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Fire detection and alarm systems —

Part 16: Sound system control and indicating equipment

Systèmes de détection et d'alarme d'incendie —

Partie 16: Équipement de contrôle et de signalisation des systèmes sonores

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 7240-16 was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting*, Subcommittee SC 3, *Fire detection and alarm systems*.

This first edition of ISO 7240-16 together with ISO 7240-19 cancels and replaces IEC 60849:1998, which has been technically revised.

ISO 7240 consists of the following parts, under the general title *Fire detection and alarm systems*:

— *Part 1: General and definitions*

— *Part 2: Control and indicating equipment*

— *Part 4: Power supply equipment*

— *Part 5: Point-type heat detectors*

— *Part 6: Carbon monoxide fire detectors using electro-chemical cells*

— *Part 7: Point-type smoke detectors using scattered light, transmitted light or ionization*

— *Part 8: Carbon monoxide fire detectors using an electro-chemical cell in combination with a heat sensor*

— *Part 9: Test fires for fire detectors* (Technical Specification)

— *Part 10: Point-type flame detectors*

— *Part 11: Manual call points*

— *Part 12: Line type smoke detectors using a transmitted optical beam*

— *Part 13: Compatibility assessment of system components*

— *Part 14: Guidelines for drafting codes of practice for design, installation and use of fire detection and fire alarm systems in and around buildings* (Technical Report)

— *Part 15: Point type fire detectors using scattered light, transmitted light or ionization sensors in combination with a heat sensor*

— *Part 16: Sound system control and indicating equipment*

— *Part 19: Design, installation, commissioning and service of sound systems for emergency purposes*

— *Part 21: Routing equipment*

— *Part 22: Smoke-detection equipment for ducts*

— *Part 27: Point-type fire detectors using a scattered-light, transmitted-light or ionization smoke sensor, an electrochemical-cell carbon-monoxide sensor and a heat sensor*

A part 26 dealing with oil mist detectors and a part 28 dealing with fire protection control equipment are under development.

Introduction

Sound system control and indicating equipment (s.s.c.i.e.) forms part of a sound system for emergency purposes (s.s.e.p.). An s.s.e.p. operates automatically or manually in a building or structure to alert occupants to a hazard which may require their evacuation in a safe and orderly manner. Equipment to warn occupants is therefore required to function after the hazard has been detected. Fire in a building is a common hazard which is often detected by an automatic fire detection and alarm system. An s.s.e.p. may operate as part of a fire detection and alarm system or may function in conjunction with other emergency detection systems, such as those for storms, earthquakes and bomb threats. The s.s.c.i.e. may be a separate unit or may be physically combined with the fire detection control and indicating equipment (see ISO 7240-2).

This part of ISO 7240 has been prepared by Subcommittee ISO/TC 21/SC 3 and is based on IEC 60849:1998, *Sound systems for emergency purposes,* prepared by the International Electrotechnical Commission IEC/TC 100, *Audio, video and multimedia systems and equipment.*

This part of ISO 7240 follows the format of, and has similar requirements to, ISO 7240-2 and is drafted on the basis of mandatory functions which are to be provided on all s.s.c.i.e. and optional functions (with requirements) which may be provided. Each optional function is included as a separate entity, with its own set of associated requirements, in order for s.s.c.i.e. with different combinations of functions to comply with this part of ISO 7240. It is intended that the options be used for specific applications, as recommended in ISO 7240-19 and the emergency management plan. Other functions associated with an s.s.e.p. may also be provided, even if they are not specified in this part of ISO 7240.

This part of ISO 7240 contains specific tests that subject the equipment to conditions likely to be met in practice, such as corrosion, vibration, direct impact, indirect shock and electromagnetic interference. Some tests specified are intended to assess the performance of the s.s.c.i.e. under such conditions. The performance of the s.s.c.i.e. is assessed from the results obtained in specific tests. This part of ISO 7240 is not intended to place any other restrictions on the design and construction of such equipment.

Fire detection and alarm systems —

Part 16: Sound system control and indicating equipment

1 Scope

This part of ISO 7240 specifies the requirements, test methods and performance criteria for sound system control and indicating equipment (s.s.c.i.e.) for use in buildings and structures as part of a sound system for emergency purposes (s.s.e.p.) (item C of Figure 2 in ISO 7240-1:2005). The s.s.c.i.e. is primarily intended to broadcast information for the protection of lives within one or more specified areas in an emergency, to effect a rapid and orderly mobilization of occupants in an indoor or outdoor area. This includes systems using loudspeakers to broadcast voice announcements for emergency purposes, alert signals complying with ISO 7731, and evacuate signals complying with ISO 8201.

The overall requirements of an s.s.e.p., especially concerning audibility and intelligibility, are contained within ISO 7240-19. In addition to ensuring compliance with this part of ISO 7240, the manufacturer should also consider the requirements of ISO 7240-19, national regulations, codes and standards that affect the s.s.c.i.e. design and usability. For example, some regulations require certain optional functions to be available on all s.s.c.i.e. installed within the jurisdiction.

The use of the equipment for normal sound reinforcement and distribution systems purposes under non-hazardous circumstances is not excluded.

This part of ISO 7240 can also be used for the assessment of similar control and indicating equipment for use in systems where the warning-signal broadcast does not include a voice message.

This part of ISO 7240 does not apply to systems using only sounders or bells.

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.

ISO 7240-1:2005, *Fire detection and alarm systems — Part 1: General and definitions*

ISO 7240-2:2003, *Fire detection and alarm systems — Part 2: Control and indicating equipment*

ISO 7240-4:2003, *Fire detection and alarm systems — Part 4: Power supply equipment*

ISO 7240-5, *Fire detection and alarm systems — Part 5: Point-type heat detectors*

ISO 7240-6, *Fire detection and alarm systems — Part 6: Carbon monoxide fire detectors using electro-chemical cells*

ISO 7240-7, *Fire detection and alarm systems — Part 7: Point-type smoke detectors using scattered light, transmitted light or ionization*

ISO 7240-8, *Fire detection and alarm systems — Part 8: Carbon monoxide fire detectors using an electro-chemical cell in combination with a heat sensor*

ISO/TS 7240-9, *Fire detection and alarm systems — Part 9: Test fires for fire detectors*

ISO 7240-10, *Fire detection and alarm systems — Part 10: Point-type flame detectors*

ISO 7240-11, *Fire detection and alarm systems — Part 11: Manual call points*

ISO 7240-12, *Fire detection and alarm systems — Part 12: Line type smoke detectors using a transmitted optical beam*

ISO 7240-13, *Fire detection and alarm systems — Part 13: Compatibility assessment of system components*

ISO/TR 7240-14, *Fire detection and alarm systems — Part 14: Guidelines for drafting codes of practice for design, installation and use of fire detection and fire alarm systems in and around buildings*

ISO 7240-15, *Fire detection and alarm systems — Part 15: Point type fire detectors using scattered light, transmitted light or ionization sensors in combination with a heat sensor*

ISO 7240-19, *Fire detection and alarm systems — Part 19: Design, installation, commissioning and service of sound systems for emergency purposes*

ISO 7240-21, *Fire detection and alarm systems — Part 21: Routing equipment*

ISO 7240-22, *Fire detection and alarm systems — Part 22: Smoke detection equipment for ducts*

ISO 7731, *Ergonomics — Danger signals for public and work areas — Auditory danger signals*

ISO 8201, *Acoustics — Audible emergency evacuation signal*

IEC 60068-1, *Environmental testing — Part 1: General and guidance*

IEC 60068-2-1, *Environmental testing — Part 2: Tests. Tests A: Cold*

IEC 60068-2-6, *Environmental testing — Part 2: Tests. Test Fc: Vibration (sinusoidal)*

IEC 60068-2-47, *Environmental testing — Part 2-47: Test — Mounting of specimens for vibration, impact and similar dynamic tests*

IEC 60068-2-75, *Environmental testing — Part 2-75: Tests — Test Eh: Hammer tests*

IEC 60068-2-78, *Environmental testing — Part 2-78: Tests — Test Cab: Damp heat, steady state*

IEC 60268-1, *Sound system equipment — Part 1: General*

IEC 60268-4:2004, *Sound system equipment — Part 4: Microphones*

IEC 60529:2001, *Degrees of protection provided by enclosures (IP Code)*

IEC 60721-3-3:2002, *Classification of environmental conditions — Part 3-3: Classification of groups of environmental parameters and their severities — Stationary use at weather protected locations*

EN 50130-4, *Alarm systems — Part 4: Electromagnetic compatibility — Product family standard: Immunity requirements for components of fire, intruder and social alarm systems*

3 Terms, definitions and abbreviated terms

For the purposes of this document, the terms and definitions given in ISO 7240-1 and the following apply. See also ISO 7240-1:2005, Figure 2.

