no other functional condition listed above is indicated.

3.1.30

hierarchical VAS

voice alarm system comprising more than one VACIE in which one VACIE is designated as the main VACIE and in which the main VACIE is able to:

- a) receive signals from and/or transmit signals to any subsidiary VACIE;
- b) indicate the status of any subsidiary VACIE

Note 1 to entry: It may be necessary to ensure that the transmission paths between VACIE are able to continue to operate correctly in case of a single fault.

3.1.31

intelligibility

measure of the proportion of the content of a message that can be correctly understood by listeners

3.1.32

listener

person of normal hearing in the voice alarm system's area of coverage who is able to understand the language used

3.1.33

loudspeaker transmission path

transmission path to one or more loudspeakers

Note 1 to entry: A loudspeaker transmission path may have more than one link to the VACIE, such as a loop connected at both ends.

Note 2 to entry: If two or more cables are directly linked without a method of isolation by a fuse, relay or similar device, they are part of the same loudspeaker transmission path.

Note 3 to entry: Loudspeaker transmission paths are often referred to as loudspeaker circuits – see EN 54-1.

3.1.34

maintenance

routine process of inspection, testing and work on the voice alarm system (including cleaning, re-alignment, adjustment and replacement) carried out at pre-determined intervals in order to maintain correct operation

Note 1 to entry: Maintenance may also be referred to as servicing.

3.1.35

manual mode

mode of operation where a trained operator is directly in control of the broadcast of live or pre-recorded emergency messages

3.1.36

multi-lingual emergency message

emergency message comprising multi-lingual content with the same meaning

3.1.37

distributed VAS

distributed VAS normally transports audio signals, control data and fault monitoring data over a transmission path and may comprise one or more VACIE that communicate with each other or may be one VACIE distributed over several locations

3.1.38

operator

person who is trained to an agreed level of proficiency in tasks relating to the operation and use of the voice alarm system

Note 1 to entry: Tasks relating to the operation and use of the voice alarm system include interpret indications and warnings, operating the VAS controls and microphones, reporting issues to the responsible person and recording relevant events in the logbook.

3.1.39

phased evacuation

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

EXAMPLE A typical two-phase system will be capable of broadcasting "alert" and "evacuate" signals in different parts of the building. A typical three-phase system will be capable of giving "staff alarm", "alert" or "evacuate" signals in different parts of the building.

Note 1 to entry: Phased evacuation is normally used where evacuation routes are restricted, such as in high-rise buildings, or where total evacuation may be dangerous or unnecessary.

Note 2 to entry: The normal condition, under which no alarm is given in a voice alarm zone, is not counted as a phase of alarm.

3.1.40

pre-recorded message

pre-recorded emergency message stored in the VACIE

3.1.41

purchaser

person or organization or their appointed representative responsible for the contract to purchase a voice alarm system

Note 1 to entry: The purchaser is often referred to as the client, customer, end-user or owner.

Note 2 to entry: Representatives of the purchaser can include members of the design team or a contractor.

3.1.42

quiescent condition

condition of the voice alarm system characterized by the absence of the voice alarm condition, fault warning condition, or disabled conditions

Note 1 to entry: If the voice alarm system is also used for non-emergency purposes, these functions are considered to be part of the quiescent condition.

3.1.43

responsible person

person appointed by the user who is responsible for ensuring that the voice alarm system operates properly, that operators are trained and competent, and that the system is correctly maintained

Note 1 to entry: In buildings with large numbers of occupants this responsibility may also be delegated so that someone with appropriate knowledge is always present.

3.1.44

reverberation time

RT

time in seconds required for the average sound-energy to decay by 60 dB after the sound source has stopped broadcasting

3.1.45

speech transmission index

STI

Speech Transmission Index (STI) is an objective measure between 0 (no intelligibility) and 1 (perfect intelligibility) used to predict the intelligibility of speech transmitted to listeners via a transmission channel

Note 1 to entry: Guidance on STI is given in EN 60268-16.

3.1.46

speech transmission index for public address systems

STIPA

method obtained by using a condensed version of the STI method but still responsive to distortions found in room acoustics and/or public address systems

Note 1 to entry: Guidance on STIPA is given in EN 60268-16.

