BRITISH STANDARD

BS 8456:2005

Code of practice for design and installation of directional sounder evacuation systems

ICS 13.200

Committees responsible for this British Standard

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Association of British Theatre Technicians

Association of County Councils

British Cables Association

British Fire Consortium

Chartered Institution of Building Services Engineers

Cinema Exhibitors Association

Department of Trade and Industry — Consumer and Competition Policy Directorate

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Contents

Foreword

This British Standard has been prepared by Subcommittee CPL/34/9.

The British Standards for fire detection and alarm systems for buildings (BS 5839) and for emergency lighting (BS 5266-1 to -7 inclusive) cover the provision of an alerting mechanism, and a signage system to indicate the escape route.

Directional sounder evacuation systems can provide additional, audible, way-guidance to indicate escape routes.

Directional sounder evacuation systems utilize a series of sounders having particular acoustic characteristics to assist building occupants in identifying the location of the escape routes and exits. They can also be used to direct occupants along particular preferred routes to avoid the source of a fire. The sounders can be activated manually or automatically in the event of an emergency when evacuation is required.

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

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

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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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 7 and a back cover.

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1 Scope

This British Standard gives recommendations and guidance on the design and installation of directional sounder evacuation systems for use in buildings, to give audible way-guidance in an emergency. It is intended for use by system designers and installers and building owners and occupiers.

NOTE A procedure for testing of directional sounder evacuation system installations is given in Annex A. Guidance on configuration of directional sounder evacuation systems is given in Annex B.

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 5266-1, *Emergency lighting — Part 1: Code of practice for emergency lighting of premises other than cinemas and certain other premises used for entertainment.*

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

BS 7671, *Requirements for electrical installations — IEE Wiring Regulations, Sixteenth Edition.*

BS EN 54-3:2001, *Fire detection and fire alarm systems — Part 3: Fire alarm devices — Sounders.*

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

BS EN 61672-2, *Electroacoustics — Sound level meters — Part 2: Pattern evaluation tests.*

3 Terms and definitions

For the purposes of this British Standard, the terms and definitions given in BS EN 54-3:2001 and the following apply.

3.1
directional sounder
device which, as part of an emergency evacuation system, provides a person, or persons, with an audible means of identifying an exit or escape route which they might be unable to see

3.2
type A directional sounder
directional sounder designed for indoor use

NOTE This is different from a type A device as defined in BS EN 54-3.

3.3
type B directional sounder
directional sounder designed for outdoor use

NOTE This is different from a type B device as defined in BS EN 54-3.

3.4
directional sounder evacuation system
system comprising one or more stand-alone or linked directional sounders for the purpose of identifying an escape route under emergency conditions

3.5
sound pattern
order and length of bursts or pulses of sound from a directional sounder

4 Planning

4.1 Risk assessment

Regulation 3 of the Management of Health and Safety at Work Regulations 1999 [1] requires a risk assessment to be carried out. On the basis of this assessment a decision then has to be made as to the appropriate fire precautions to be instituted.

4.2 Consultation

Consultation between the owner and/or occupier of the building, the architect, the fire alarm system designer, the directional sounder system designer and installer, the enforcing authority (e.g. the fire authority) and any other parties concerned (e.g. the local authority) should be arranged at the beginning of the planning stage. In addition to the recommendations given in this British Standard it is important that the requirements of any national and/or local legislation which might apply to the premises in question are fully recognized and discussed at this time.

4.3 Supply of plans

Plans showing the layout of the building and of all existing or proposed escape routes, and indicating the positions of all items, structural or otherwise, which might obstruct escape, should be obtained at an early stage for use in the consultation recommended in **4.2**.

4.4 Escape route assessment

An essential part of the risk assessment (see **4.1**) is the identification of escape routes. For a directional sounder evacuation system to be effective it is essential that the system provides complete coverage of the entire escape route and that possible points of confusion are avoided.

To achieve this the following should be considered:

a) the siting and nature of all designated escape routes, as shown on the plans, noting particularly the location of stairs and any changes of direction;

b) the positions of all doors on escape routes and final exits;

c) escape routes from open spaces;

d) multiple escape routes from corridors;

e) any sources of loud noise that might compromise the audibility of the system.

4.5 System configuration

A decision should be made at the planning stage regarding the way in which the system is to be configured. The system can be configured so that all sounders are triggered together, for example where total evacuation of a building is required. Alternatively, the system can be configured so that sounders in selected escape routes are triggered to enable phased evacuation to be carried out. A decision should also be made as to whether the directional sounder evacuation system is to be triggered automatically or manually.

NOTE An example of the configuration of a directional sounder evacuation system is shown in Figure B.1.

5 Design

5.1 General

5.1.1 Directional sounders suitable for use in a directional sounder evacuation system are specified in PAS 41 [2]. However, other directional sounders may be used provided that they exhibit directional characteristics equivalent to those specified in PAS 41. PAS 41 divides directional sounders into two classes on the basis of their sound dispersion characteristics, as follows.

a) *Class I*. These sounders, which can be type A or type B, are suitable for use in open spaces.

b) *Class II*. These sounders, which are type A, are suitable for use in corridors.