3.1 Terms and definitions

3.1.1
automatic mode
mode of operation of a sound system which is linked to an emergency detection system, or other means of triggering the sound system, to broadcast emergency messages without human intervention in a manner which is pre-set according to an agreed emergency-response procedure unique to that building

3.1.2
cabinet
housing which affords a degree of protection and robustness to its constituent parts and subassemblies

3.1.3
emergency microphone
microphone dedicated for use by competent personnel during the voice-alarm condition

3.1.4
emergency microphone control
manual control which activates an emergency microphone (also called a “push-to-talk” control)

3.1.5
emergency loudspeaker zone
subdivision of the premises such that the occurrence of an emergency within it will be indicated separately from any other subdivision at the s.s.c.i.e. and broadcast separately within the subdivision

3.1.6
functional condition
condition of the s.s.c.i.e. characterized by its indication at the s.s.c.i.e

NOTE The functional conditions recognized in this part of ISO 7240 are

— the quiescent condition,

— the voice-alarm condition,

— the fault-warning condition,

— the disabled condition, and

— the test condition.

3.1.7
manual mode
mode of operation where an operator is directly in control of the broadcast of live or pre-recorded sounds, especially those of an emergency nature

3.1.8
quiescent condition
functional condition characterised by the absence of the voice-alarm, fault-warning, disabled and test conditions

3.1.9
transmission path
physical connection between s.s.e.p. components (external to the cabinet of the component) used for the transmission of information, including audio and/or power

3.1.10
voice-alarm condition
alert signal, evacuate signal, recorded or live emergency signal broadcast in at least one emergency loudspeaker zone

3.2 Abbreviations

— c.i.e. control and indicating equipment

— r.m.s. root mean squared

— S/N signal-to-noise ratio

— s.s.c.i.e. sound system control and indicating equipment

— s.s.e.p. sound system for emergency purposes

— THD total harmonic distortion

4 General requirements

4.1 General

4.1.1 If an optional function is included in the s.s.c.i.e., then all the corresponding requirements shall be met (see also Annex A).

4.1.2 If functions other than those specified in this part of ISO 7240 are provided, they shall not jeopardize compliance with any requirements of this part of ISO 7240.

4.2 Combined s.s.c.i.e. and c.i.e.

When the s.s.c.i.e. and c.i.e. are in the same cabinet, they may share common indications, manual controls and outputs (see Annex B). In this case, the following shall apply.

a) A single fault in the c.i.e. shall not adversely affect the mandatory functions of the s.s.c.i.e.

b) Indication(s) and manual control(s) associated with the s.s.c.i.e which are dedicated to the fault-warning function shall be clearly identifiable.

4.3 Power supply

Power-supply equipment shall comply with the requirements of ISO 7240-4 and may be internal or external to the s.s.c.i.e. cabinet.

The power supply may be shared with that of the emergency detection system.

5 General requirements for indications

5.1 Display of functional conditions

5.1.1 The s.s.c.i.e. shall be capable of unambiguously indicating the following functional conditions, as described in Clauses 6 to 10:

— quiescent condition;

— voice-alarm condition;

— fault-warning condition;

— disabled condition (optional function);

— test condition (optional function).

5.1.2 The s.s.c.i.e. shall be capable of being simultaneously, in any combination of the following functional conditions:

— one or more voice-alarm conditions;

— fault-warning condition;

— disablement condition;

— test condition.

5.2 Display of indications

All mandatory indications shall be clearly identifiable, except where otherwise specified in this part of ISO 7240.

5.3 Indications on alphanumeric displays

Where an alphanumeric display is used to display indications relating to different functional conditions, these may be displayed at the same time. However, for each functional condition, there shall be only one window in which all of the fields relating to that functional condition are grouped.

5.4 Indication of the supply of power

5.4.1 A visible indication shall be given by means of a separate light-emitting indicator while the s.s.c.i.e. is supplied with power.

5.4.2 Where the s.s.c.i.e. is distributed in more than one cabinet, an indication of supply of power shall be given at each distributed cabinet.

5.5 Additional indications

Where indications are used in addition to mandatory indications, these shall not result in contradiction or confusion.

6 Quiescent condition

Any kind of system information may be displayed during the quiescent condition. However, no indications shall be given that can be confused with indications used in

— the voice-alarm condition,

— the fault-warning condition,

— the disabled condition, or

— the test condition.

7 Voice-alarm condition

7.1 Reception and processing of alarm signal

7.1.1 The s.s.c.i.e. shall be capable of receiving and processing voice-alarm condition signals from an emergency detection system (see Annex C) and/or manual controls, and causing the appropriate alarm and warning-signal outputs to be activated within 3 s, or after the expiry of any delay period (see 7.6).

7.1.2 The mandatory indications and/or outputs shall not be falsified by multiple signals received from the same or different emergency detection systems and/or manual controls.

7.1.3 Where the s.s.c.i.e. and the c.i.e. are in separate cabinets, failure of the transmission path between the emergency detection system and the s.s.c.i.e. shall not affect the operation of the s.s.c.i.e. or any change of state of the voice-alarm condition.

7.1.4 Where the s.s.c.i.e. is used for non-emergency purposes (e.g. paging, music or general pre-recorded announcements), the voice-alarm condition shall disable or override any functions not connected with the emergency functions.

7.2 Alert signal – Optional function

7.2.1 The s.s.c.i.e. may produce one or more alert signals complying with ISO 7731.

NOTE The alert signal can be used together with an emergency management plan (see ISO 7240-19) to alert occupants to a hazard and to prompt evacuation supervisors to attend control points and prepare for further instructions.

Different alert signals may be used to alert trained personnel to different hazards.

7.2.2 Where a voice signal is used as part of the alert signal, the alert signal shall precede the first pre-recorded voice message for 3 s to 10 s. Successive alert signals and messages shall then continue until either automatically or manually changed or silenced. The interval between successive messages shall not exceed 30 s and alert signals shall be broadcast whenever periods of silence might otherwise exceed 10 s.

7.2.3 Where more than one alert signal is provided, each signal shall be clearly distinguishable.

Where an alert signal is used as part of an automatic evacuation plan, it should precede the evacuate signal and may include voice messages.

7.3 Evacuate signal

7.3.1 The evacuate signal may be preceded by an alert signal (see 7.2).

The use of an alert signal, together with an evacuate signal, should be assessed as part of an emergency management plan (see ISO 7240-19). For buildings and structures where the plan requires the unassisted evacuation of occupants, the s.s.e.p. may be configured to generate a warning signal that does not incorporate an alert signal.

7.3.2 The evacuate signal shall include the tone signal and pre-recorded voice messages, as specified in ISO 8201.

Manufacturers may implement other signal templates to satisfy specific mandated national requirements.