3.1.47

system designer

technically competent person or organization that takes responsibility for the specification and adequacy of the design of the voice alarm system

3.1.48

transmission path

physical connection, external to the cabinet(s) of the VACIE, for the transmission of information, emergency messages and/or power between the VACIE and other components of the voice alarm system and/or parts of the VACIE contained in different cabinets

3.1.49

user

person or organization having day-to-day responsibility for the building and for implementation of fire-safety procedures

3.1.50

verification

process by which the installer or other contractor satisfies the purchaser that the voice alarm system meets the defined requirements

3.1.51

voice alarm condition

condition of the VACIE when an emergency message, pre-recorded or live, or an alarm signal is broadcast in at least one voice alarm zone

3.1.52

voice alarm control and indicating equipment

VACIE

component of a voice alarm system that generates and transmits emergency messages or alarm signals to loudspeaker(s) when it receives alarm signal(s) from a fire detection and fire alarm system and/or from manual controls

Note 1 to entry: VACIE can vary in size and complexity from a single cabinet through to many cabinets distributed throughout a building or site.

3.1.53

voice alarm system

VAS

sound distribution system complying with EN 54 that provides means for broadcasting emergency messages or alarm signals in the event of a fire or other emergency, either automatically under control from a fire detection and alarm system, or manually, or both (see item M of EN 54-1)

3.1.54

voice alarm zone

defined area composed of one or more ADAs, to which emergency messages can be broadcast separately

Note 1 to entry: Voice alarm zones may be selected and controlled to broadcast emergency messages singly or in groups.

Note 2 to entry: When used for non-emergency purposes, such as public address announcements or music, the boundaries of loudspeaker zones may differ from the voice alarm zones, in which case they are commonly called public address or PA zones.

3.2 Symbols and abbreviations

CIE	control and indicating equipment (item B of Figure 1 in EN 54-1: 2011)
GUI	graphical user interface
PSE	power supply equipment (item L of Figure 1 in EN 54-1: 2011)
RMS	root mean square (e.g. of a signal)
SPL	sound pressure level

4 General

4.1 Use of this Technical Specification

This Technical Specification provides recommendations for planning, design, installation, commissioning, verification, use, maintenance and modification of VAS. They are not mandatory, but are intended to provide a basis for the provision and use of effective systems and so specify what “should” be done, rather than giving requirements for what “shall” be done.

4.2 Guideline format

This Technical Specification cannot cover every case that might arise. For this reason, variations from these recommendations are possible, provided that they achieve the safety objectives of the VAS and have been agreed between all responsible parties (see 5.4) and that the variations are documented (see 8.3 c).

This Technical Specification has been drawn up so that the provision and use of an installed VAS will follow the pattern shown in Table 1.

4.3 Project phases

The project should be split into phases as shown in Table 1. This Technical Specification is written as though each of the phases is to be carried out by different organizations. Each organization will have its own expertise but will also need information derived from previous work and will need to pass information on to the parties responsible for the next phase in order to ensure a clear understanding of the VAS objectives.

This Technical Specification gives recommendations for qualifications of personnel or organizations, responsibility for the work, and for the documentation to be carried on from one phase to the next phase.

Table 1 — VAS: phases, content and ownership of the planning, design, installation, commissioning, use, maintenance and modification

Phase	Clause	Content	Ownership
Concept (Assessment of needs)	5	Purpose, risk-assessment, local, regional or national requirements, emergency management plan, subdivision of the building into voice alarm zones, interaction of the VAS with other systems	Purchaser
Planning and design	6	Selection of and intended locations of components, provision for VAS indications and controls, provision of power supplies, selection, routing and protection of interconnection cables	VAS designer
Installation	7	Mounting, interconnecting and testing the equipment and cables	Installer
Commissioning	8	Commissioning the VAS and training of operators	Installer
Verification	9	Verification of correct operation of the VAS	Purchaser
Third-Party Approval	10	Verification and certification of correct operation of the VAS	AHJ
Acceptance	11	Acceptance of the performance of the VAS	Purchaser
Use	12	Operation of control and indicating equipment and emergency microphones	User
Maintenance	13	Routine testing Repair and/or replacement of defective components Identifying changes that may affect the performance of the VAS that may require modification or extension	Responsible person Maintenance contractor Maintenance contractor
Modification	14	Modification or extension of an installed VAS	Purchaser

4.4 Safety requirements

There may be local, regional or national or European requirements related to the safety of the VAS, such as requirements for electrical safety. These requirements are not covered in this Technical Specification.