5.1.2 The sound levels on the escape route are determined by the location of the sounders and their individual volume settings. The design sound level at any point on the escape route should be at least 72 dBA, or 10 dBA above the ambient noise level, whichever is higher.

5.1.3 When selecting the correct sounder for use in a particular location the following factors should be taken into account:

a) the size of the space which is intended to be influenced by the sounder, as this determines the sound volume required;

b) the angle of spread of sound needed to cover the shape of the space to be influenced: a wide angle for large open spaces, a narrow angle for corridors;

c) the sound characteristics of the space as follows:

— ambient noise levels in normal circumstances and potential noise levels under emergency conditions;

— reverberation times, which are influenced by soft furnishings and ceiling height, and the potential effect on reverberation times of many people being present in the space;

d) interaction with nearby sounders;

e) whether a voice alarm system is also to be used.

5.1.4 The following procedure should be adopted when planning the positions of the directional sounders.

a) All exits and stairways on the escape route should be identified.

b) All points at which a decision has to be made to select a direction should be identified e.g. corridor "T" junctions and lobby areas.

c) A directional sounder should be placed at each exit and at each decision point.

d) Sounders should be placed such that after a person has passed one sounder on an escape route the next sounder can be expected to be audible.

e) If there is an area in which there is a distance of more than 30 m between adjacent sounders then another sounder should be placed midway between them.

f) In the case of a multi-storey building in which the different floors have the same layout, the layout of the sounders and their sound pattern should be the same on all floors.

g) Once escape routes and sounder positions have been established the layout should be re-checked to ensure that a person entering the escape route part of the way along would still be directed correctly to a point of safety.

NOTE In premises with phased evacuation systems, care should be taken that the location and sound pressure levels of the sounders in one area do not risk causing an unwanted evacuation in another area.

5.1.5 The sound pattern should be as follows.

a) The pulse length should be between 50 ms and 1 000 ms.

b) The gap between pulses should be between 25 ms and 1 000 ms.

c) Each of the pulse strings may be interleaved with other messages provided that the following conditions are met.

1) There should be at least three complete pulse cycles between messages.

2) The message should be no longer than 10 s.

3) Voice alarm messages should be in accordance with the recommendations given in BS 5839-8.

5.1.6 The system should be provided with a battery back-up power supply capable of maintaining the requisite system performance for a length of time equal to the design duration of the emergency lighting system in the building as given in BS 5266-1.

5.2 Corridors

5.2.1 Sounders for installation in corridors should be equivalent to Class II (see **5.1.1**). The sounder should be positioned so that the direction of its maximum sound level is pointing at the expected approach to the identified exit from the corridor.

5.2.2 If sounders are needed to attract people to an exit in the middle of a corridor these sounders should provide equal sound levels in both directions along the corridor. This can be achieved by mounting two Class II sounders back to back.

5.2.3 Sounders should be positioned such that at least two sounders are audible at any point on an escape route where alternative routes are possible.

5.3 Doors

5.3.1 The system design should be based on all smoke control doors being shut.

NOTE It is also essential that testing of the system is carried out with the smoke control doors shut (see Clauses **7** and **8**).

5.3.2 Internal doors at decision points which form part of an escape route (e.g. fire doors in corridors), or doors leading to stairways, should be indicated by directional sounders.

5.3.3 The directional sounders should be oriented towards the direction from which evacuees can be expected to arrive.

5.4 Open spaces

5.4.1 Sounders for installation in open spaces should be equivalent to Class I (see **5.1.1**). The directional sounder system should be configured in such a way as to enable people to identify escape routes from any point in all open spaces.

5.4.2 A directional sounder should be mounted at each exit from an open space. The direction of the maximum sound level should be pointed at the major approach path to the identified exit.

5.5 Stairways

5.5.1 Directional sounders at the exit from a floor onto a stairway should be positioned so as to clearly identify the exit.

5.5.2 In high-rise buildings, i.e. buildings with more than 6 levels to the final exit level, directional sounders should be located on the stairway at every 5th level to provide continuity of direction. The final exit from the stairway should be indicated by a directional sounder.

5.5.3 In low-rise buildings, i.e. buildings with 6 levels or less to the final exit level, there should be one directional sounder only, located on the stairway. This should be positioned so as to identify the exit from the stairway onto the final exit floor for people arriving from either the floor(s) above or the floor(s) below.

6 Installation

The system should be installed in accordance with the recommendations given in BS 5266-1, and the wiring should be installed in accordance with BS 7671.

7 Testing after installation

After installation, testing of the directional sounder evacuation system should be carried out in accordance with Annex A. The sound level should be at least 72 dBA, or 10 dBA above the ambient noise level, whichever is higher.

8 Maintenance and functional testing

8.1 An operational test, in which the system is activated manually, should be conducted monthly to check that the sounders function.