7.4 Indication of the voice-alarm condition

The presence of a voice-alarm condition shall be indicated on the s.s.c.i.e., without prior manual intervention, by

a) a visible indication by means of a separate discrete light-emitting indicator (the general voice-alarm-activated indicator);

b) a visible indication for each activated emergency loudspeaker zone where manual controls are provided; this may be by means of separate discrete indicators or an alphanumeric display, as specified in 14.8;

c) an optional audible indication, as specified in 7.5.

7.5 Audible warning – Optional function

7.5.1 An audible warning, at the s.s.c.i.e., of the voice-alarm condition may be the same as that for the fault-warning condition. If they are different, the voice-alarm condition warning shall have priority.

7.5.2 The audible warning shall be capable of being silenced at access level 1 or 2 (see Annex D for more information on access levels).

7.5.3 The audible warning shall be silenced automatically when the s.s.c.i.e. is reset from the voice-alarm condition.

7.6 Delay before entering the voice-alarm condition – Optional function

The s.s.c.i.e. may be provided with a facility to introduce a delay before entering the voice-alarm condition. In this case, the following shall apply.

a) The configuration of delays shall be selectable at access level 3 (see Annex D for more information on access levels).

b) The operation of the delay shall be in increments not exceeding 1 min, up to a maximum of 10 min.

c) The delay to one output signal shall not affect the delay to other outputs.

d) It shall be possible to override the delay by a manual operation at access level 1 and/or by a signal from a manual call point.

e) There shall be a provision to switch on and switch off delays by means of a manual operation at access level 2.

f) There may be a provision to automatically switch on and/or switch off delays by means of a programmable timer, which shall be configurable at access level 3.

g) A separate light-emitting indicator and/or a field on the alphanumeric display shall be visible when an alarm signal is received and the delay is activated. This indication shall be suppressed after the s.s.c.i.e. enters the voice-alarm condition.

7.7 Phased evacuation – Optional function

The s.s.c.i.e. may be provided with a facility to delay the warning signals to the emergency loudspeaker zones (see 7.6). The following shall apply.

a) The facility shall be configurable at access level 3 (see Annex D for more information on access levels).

b) There may be a provision to switch between manual mode and a phased evacuation sequence by means of a manual operation at access level 2.

c) When switching from phased evacuation to manual mode, the phased evacuation sequence shall halt.

d) When switching from manual mode to phased evacuation, the phased evacuation sequence shall resume from the point at which it was halted.

7.8 Silencing the voice-alarm condition

7.8.1 Silencing the voice-alarm condition from the emergency detection system

7.8.1.1 Where the voice-alarm condition has been initiated from the emergency detection system, the s.s.c.i.e. shall respond appropriately to a silence instruction from the emergency detection system.

7.8.1.2 The silencing procedure may allow for the completion of messages in the process of being broadcast.

7.8.2 Silencing of the voice-alarm condition with a manual control – Optional function

7.8.2.1 The voice-alarm condition may be manually silenced at the s.s.c.i.e. at access level 2.

7.8.2.2 Following silencing, it shall be possible to reactivate the voice-alarm condition at access level 2.

7.9 Reset of the voice-alarm condition

7.9.1 Reset of the voice-alarm condition from the emergency detection system

Where the voice-alarm condition has been initiated from the emergency detection system, the s.s.c.i.e. shall implement a reset instruction from the emergency detection system.

7.9.2 Reset of the voice-alarm condition with a manual control – Optional function

7.9.2.1 A separate manual control at the s.s.c.i.e. may be provided to reset the voice-alarm condition. This control shall be accessible at access level 2, used only for reset, and may be the same as that used for reset from the fault-warning condition.

7.9.2.2 Following a reset operation, the indication of the correct functional condition corresponding to any received signals shall either remain or be re-established within 20 s.

7.10 Output to alarm devices – Optional function

The s.s.c.i.e. may have a provision for the automatic transmission of alarm signals to alarm devices, such as beacons and vibrating devices. In this case, the following shall apply.

a) It shall be possible to deactivate the alarm devices at access level 2.

b) Following deactivation, it shall be possible to reactivate the alarm devices at access level 2.

c) The alarm devices shall not be deactivated automatically.

d) It shall be possible to configure the s.s.c.i.e. at access level 3, to automatically reactivate the alarm devices if an alarm is reported in another emergency loudspeaker zone.

7.11 Voice-alarm condition output signal – Optional function

The s.s.c.i.e. may have a provision for transmitting the voice-alarm condition. In this case, it shall activate the output only in the voice-alarm condition.

8 Fault-warning condition

8.1 Reception and processing of fault signals

8.1.1 The s.s.c.i.e. shall enter the fault-warning condition when signals are received that, after any necessary processing, are interpreted as a fault.

8.1.2 The s.s.c.i.e. shall be capable of simultaneously recognizing all of the faults specified in 8.2, and in 8.3 if provided, unless this is prevented by

— the presence of voice-alarm signals in the same emergency loudspeaker zone, and/or

— the disablement of the corresponding emergency loudspeaker zone or function, and/or

— the testing of a corresponding zone or function.

8.1.3 The s.s.c.i.e. shall enter the fault-warning condition within 100 s of the occurrence of the fault or the reception of a fault signal, or as otherwise specified in this part of ISO 7240, or within another time period, as specified in other parts of ISO 7240.

8.2 Indication of faults in specified functions

8.2.1 The presence of faults in specified functions shall be indicated without prior manual intervention. The fault-warning condition is established when the following are present:

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

b) a visible indication for each recognized fault, as specified in 8.2.4, 8.2.5 and 8.3 (if provided);

c) an audible indication, as specified in 8.4.

8.2.2 If the indication is by means of separate light-emitting indicators, these may be the same as those used to indicate disablement and/or testing of the corresponding emergency loudspeaker zones or functions.

8.2.3 If the indication is on an alphanumeric display that cannot simultaneously indicate all of the faults, the following shall apply.

a) The presence of fault indications that have been suppressed shall be indicated.

b) Suppressed fault indications shall be capable of being displayed by means of a manual operation at access level 1 or 2, which interrogates only fault indications.

8.2.4 The following faults shall be indicated by means of separate light-emitting indicators and/or an alphanumeric display. The following indications may be suppressed during the voice-alarm condition:

a) an indication at least common to any power-supply fault resulting from

   — a short-circuit or an interruption in a transmission path to power-supply equipment (item C7 of Figure 2 of ISO 7240-1:2005), where the power supply is contained in a different cabinet from that of the s.s.c.i.e.;

   — power-supply equipment faults, as specified in ISO 7240-4;

b) an indication at least common to any single earth fault of less than 50 kΩ that affects a mandatory function and which is not otherwise indicated as a fault of a supervised function;

c) an indication of the rupture of any fuse or the operation of any protective device that is capable of affecting a mandatory function in the voice-alarm condition;

d) an indication of any short-circuit or interruption, at least common to all transmission paths between parts of the s.s.c.i.e. contained in more than one mechanical cabinet that is capable of affecting a mandatory function and that is not otherwise indicated as a fault of a supervised function;

8.2.5 The following faults shall be indicated at least by means of the general fault-warning indicator:

a) any short-circuit or interruption in a transmission path between parts of the s.s.c.i.e. contained in more than one cabinet, where the fault does not affect a mandatory function;

b) a short-circuit or interruption of the transmission path to the microphone capsule, if provided;

c) any short-circuit or interruption in a transmission path between the s.s.c.i.e. and the loudspeaker, even where the fault does not affect the operation of the loudspeaker;

d) any short-circuit or interruption in the voice-alarm transmission path between the s.s.c.i.e. and alarm devices, if used (see 7.10);

e) a failure of any power amplifier.