4.5 Warranties and guarantees

In addition to any warranties required by legislation, manufacturers or suppliers will usually guarantee the components of installed VAS. The performance of the installed VAS may be guaranteed by one of the organizations responsible for supply, design or installation.

Any warranty should be in written form, and should at least specify the:

- a) organization responsible for fulfilling the warranty;
- b) date(s) from which the warranty will operate;
- c) duration of the warranty;
- d) extent of responsibility under the warranty.

Where possible, all warranties should operate from the same date.

4.6 Documentation

The person or organization taking responsibility for each phase should certify proper execution of that phase of the work.

Model certificates and logbook are shown in Annex A.

4.7 Responsibility

Responsibility for the planning, design, installation and the initial performance of the installed VAS should be clearly defined and documented by the purchaser in consultation with the AHJ. It is desirable that, from the installation phase, one organization should take overall responsibility for the project.

At acceptance (see Clause 11) a responsible person should be appointed and take responsibility for the

- availability of documentation giving instructions for use;
- training and assessment of operators;
- routine testing procedures and records;
- maintenance of the VAS;
- ensuring hand-over of their responsibilities to their successor.

4.8 Qualifications

Persons or organizations carrying out the tasks referred to in this Technical Specification should be appropriately competent and experienced and, where applicable, in conformity with local, regional or national requirements for qualifications.

5 Concept (Assessment of needs)

5.1 Responsibility

The purchaser is responsible for consulting with local, regional and national AHJs and for ensuring that the concept for the VAS including the safety level (see B.1) or category (see B.2) complies with their requirements.

5.2 Intention and purpose

VAS are installed for the protection of life and are normally used when any or all of the following apply:

- untrained occupants or members of the public are present in a building or on a site, for instance, in sports stadiums, transport terminals, shopping centres and places of entertainment;
- there are restrictions to escape routes that require occupants to be directed when and how to evacuate the building, such as in tall buildings with restricted capacity stairs;
- although occupants are trained, there are risks that require different warnings and/or instructions to those for fire, such as terrorist attacks and in some chemical processing facilities.

5.3 Risk-assessment

5.3.1 General

The purpose of risk-assessment is to evaluate the consequences of an emergency to personal safety, property and everyday activities and consists of a risk analysis followed by a risk evaluation.

A team representing the relevant disciplines should carry out the risk-assessment and should consist of at least two persons.

5.3.2 The risk-assessment should be carried out systematically. For example:

- split the building into functional groups and activity areas;
- identify the likely occupant groups;
- identify hazards and risk-increasing factors;
- identify which measures should be assessed at which level in the organization;
- conduct a risk analysis and evaluation for each identified risk, hazard and user group;
- determine what critical measures can reduce each risk;
- estimate residual risks and judge whether they can be tolerated;
- if a risk cannot be tolerated, reduce the risk until it becomes tolerable.

This information should be analysed in order to estimate the likelihood and seriousness of each risk and decisions made whether to prevent the risk, reduce the impact of the risk or accept the risk.

This process should be repeated as often is necessary for the risk-assessment team to be satisfied that the remaining risks are acceptable.

5.3.3 The risk-assessment will lead to proposals for VAS design to reduce the risks during an emergency such as:

- identification of areas needing coverage;
- identification of the boundaries of voice alarm zones;
- the content and language(s) of live or pre-recorded messages or both;
- whether coded or clear alert message(s) or both are needed;
- alternative methods of warning for ADAs that do not need to be covered by the VAS;
- supplementary or alternative methods of warning for the deaf;
- supplementary or alternative methods of warning in areas with high ambient noise;
- whether a phased evacuation VAS is needed;
- the extent of user and operator training;
- whether one or more emergency microphones are needed;

NOTE Local, regional or national regulations may require at least one emergency microphone.

5.3.4 The risk-assessment will also lead to proposals for VAS design to ensure the integrity of the VAS, such as:

- whether multiple and/or spare components such as amplifiers are needed;
- whether diverse routeing or protected or fire-resistant cables or both are needed;
- whether multiple loudspeaker transmission paths or interleaving of loudspeakers or both are needed;
- whether loop wiring of loudspeakers with or without isolators is needed.