8.2 Maintenance of the system should be carried out at least once a year. Maintenance should be carried out in accordance with the manufacturer's instructions, by a competent person.

NOTE A competent person is defined in the Health and Safety Executive document *Fire Safety. An Employers Guide* [3] as someone who has the necessary knowledge, training, experience and abilities to carry out the work.

8.3 At least once a year, the directional sounder evacuation system should be tested in accordance with the method given in Annex A. If the design sound levels given in **5.1.2** are not achieved the sounder location and/or volume should be adjusted and the system retested. The test results should be recorded and the records kept for inspection by the appropriate authority.

8.4 Whenever there are changes to the walls, floor, ceiling decorations or the furnishings, or if there is a change of use, a functional test should be carried out to check that each sounder is operating and is sufficiently audible. In case of doubt, the annual testing procedure in accordance with **8.3** should be carried out.

Annex A (normative)
Testing of directional sounder evacuation system installations

A.1 Audibility measurements

A.1.1 A sound level meter conforming to BS EN 61672-1 and -2, set to "A" weighting, fast, should be used. Sound pressure level readings should be taken along each escape route.

A.1.2 In each area, with the directional sounders not operating, the ambient noise level should be measured and recorded.

A.1.3 The sounders should then be activated by operation of the trigger device. Each test should be commenced at a point on the escape route which is furthest away from any directional sounders.

A.1.4 Heading along the escape route towards a chosen exit, the sound pressure level should be measured at 10 m intervals.

A.2 Recording of results

The results of the measurements should be recorded in tabular form and stored so that they are available for examination by the appropriate authority.

Annex B (informative)
Configurations of directional sounder evacuation systems

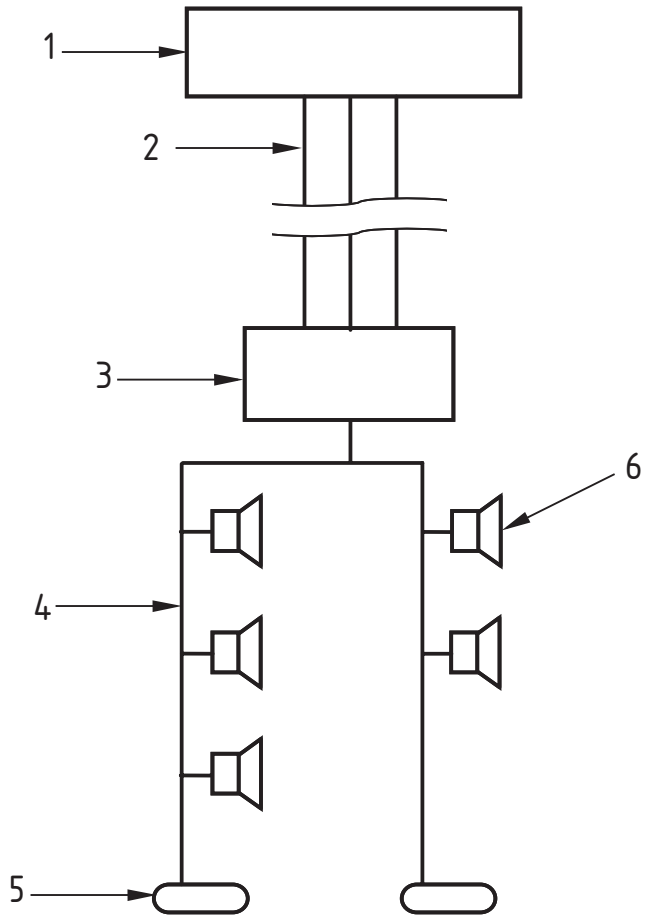
An example of the configuration of a directional sounder evacuation system is shown in Figure B.1.

Each zone can be wired as a monitored radial circuit, as shown in Figure B.1 or as a star circuit.

Signals used to trigger directional sounders may be closed or open contacts or more sophisticated communication through addressable nodes (not shown in Figure B.1).

One or more power supplies may be used to power the directional sounder system, as required. The triggering of each power supply, and the directional sounders connected to it in each zone, may be independent or linked.

A battery back-up power supply may be contained within each power supply unit or the back-up power may be supplied from a central battery system.



Key

1 Control unit
2 Trigger cables
3 Power supply unit
4 Zone cables
5 End of line terminator
6 Directional sounder

Figure B.1 — Example of the configuration of a directional sounder evacuation system

Bibliography

Standards publication

ISO 8201:1987*, Acoustics — Audible emergency evacuation signal.*

Other publications

[1] GREAT BRITAIN. The Management of Health and Safety at Work Regulations 1999. London: The Stationery Office.

[2] PAS 41:2003, *Directional sounders — Requirements and tests*.

[3] HEALTH AND SAFETY EXECUTIVE. *Fire Safety. An Employers Guide*. 1999, London: HSE Books.

[4] GREAT BRITAIN. The Fire Precautions (Workplace) Regulations 1997 (as amended). London: The Stationery Office.

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