8.2.6 The following are provisions for faults related to specific functions.

8.2.6.1 Faults related to the transmission path to the emergency detection system – Optional function

The s.s.c.i.e. may have a provision for an indication of faults related to the transmission path to the emergency detection system. In this case, the short-circuit or interruption of the transmission path to the emergency detection system shall be indicated by means of a separate light-emitting indicator and/or an alphanumeric display.

8.2.6.2 Faults related to emergency loudspeaker zones – Optional function

The s.s.c.i.e. may have a provision for an indication of faults related to emergency loudspeaker zones. In this case, the short-circuit or interruption of a transmission path between the s.s.c.i.e. and the loudspeakers in that zone shall be indicated by means of a separate light-emitting indicator per zone and/or an alphanumeric display.

8.3 System fault

A system fault is a fault, as specified in 15.4 or 15.6, in the case of a software-controlled s.s.c.i.e. A system fault may prevent the requirements of this part of ISO 7240, other than those specified below, from being fulfilled. In the event of a system fault, at least the following shall apply.

a) A system fault shall be visibly indicated by means of the general fault-warning indicator and a separate light-emitting indicator. These indications shall not be suppressed by any other functional condition of the s.s.c.i.e., and shall remain until a manual reset and/or another manual operation at access level 2 or 3 is carried out.

b) A system fault shall be audibly indicated. This indication may be capable of being silenced.

8.4 Audible indication

8.4.1 The audible indication of faults in 8.2 shall be capable of being silenced manually at access level 1 or 2. The same manual operation may be used as that for silencing the audible indication in the voice-alarm condition.

8.4.2 The audible indication shall be silenced automatically if the s.s.c.i.e. is automatically reset from the fault-warning condition.

8.4.3 If previously silenced, the audible indication shall re-sound for each newly recognised fault.

8.5 Reset of fault indications

8.5.1 The indications of faults in 8.2 shall be capable of being reset

— automatically when faults are no longer recognised, and/or

— by a manual operation at access level 2, which may be the same as that used for resetting from the voice-alarm condition.

8.5.2 Following the completion of the reset process, the indication of the correct functional conditions corresponding to any received signals shall either remain or be re-established within 100 s.

8.6 Fault-warning condition output signal

The s.s.c.i.e. shall have an output to transmit the fault-warning condition specified in 8.2. The output signal shall be given if the s.s.c.i.e. is de-energized.

9 Disabled condition – Optional function

9.1 General

9.1.1 The s.s.c.i.e. may have a provision to independently disable and re-enable each emergency loudspeaker zone by means of manual operations at access level 2.

9.1.2 Disabled emergency loudspeaker zones shall inhibit all corresponding mandatory indications and/or outputs, but shall not prevent other mandatory indications and/or outputs.

9.1.3 The s.s.c.i.e. shall be in the disabled condition while a disablement in accordance with the requirements of 9.1.1 exists.

9.1.4 Disablement and re-enablement shall not be affected by a reset from the voice-alarm condition or from the fault-warning condition.

9.2 Indication of the disabled condition

The disabled condition shall be indicated visibly by means of the following:

a) a separate light-emitting indicator (the general disablement indicator);

b) an indication for each emergency loudspeaker zone, as specified in 9.1.1.

9.3 Indication of specific disablements

9.3.1 Each emergency loudspeaker zone shall be indicated by means of separate light-emitting indicators and/or an alphanumeric display. The indications shall not be suppressed during the voice-alarm condition.

9.3.2 Disablements shall be indicated within 2 s of completion of the manual operation. Where the disablement cannot be completed within 2 s, it shall be indicated within 2 s from the commencement of the disabling process.

9.3.3 The same light-emitting indicator may be used as that for the indication of the corresponding fault, although the indication shall be distinguishable. The same light-emitting indicator and the same indication may be used to indicate a disabled emergency loudspeaker zone and an emergency loudspeaker zone under test.

9.3.4 If the indication is on an alphanumeric display that cannot simultaneously indicate all of the disablements because of its limited capacity, at least the following shall apply.

a) The presence of suppressed disablement indications shall be indicated;

b) Suppressed disablement indications shall be capable of being displayed, independently of other indications, by means of a manual operation at access level 1 or 2, which interrogates only the disablement indications.

9.4 Disablement condition output – Optional function

The s.s.c.i.e. may have a provision to transmit a general disablement signal, as specified in 9.2.

10 Test condition – Optional function

10.1 General

The s.s.c.i.e. may have a provision for testing the processing and indication of alarm input signals. This may inhibit the requirements during the voice-alarm condition which correspond to that emergency loudspeaker zone. In this case, at least the following shall apply.

a) The s.s.c.i.e. shall be in the test condition while one or more zones are under test.

b) A test state shall only be entered and cancelled by a manual operation at access level 2 or 3.

c) It shall be possible to test the operation of each emergency loudspeaker zone individually.

d) Emergency loudspeaker zones in the test state shall not prevent the mandatory outputs to emergency loudspeaker zones not in the test state.

10.2 Indication of the test condition

The test condition shall be indicated visibly, by means of the following:

a) a separate light-emitting indicator (the general test indicator);

b) an indication for each emergency loudspeaker zone, as specified in 10.3.

10.3 Indication of specific emergency loudspeaker zones in the test state

Emergency loudspeaker zones in the test state shall be visibly indicated by means of a separate light-emitting indicator for each zone and/or an alphanumeric display. The same light-emitting indicator and the same indication may be used to indicate an emergency loudspeaker zone under test and a disabled zone. Entry to test states shall be indicated within 2 s of the completion of the manual operation. For indications on alphanumeric displays, at least the requirements of 9.3.4 shall apply.

11 Manual mode control – Optional function

11.1 General

11.1.1 The s.s.c.i.e. may have a provision to manually initiate the alarm output signals to emergency loudspeaker zones. Where the control is provided, the following shall apply.

a) The control shall be accessible only at access level 2.

b) The control shall initiate each emergency loudspeaker zone individually or in groups of emergency loudspeaker zones.

c) The initiation of the control shall not prevent mandatory indications and outputs to other emergency loudspeaker zones.

11.1.2 In the manual mode, the receiving and display of signals shall not be inhibited.

11.1.3 In the manual mode, any phased evacuation sequence shall be halted. Returning the system to automatic mode shall reinstate the phased evacuation sequence as if it had not been halted.

11.2 Indications of emergency loudspeaker zones in the voice-alarm condition

The initiation of an emergency loudspeaker zone shall be visibly indicated without prior manual intervention and shall not be suppressed. The indication shall be by the following means:

a) a separate light-emitting indicator (the general alarm-output-activated indicator);

b) an indication for each emergency loudspeaker zone and/or an alphanumeric display.

NOTE It is not necessary that these indicators distinguish which emergency message is being broadcast in each emergency loudspeaker zone.

11.3 Indication of emergency loudspeaker zones in the fault-warning condition – Optional function

An indication of a fault-warning condition that can prevent the generation and transmission of the warning signal to the emergency loudspeaker zone(s) associated with each manual control may be available without any manual action and, if available, shall not be suppressed. This indication shall be by

a) a separate light-emitting indicator (the general fault-warning indicator), and

b) an indication for each emergency loudspeaker zone and/or an indication for defined group(s) of zones.

11.4 Indication of emergency loudspeaker zones in the disabled condition – Optional function

An indication of a disabled condition in the emergency loudspeaker zone(s) associated with each manual control may be available without any manual action and, if available, shall not be suppressed. This indication shall be by

a) a separate light-emitting indicator (the general disablement indicator), and

b) an indication for each emergency loudspeaker zone and/or an indication for defined group(s) of zones.