The risk analysis should be reviewed regularly during the project and updated when new risks and hazards are identified.

When an existing building is modified the risk-assessment should be reviewed and updated.

5.3.5 If the purchaser wishes to reduce the standby time of the VAS below the normal minimum of 24 h, (see 6.10.1) the risk assessment should also consider the points in 6.11.

5.4 Consultation

The purchaser of the VAS should decide the requirements for the VAS after consultation with other responsible parties such as the:

- authority having jurisdiction (AHJ);
- emergency services;
- emergency risk insurer;
- designers and installers of emergency detection/protection alarm systems in the protected building or site;

- VAS equipment supplier(s);
- VAS installer.

If the design of the VAS depends on the requirements of an AHJ, it is important that this authority is identified at the earliest stage possible and its requirements established, including any need for third-party approval.

If approval is required from more than one AHJ and they have different requirements the VAS should be designed and installed to meet the most stringent of the requirements. In the event that the requirements are incompatible, then the incompatibility should be resolved by discussion and the results recorded in the design documentation.

5.5 Local, regional or national requirements

- The regulations of some countries recommend that the design of the VAS should be categorized in safety levels that specify the level of redundancy that should be built into systems (see B.1).
- The regulations of some countries recommend that the design of the VAS should be categorized on the basis of the degree of manual control and training of operators (see B.2).
- The designer should consider the need to define the security level and/or VAS category and ensure that an appropriate level and/or category are selected for the application.

5.6 Documentation

5.6.1 General

Documents should be prepared to cover the general requirements and objectives for the VAS, including the emergency management plan, security level, and category if required, taking into account the expected occupancy of the building. The amount of information given in these documents should be sufficient to allow detailed designs to be prepared.

The documents should also include where applicable;

- a) requirements for third-party approval or acceptance;
- b) information on any areas of the building with special risks (see 6.6);
- c) requirements for options that are mandatory under local, regional or national regulations.

5.6.2 Emergency management plan

An emergency management plan for the building or site should be prepared by a suitably qualified person and should consider at least the following:

- a) what kinds of emergencies are to be covered, what response is expected in case of an emergency and whether the response will depend on the position and nature of the emergency;
- b) occupancy and use of the building or site, which may differ substantially at different times;
- c) the time required to evacuate the building or site and therefore how long the VAS will need to be in the voice alarm condition;
- d) the need for coded or clear alert messages and/or signals;
- e) the need for alternative alarm signals for noisy areas such as plant rooms, where satisfactory intelligibility is unlikely to be achieved and occupants can be trained;

- f) the need for alarm signals for the hearing-impaired;
- g) the need for phased evacuation where exit routes have limited capacity or where complete evacuation of the building may be dangerous or unnecessary;
- h) whether or not to override all non-emergency functions in a PA/VA system that is in the voice alarm condition;

EXAMPLE In a football stadium, where crowd control is a major concern, it may be sensible to continue to broadcast game commentary to most of the crowd while an evacuation is in progress in other areas.

- i) the specification of live and pre-recorded emergency messages including scripts, language(s), dialect and gender of the talkers(s);
- j) the extent of operator training, including the correct use of emergency microphones;
- k) the location of equipment such as emergency microphones and VACIE cabinets including adequate temperature control, space and weight bearing ability;
- l) the need to control the evacuation using manual controls;
- m) if the VAS is to have manual controls, decide who will control it in the voice alarm condition, and what control priority they will have. Decide what arrangements need to be made to transfer control between control rooms or control points;
- n) if the VAS is to have manual controls, who will decide the content and frequency of initial and on-going training and ensure that it takes place;
- o) the voice alarm zone coverage areas and boundaries;

NOTE For non-emergency purposes, loudspeaker zones may differ from voice alarm zones.

- p) the acoustic limits of each ADA and voice alarm zone, acoustic overlap from adjacent voice alarm zones and their effect on intelligibility;
- q) the need to control other sound sources that may affect intelligibility, such as fire alarm sounders, paging systems and music systems;
- r) the need to ensure that the emergency functionality of the VAS cannot be affected by unauthorized persons.

5.6.3 Documentation necessary to prepare design

The purchaser should ensure that the designer is provided with the documentation necessary to design the VAS in accordance with the requirements of this part of EN 54 including:

- a) plans of the building showing voice alarm zone boundaries, boundaries of ADAs in each voice alarm zone, emergency microphone locations (control rooms and/or control points) and other VAS equipment locations;
- b) the emergency management plan;
- c) the acoustic report, including:
 - 1) a list of the ADA(s) in each voice alarm zone. The sum of the areas of the ADAs should equal the total area of the voice alarm zone;

- 2) the predicted or measured reverberation time of each ADA in octave bands from 125 Hz to 8 kHz;
- 3) the predicted or measured ambient noise level in each ADA in octave bands from 125 Hz to 8 kHz;

In existing buildings the data should be measured directly. In new buildings, the data should be derived from existing buildings with equivalent properties and purposes.

- d) information on environmental conditions such as temperature, humidity, corrosive atmosphere, electromagnetic influences (e.g. areas subject to severe thunderstorms);
- e) a description of the environments where equipment is to be installed (e.g. occupancy of the building and hazardous locations).

5.7 Parts of the building needing cover

5.7.1 Extent of coverage

5.7.1.1 General

The purchaser should specify the parts of the building to be covered but they may also be specified by a third-party, such as an AHJ or an insurance company.

Where the extent of the VAS coverage is not specified by a third-party, or where there is a desire to install a more extensive system than the minimum required by local, regional or national regulations, the extent of coverage should be defined as part of the risk-assessment (see 5.3).

The extent of coverage should be specified as one of the following:

5.7.1.2 Total coverage

A VAS providing total coverage includes all occupied ADAs other than those specifically exempted by this Technical Specification.

5.7.1.3 Partial coverage

A VAS providing partial coverage includes occupied ADAs in specific areas of risk such as the public areas of a stadium or the malls of a shopping centre.

5.7.2 Areas not needing coverage

Some areas may have a sufficiently low risk to life during an emergency that they need not be covered by a VAS. However, alternative means of warning should still be provided in all areas that can be occupied (see 5.3.3).

Areas not normally needing coverage by a VAS include:

- a) all normally unoccupied parts of the building;
- b) unventilated frozen food stores with gross volume below 20 m³;
- c) areas of excessive ambient noise where other warning methods are used, such as equipment plant rooms;
- d) areas where VAS broadcast is not appropriate, such as in patient areas of hospitals and nursing homes, where evacuation is managed by staff.

5.8 Extent of manual control

VAS may be designed to automatically or manually broadcast pre-recorded and/or live emergency messages or both.

The purchaser, in consultation with the AHJ, should carefully consider the extent of manual control. Manual controls should suit the application and should not be over-specified. Unnecessarily complex controls may lead to serious consequences if misused and so there will be more need for regular and thorough training of staff and exercising of the VAS, including regular evacuation drills.

NOTE 1 Guidance on VAS categories and the complexity and training recommendations for VAS is given in B.2.

NOTE 2 Some buildings, such as sports stadiums, may benefit from the provision of indications and controls that use topographical graphical user interfaces (GUIs) in order to reduce the risk of errors and misuse.

6 Planning and design

6.1 Responsibility of the designer

Responsibility for compliance of the VAS design with the specification and with local, regional or national regulations lies with the person or organization that signs the design certificate (see A.1).

The designer should list any assumptions made and provide written justification for selected solutions.

The designer should ensure that all components of the VAS are compatible with each other.

NOTE Where components are Construction Products as defined by the Construction Products Regulation, it may be possible to ensure compatibility by reference to the Declarations of Performance issued for each component.

6.2 Devices connected to the VAS

Components of, or devices connected to, the VAS should comply with the relevant parts of EN 54.

Devices to be connected to the VAS for which there is no relevant part of EN 54 should be demonstrated to have no detrimental effect on the performance of the VAS if they should fail, e.g. through compliance with other local, regional, national, European or International standards, or other documents that are acceptable to the responsible parties (see 5.4).

EXAMPLE Active loudspeakers, "local" volume controls, PCs, music sources, printers.

Duplication of devices is not considered to be sufficient to achieve this since both devices are likely to be subject to from the same mode(s) of failure.