12 Interface to external control device(s) – Optional function

The s.s.c.i.e. may have a provision for interfacing to (an) external control device(s), such as standardized user interfaces. In this case, the following shall apply.

a) The interface shall allow only access level 1 and 2 functions.

b) The mandatory functions of the s.s.c.i.e. shall not be overridden.

c) Any short-circuit, interruption or earth fault in the transmission path to the external device(s) shall

   1) not prevent the mandatory function of the s.s.c.i.e., and

   2) be indicated on the s.s.c.i.e., at least by means of the general fault-warning indicator.

13 Emergency microphone – Optional function

13.1 General

The s.s.c.i.e. may have a provision for an emergency microphone. Where an emergency microphone is provided, the following shall apply.

a) The emergency microphone shall have priority over all other sound source inputs, including pre-recorded messages.

b) An emergency microphone control facility to open the emergency microphone channel shall be provided at access level 2.

c) The emergency microphone control shall mute alert and evacuate signals within the selected emergency loudspeaker zone.

d) Use of the emergency microphone shall not reset an existing functional condition. After the microphone is no longer used, the functional condition shall be re-established.

e) Unless 13.3 applies, the microphone shall broadcast voice messages to a pre-configured set of emergency loudspeaker zones.

13.2 Microphone priority – Optional function

13.2.1 Where more than one microphone can be connected to the s.s.c.i.e., the microphones may be configurable for priority at access level 3 or access level 4.

13.2.2 Where more than one microphone is configured at each priority level, only one microphone shall be active at any one time. If more than one microphone at the same priority is activated, the most recently activated microphone shall be enabled.

13.3 Microphone emergency loudspeaker zone control – Optional function

The s.s.c.i.e. may be configurable to route microphone messages to groups of emergency loudspeaker zones, with each group containing at least one emergency loudspeaker zone.

14 Design requirements

14.1 General requirements and manufacturer's declarations

14.1.1 The s.s.c.i.e. shall comply with the design requirements of Clause 14, where relevant to the technology used. Some requirements can be verified by testing. Others can be verified only by inspection of the design and its accompanying documentation because of the impracticability of testing all of the possible combinations of functions and of establishing the long-term reliability of the s.s.c.i.e.

14.1.2 In order to assist the process of design inspection, the manufacturer shall declare in writing that

a) the design has been carried out in accordance with a quality management system that incorporates a set of rules for the design of all elements of the s.s.c.i.e. [e.g. ISO 9001 [1)]], and

b) the components of the s.s.c.i.e. have been selected for the intended purpose and are expected to operate within their specification when the environmental conditions outside the cabinet of the s.s.c.i.e. comply with IEC 60721-3-3:2002, class 3k5.

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1) *Quality management systems — Requirements*

14.2 Documentation

14.2.1 The manufacturer shall prepare installation and user documentation, which shall be submitted to the testing authority together with the s.s.c.i.e. This shall comprise at least the following:

a) a general description of the equipment, including a list of

   1) the optional functions of this part of ISO 7240,

   2) the functions relating to other parts of ISO 7240, and

   3) the ancillary functions not required by this part of ISO 7240;

b) technical specifications of the inputs and outputs of the s.s.c.i.e., sufficient to permit an assessment of the mechanical, electrical, and software compatibility with other components of the system (e.g. as described in ISO 7240-1), including where relevant

   1) the power requirements for recommended operation,

   2) the maximum number of emergency loudspeaker zones,

   3) the maximum number of alarm inputs from an emergency detection system,

   4) the maximum and minimum electrical ratings for each input and output,

   5) information on the communication parameters employed on each transmission path,

   6) recommended cable parameters for each transmission path,

   7) fuse ratings, and

   8) information concerning the connection of a microphone, when included;

c) installation information, including

   1) the suitability for use in various environments,

   2) how the requirements of 14.3.3 and 14.5.3 can be met if the s.s.c.i.e. is contained in more than one cabinet,

   3) how the requirements of 14.3.3 and 14.5.4 can be met if the s.s.c.i.e is designed to be used with power-supply equipment contained in a separate cabinet,

   4) mounting instructions, and

   5) instructions for connecting the inputs and outputs;

d) configuring and commissioning instructions;

e) operating instructions;

f) service and maintenance information.

14.2.2 The manufacturer shall prepare design documentation, which shall be submitted to the testing authority together with the s.s.c.i.e. This documentation shall include drawings, lists of parts, block diagrams, circuit diagrams and a functional description, to such an extent that compliance with this part of ISO 7240 may be checked, and that a general assessment of the mechanical and electrical design is made possible.

14.3 Mechanical design requirements

14.3.1 The cabinet of the s.s.c.i.e. shall be of robust construction, consistent with the method of installation recommended in the documentation. It shall meet at least classification IP30 of IEC 60529:2001.

14.3.2 All interconnections and settings inside the cabinet shall be accessible at access level 3.

14.3.3 The s.s.c.i.e. may be housed in more than one cabinet. If the documentation shows that the cabinets may be installed in locations distributed within a site, then all of the mandatory manual controls and indicators shall be on one cabinet or on cabinets declared to be suitable only for mounting adjacent to each other.

NOTE For the purposes of 14.3.3, adjacent cabinets are those that are mounted in physical contact with each other.

14.3.4 All mandatory manual controls and light-emitting indicators shall be clearly labelled to indicate their purpose. The information shall be legible at 0,8 m distance, in an ambient light intensity from 100 lx to 500 lx.

14.3.5 The terminations for transmission paths and the fuses shall be clearly labelled.

14.4 Electrical and other design requirements

14.4.1 Transitions between the main and the standby power sources shall not change any indications and/or the state of any outputs, except those relating to the power supplies.

14.4.2 If the s.s.c.i.e. has a provision for disconnecting or adjusting the main or the standby power source, this shall be possible only at access level 3 or 4.

14.5 Integrity of transmission paths

14.5.1 A fault in any transmission path between the s.s.c.i.e. and other components of the s.s.e.p. (as defined in ISO 7240-1) shall not affect the correct functioning of the s.s.c.i.e. or of any other required transmission path.

14.5.2 A short-circuit or an interruption in the transmission path to (a) loudspeaker(s) shall not affect more than one emergency loudspeaker zone for more than 100 s following the occurrence of the fault.

14.5.3 A short-circuit or an interruption in any transmission path between distributed cabinets of an s.s.c.i.e. shall not prevent the activation of the alarm output to more than one emergency loudspeaker zone for longer than 100 s following the occurrence of the fault.

14.5.4 Where the s.s.c.i.e. is designed to be used with a power supply (item L of Figure 1 in ISO 7240-1:2005) contained in a separate cabinet, then an interface shall be provided for at least two transmission paths to the power supply, such that a short-circuit or an interruption in one shall not prevent the supply of power to the s.s.c.i.e.

14.6 Accessibility of indications and controls

NOTE 1 See also Annex D.

Four access levels shall be provided on the s.s.c.i.e., from access level 1 (most accessible) to access level 4 (least accessible). Manual controls and other functions shall be grouped on the appropriate access level, as specified in this part of ISO 7240. The following shall apply.

a) All mandatory indications shall be visible at access level 1 without prior manual intervention (e.g. the need to open a door).

b) Manual controls at access level 1 shall be accessible without special procedures.

c) Indications and manual controls which are mandatory at access level 1 shall also be accessible at access level 2.

d) The entry to access level 2 shall be restricted by a special procedure.

e) The entry to access level 3 shall be restricted by a special procedure, differing from that for access level 2.

f) The entry to access level 4 shall be restricted by special means that are not part of the s.s.c.i.e.

NOTE 2 Further access levels are permitted, provided that they are distinct from the access levels described in this part of ISO 7240.

14.7 Indications by means of light-emitting indicators

14.7.1 Mandatory indications from light-emitting indicators shall be visible in an ambient light intensity up to 500 lx, at any angle up to 22,5° from a line through the indicator perpendicular to its mounting surface

a) at 3 m distance for the general indications of functional condition,

b) at 3 m distance for the indication of the supply of power,

c) at 0,8 m distance for other indications.

14.7.2 If flashing indications are used, both the on-period and the off-period shall be greater than or equal to 0,25 s, and the frequencies of flash shall not be less than

a) 1 Hz for voice-alarm indications, or

b) 0,2 Hz for fault indications.

14.7.3 If the same light-emitting indicators are used for the indication of specific faults, disablements and tests, fault indications shall be flashing and disablement or test indications shall be steady.

14.8 Indications on alphanumeric displays

14.8.1 If an alphanumeric display consists of elements or segments, the failure of one of these shall not affect the interpretation of the displayed information.

14.8.2 Alphanumeric displays used for mandatory indications shall have at least one clearly distinguishable window, consisting of at least two clearly identifiable fields.

14.8.3 If not included in the displayed information, the purpose of each field shall be clearly labelled.

14.8.4 Where roman characters are used, a field shall be capable of containing at least the following:

a) at least 16 characters where the display of a functional condition uses a cross-reference to other information to identify the location;

b) at least 40 characters where the display is intended to include the complete information on the location of a functional condition.

14.8.5 Where other characters are used, a field shall be capable of containing at least the following:

a) at least 4 characters where the display of a functional condition uses a cross-reference to other information to identify the location;

b) at least 8 characters where the display is intended to include the complete information on the location of a functional condition.

14.8.6 Mandatory indications on an alphanumeric display shall be legible for the lesser of 1 h or the duration of the standby power source, following the display of a new indication of a functional condition, at 0,8 m distance in ambient light intensities from 5 lx to 500 lx and at any angle from the normal to the plane of the display up to

— 22,5° when viewed from each side;

— 15° when viewed from above and below.

Following the lesser of 1 h or the duration of the standby power source, the indications shall be legible at 100 lx to 500 lx at the above distance and angles. It shall be possible to re-establish the legibility at 5 lx to 100 lx by means of a manual operation at access level 1.

14.9 Colours of indications

14.9.1 The colours of the general and specific indications from light-emitting indicators shall be as follows:

a) red for indications of activated emergency loudspeaker zones;

b) yellow for indications of

   1) fault warnings,

   2) disablements, and

   3) emergency loudspeaker zones in the test state;

c) green for the indication that the s.s.c.i.e. is supplied with power.

14.9.2 The use of different colours is not necessary for indications on alphanumeric displays. However, if different colours are used for different indications, the colours used shall be as specified in 14.9.1.

14.10 Audible indications

14.10.1 Audible indicators shall be part of the s.s.c.i.e. The same device may be used for voice-alarm condition and fault-warning condition indications. If they are different, the voice-alarm indicator shall have priority.

14.10.2 The minimum sound level, measured under anechoic conditions, at a distance of 1 m with any access door on the s.s.c.i.e. closed, shall be either

— 60 dBA for voice-alarm indications and 50 dBA for fault-warning indications, or

— 85 dBA for voice-alarm indications and 70 dBA for fault-warning indications.

NOTE The allowance for two sets of audible indications contemplates some s.s.c.i.e. being installed in normally occupied areas (such as a security room). The selection of an appropriate sound level can be controlled by national requirements.

14.11 Testing of indicators

All mandatory visible and audible indicators shall be testable by a manual operation at access level 1 or 2.

14.12 Audio performance

14.12.1 Output power

The s.s.c.i.e. output power shall be declared by the manufacturer.

14.12.2 Signal-to-noise ratio

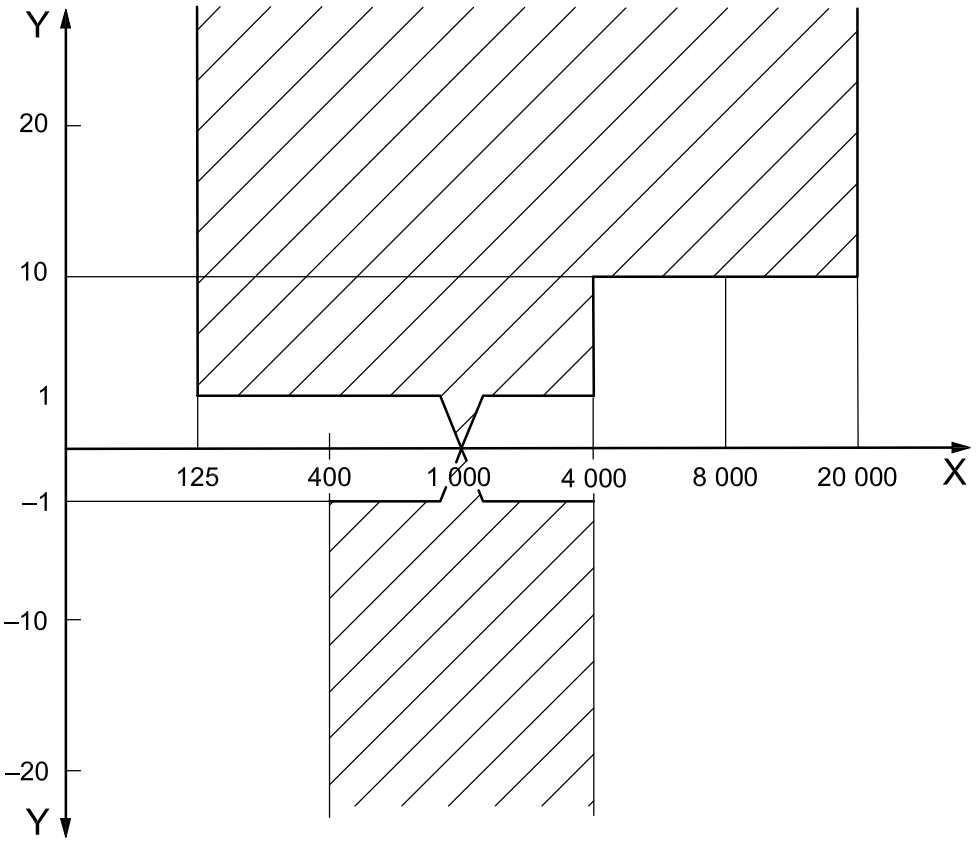
The s.s.c.i.e. shall have an A-weighted signal-to-noise ratio of at least 45 dB (see IEC 60268-1).

14.12.3 Frequency response of s.s.c.i.e.

The frequency response curve of the s.s.c.i.e. shall fit within the non-shaded area in Figure 1 for sound sources without microphone(s) (e.g. message store) and in Figure 2 for sound sources with microphone(s).

NOTE 1 A bandwidth of 400 Hz to 4 kHz is sufficient to achieve acceptable intelligibility in some acoustic environments. However, a wider frequency range can be necessary to achieve acceptable intelligibility in more difficult acoustic environments.

NOTE 2 The frequency response limits exclude loudspeakers.