It is important to ensure that all devices connected to the VAS are compatible with each other and that fault monitoring is maintained where needed, such as where volume restoration devices are employed.

6.3 Faults

The design of the VAS should be such that the effects of faults in transmission paths, cables or connectors are minimized.

Fault warnings from the VAS should be transmitted to a connected fire detection and fire alarm system at least as a general voice alarm fault.

Fault warnings may also be transmitted to other equipment such as building management systems.

6.4 Modes and conditions of operation

6.4.1 General

When a fire emergency occurs the VAS should be put into the voice alarm condition manually or automatically following any pre-planned delay.

6.4.2 Phased evacuation

Where phased evacuation is required, the evacuation procedure should be specified in the emergency management plan and agreed with all responsible parties (see 5.4).

6.4.3 Audio channels

Where the emergency management plan requires simultaneous broadcast of different emergency messages, sufficient audio channels should be provided in the VACIE.

6.4.4 Automatic mode

In automatic mode the voice alarm condition is initiated by a fire detection and alarm system and subsequent signals and emergency messages should be continuously broadcast until they are either overridden manually or silenced by a signal from the fire detection and alarm system. Removal of the initiating signal should not result in cancellation of the voice alarm condition.

6.4.5 Manual mode

In manual mode, a trained operator in a control centre or at a control point manually selects the voice alarm condition.

Where manual controls are provided, the following indications should be given for each voice alarm zone or group of voice alarm zones that can be controlled from that location:

- a) indication of the voice alarm condition,
- b) indication of the fault condition,
- c) indication of the disabled condition.

6.4.6 Quiescent condition

The VAS may be silent while in the quiescent condition or it may be used for non-emergency broadcasts such as information or entertainment, in which case, fault monitoring should operate normally.

In case of failure of the mains power supply, sound systems that are not part of the VAS should normally be muted to avoid interference and conserve the standby power supply.

If the user wishes to operate the VAS for non-emergency purposes during failure of the mains power supply this is considered to be part of the quiescent condition. However, significant power may be consumed and so additional power capacity should be provided, typically from an uninterruptible power supply (UPS) or generator, so that the recommendations of this Technical Specification are still met (see 6.10.2).

6.4.7 Voice alarm condition

The voice alarm condition is used to inform occupants of an emergency and then instruct them what action to take.

All emergency messages, whether live or pre-recorded, should take precedence over non-emergency broadcasts.

Fire emergency messages should be preceded by the same attention-drawing signal. However, emergency messages for different types of emergency may be preceded by different attention-drawing signals.

Where local, regional or national regulations specify the use of particular attention-drawing signals, these should be used.

An attention-drawing signal may be omitted before coded messages.

6.4.8 Order of priorities

The VAS design should ensure that the following order of priorities is adhered to:

- a) live emergency messages via an emergency microphone;
- b) manually activated pre-recorded emergency messages;
- c) automatically activated pre-recorded emergency messages;
- d) non-emergency broadcasts.

6.4.9 Emergency microphones

Emergency microphones should be located in quiet, low-reverberation areas so that the intelligibility of emergency messages is not compromised.

The following points should be considered:

- reverberation time of the location;
- normal ambient noise (e.g. from a busy road or noisy machinery);
- abnormal ambient noise (e.g. a control room where during an emergency there is an increase in the ambient noise due to warning devices, etc.);
- avoiding interference and feedback from VAS loudspeakers and other sound systems.

Emergency microphones should be operable at access level 2 (see EN 54-16). This can be achieved by locating the microphone in a secure area such as a control room, or by means of keys or codes.

In large and/or complex buildings there may be more than one emergency microphone, in which case it may be in a different part of the building so that a secondary location can be used if the primary location is compromised.

6.4.10 Emergency messages

Emergency messages may be pre-recorded or live or both. Where it is practical, pre-recorded messages are preferred because their content is controlled.

It is important that emergency messages are clear and intelligible, with sound levels normalized in relation to each other, and that they only contain information relevant to safe evacuation. Emergency messages should be short and as comprehensible as possible in order to aid understanding and should avoid the use of words that are likely to cause panic. If many occupants are not familiar with the chosen language the announcements should be given in more than one language as specified in the emergency management plan.