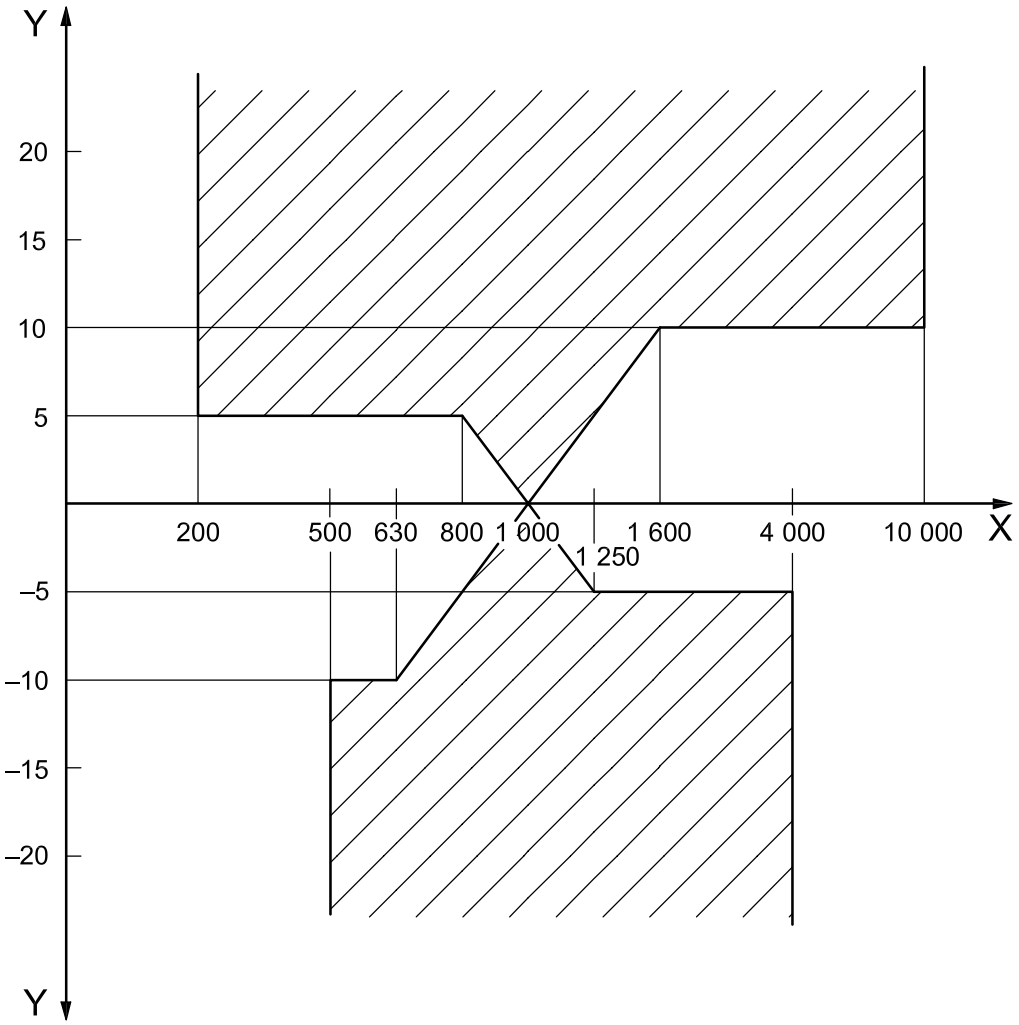


Key

X 1/3 octave frequency band, expressed in hertz

Y relative output signal level, with reference to 0 dB signal level measured at 1 kHz, expressed in decibels

Figure 1 — s.s.c.i.e. minimum frequency-response limits without microphone(s)



Key

X 1/3 octave frequency band, expressed in hertz

Y relative output signal level, with reference to 0 dB signal level measured at 1 kHz, expressed in decibels

Figure 2 — s.s.c.i.e. minimum frequency-response limits with microphone(s)

14.13 Message store

Pre-recorded messages shall be stored in a non-volatile memory that retains the messages when all power sources are removed.

14.14 Redundant power amplifiers – Optional function

14.14.1 The s.s.c.i.e. may have a provision for at least one spare power amplifier. In this case,

a) in the event of the failure of a power amplifier, the faulty amplifier shall be capable of being replaced automatically with a spare amplifier within 10 s of the fault being detected;

NOTE This can be achieved, for example, by switching or by permanently connected parallel amplifiers.

b) the spare power amplifier(s) shall have at least the same functionality and output characteristics as the replaced amplifier.

14.14.2 Every fault of an amplifier shall be indicated by the general fault-warning indicator, as specified in 8.2.1.

14.14.3 Supervision of the spare amplifier(s) shall be maintained during the functional condition whilst the s.s.c.i.e. is powered.

15 Additional design requirements for software-controlled s.s.c.i.e.

15.1 General requirements and manufacturer's declarations

The s.s.c.i.e. may contain elements that are controlled by software in order to fulfil the requirements of this part of ISO 7240. In this case, the s.s.c.i.e. shall comply with the requirements of Clauses 14 and 15, where relevant to the technology used.

15.2 Software documentation

15.2.1 The manufacturer shall prepare documentation which gives an overview of the software design, which shall be submitted to the testing authority together with the s.s.c.i.e. This documentation shall be of sufficient detail for the design to be inspected for compliance with this part of ISO 7240 and shall be comprised of at least the following:

a) functional description, using a clear methodology appropriate to the nature of the software, e.g. graphical representations of the system design, data flows and control flows and of the main program flow, including

   1) a brief description of each module and the tasks it performs,

   2) the way in which the modules interact,

   3) the way in which the modules are called, including any interrupt processing, and

   4) the overall hierarchy of the program;

b) a description of which areas of memory are used for the various purposes (e.g. the program, site-specific data and running data);

c) a description of how the software interacts with the hardware of the s.s.c.i.e.

Where dynamic memory management is employed, a separation shall be implemented between the program, site-specific data and running data, and this shall be described in connection with the method of memory allocation.

15.2.2 The manufacturer shall prepare and maintain detailed design documentation. It is not necessary that this be submitted to the testing authority, but it shall be available for inspection in a manner that respects the manufacturer's rights of confidentiality. This documentation shall be comprised of at least the following:

a) description of each module of the program as it is implemented in the source code of the program, containing

   1) the name of the module, and

   2) the identification of the author(s);

b) source code listing, including all global and local variables, constants and labels used, and sufficient comments for the program flow to be recognized;

c) details of any software tools used in the preparation of the program (e.g. high-level design tools, compilers, assemblers).

See Annex E for circumstances in which the requirements for documentation may be relaxed.

15.3 Software design

In order to ensure the reliability of the s.s.c.i.e., the following requirements for software design shall apply.

a) The software shall have a modular structure.

b) The design of the interfaces for manually and automatically generated data shall not permit invalid data to cause an error in the program execution.

c) The software shall be designed to avoid the occurrence of a deadlock in the program flow.

See Annex E for circumstances in which the requirements for design may be relaxed.

15.4 Program monitoring

NOTE See also Annex E.

15.4.1 The execution of the program shall be monitored as in 15.4.2 or 15.4.3. If routines associated with the main functions of the program are no longer executed, either or both of the following shall apply.

a) The s.s.c.i.e. shall indicate a system fault (as in 8.3).

b) The s.s.c.i.e. shall enter the fault-warning condition and indicate faults of affected supervised functions (as in 8.2.4, 8.2.5, 8.2.6.1 and 8.3), where only these functions are affected.

15.4.2 If the program executes in one processor, the execution of the routines in 15.4.1 shall be monitored by a monitoring device as in 15.4.4.

15.4.3 If the program executes in more than one processor, the execution of the routines in 15.4.1 shall be monitored in each processor. A monitoring device as in 15.4.4 shall be associated with one or more processors, and at least one such processor shall monitor the functioning of any processor not associated with such a monitoring device.

15.4.4 The monitoring devices of 15.4.2 and 15.4.3 shall have a time-base independent of that of the monitored system. The functioning of the monitoring device and the signalling of a fault warning shall not be prevented by a failure in the execution of the program of the monitored system.

15.4.5 In the event of a system fault as specified in 15.4.1 a) or 15.6, those parts of the s.s.c.i.e. affected shall enter a safe state not later than the indication of the system fault. This safe state shall not result in the false activation of mandatory outputs.

15.5 Storage of programs and data

NOTE See also Annex E.

15.5.1 All executable codes and data necessary to comply with this part of ISO 7240 shall be held in a memory which is capable of continuous, unmaintained, reliable operation for a period of at least 10 years.

15.5.2 For the program, the following requirements shall apply.

a) The program shall be held in a non-volatile memory that can be written to only at access level 4.

b) It shall be possible to identify the version reference or references of the program at access level 3. The version reference or references shall be in accordance with the documentation of 14.2.1.

15.5.3 For site-specific data, including emergency message(s), the following requirements shall apply.

a) The alteration of site-specific data shall be possible only at access level 3 or 4.

b) The alteration of site-specific data shall not affect the structure of the program.

c) If stored in read-write memory, there shall be a mechanism that prevents the memory being written to during normal operation at access level 1 or 2, such that its contents are protected during a failure in program execution.

d) It shall be possible to either read or interrogate the site-specific data at access level 2 or 3, or the site-specific data shall be given a version reference that shall be updated when each set of alterations is carried out.

e) If the site-specific data have a version reference, it shall be possible to identify this at access level 2 or 3.

15.6 Monitoring of memory contents

The contents of the memories containing site-specific data shall be automatically checked at intervals not exceeding 1 h. The checking device shall signal a system fault if a corruption of the memory contents is detected.

16 Marking

The s.s.c.i.e. shall be marked with the following information, which shall be legible at access level 1:

a) the number of this part of ISO 7240 (i.e. ISO 7240-16:2007);

b) the name or trademark of the manufacturer or supplier;

c) the type number or other designation of the s.s.c.i.e.

It shall be possible to identify a code or number which identifies the production period of the s.s.c.i.e. at access levels 1, 2 or 3.

17 Tests

17.1 General

17.1.1 Combined s.s.c.i.e. and c.i.e.

Where the s.s.c.i.e. is integrated with fire detection c.i.e., the testing programme may be combined with the testing programme of ISO 7240-2.

17.1.2 Atmospheric conditions for tests

Unless otherwise stated in a test procedure, the testing shall be carried out after the test specimen has been allowed to stabilise in the standard atmospheric conditions for testing as described in IEC 60068-1, as follows:

— temperature: (15 to 35) °C;

— relative humidity: (25 to 75) %;

— air pressure: (86 to 106) kPa.

If variations in these parameters have a significant effect on a measurement, then such variations should be kept to a minimum during a series of measurements carried out as part of one test on one specimen.

17.1.3 Operating conditions for tests

If a test method requires a specimen to be operational, then the specimen shall be connected to power-supply equipment complying with ISO 7240-4. Unless otherwise specified in the test method, the supply parameters applied to the specimen shall be set within the manufacturer's specified range(s) and shall remain substantially constant throughout the tests. The value chosen for each parameter shall normally be the nominal value or the mean of the specified range. If a test procedure requires a specimen to be monitored to detect any voice-alarm or fault signals, then connections shall be made to any necessary ancillary devices to allow the signal to be recognized.

Equipment other than the s.s.c.i.e. may be kept in standard atmospheric conditions during the tests.

The details of the power-supply equipment and the alarm criteria used should be given in the test report (Clause 18).

17.1.4 Specimen configuration

The specimen configuration shall include at least one of each type of voice-alarm function. When the s.s.c.i.e. is constructed from configurable functions or when these functions can be distributed in several cabinets, the exact test configuration shall be agreed between the test house and the manufacturer.

17.1.5 Mounting arrangements

The specimen shall be mounted by its normal means of attachment in accordance with the manufacturer's instructions. If these instructions describe more than one method of mounting, then the method considered to be the least favourable shall be chosen for each test.

17.1.6 Tolerances

Unless otherwise stated, the tolerances for the environmental test parameters shall be as given in the basic reference standards for the test (e.g. the relevant part of IEC 60068).

If a specific tolerance or deviation limit is not specified in a requirement or test procedure, then a deviation limit of $\pm$ 5 % shall be applied.

17.1.7 Provisions for tests

At least one s.s.c.i.e. shall be provided for testing compliance with this part of ISO 7240.

The specimen(s) submitted shall be representative of the manufacturer's normal production with regard to their construction and settings and shall include the claimed options.

17.2 Functional test

17.2.1 The object of the test

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

17.2.2 Test schedule

17.2.2.1 General

A test schedule shall be prepared that ensures that during the functional test, each type of input function and each type of output function is exercised. This shall include tests of the voice-alarm condition initiated from an emergency-detection system, the fault-warning condition and the disabled condition.

17.2.2.2 Voice-alarm condition

Initiate, silence and reset a voice alarm to at least two emergency loudspeaker zones (unless only one zone is provided).

Check that the correct indications and outputs are given and that the functions are executed, as specified in Clause 7.

17.2.2.3 Fault-warning condition

Initiate and reset fault warnings corresponding at least to the following:

a) loss of one of the power sources;

b) earth fault affecting a mandatory function;

c) rupture of a fuse in the s.s.c.i.e. affecting a mandatory function;

d) short-circuit of a transmission path between parts of the s.s.c.i.e. contained in more than one cabinet and affecting a mandatory function, if applicable;

e) interruption in a transmission path between parts of the s.s.c.i.e. contained in more than one cabinet and affecting a mandatory function, if applicable;

f) short-circuit in a transmission path to an emergency microphone capsule, if provided;

g) interruption in a transmission path to an emergency microphone capsule, if provided;

h) short-circuit in a transmission path to a loudspeaker circuit;

i) interruption in a transmission path to a loudspeaker circuit;

j) short-circuit in a transmission path to an alarm device circuit, if provided;

k) interruption in a transmission path to an alarm device circuit, if provided;

l) failure of a power amplifier;

m) short-circuit in a transmission path to the emergency detection system, if provided;

n) interruption in a transmission path to the emergency detection system, if provided.

Because of the diversity of possible amplifier designs, it is not possible to define a common test method when initiating the fault in 17.2.2.3 l). The manufacturer shall explain the monitoring method used and provide means for the test house to verify this function.

Check that the correct indications and outputs, as specified in Clause 8, are given.

If the option of indicating faults related to emergency loudspeaker zones is provided, check that the faults in 17.2.2.3 h) and 17.2.2.3 i) give the indication specified in 8.2.6.2.

17.2.2.4 Disabled condition

Where a disablement function is provided, disable and restore at least two emergency loudspeaker zones (unless only one zone is provided).

Check that the operation of the disablement controls result in the correct indication on the s.s.c.i.e., that only the relevant parts of the system are disabled and that, on restoration of the disablements, the function is restored.

17.2.2.5 Manual mode control

When the manual mode control is provided,

a) check the general requirement specified in 11.1;

b) activate the voice-alarm condition and check the indication of the emergency-loudspeaker-zone requirements, as specified in 11.2;

c) deactivate the voice-alarm condition, generate a fault-warning condition and check the indication of the emergency-loudspeaker-zone requirements, as specified in 11.3;

d) reset the fault-warning condition, generate a disablement condition and check the indication of the emergency-loudspeaker-zone requirements, as specified in 11.4.

17.2.2.6 Interface to external control device(s)

When an interface to external control device(s) is provided,

a) check the access level requirements, as specified in Clause 12 a);

b) check that the external control devices do not override the mandatory functions of the s.s.c.i.e., as specified in Clause 12 b);

c) check that the fault-warning condition requirements specified in Clause 12 c) are met.

17.2.2.7 Emergency microphone(s)

When (an) emergency microphone(s) is/are provided

a) check the priority levels, as specified in 13.1 a),

b) check the operation of the emergency microphone control, as specified in 13.1 b),

c) when the emergency microphone control is operated, check that any audible indications are automatically muted, as specified in 13.1 c),

d) when the emergency microphone control is operated, check that an existing functional condition is not reset and that the functional condition resumes when the microphone is no longer in use, as specified in 13.1 d),

e) when the emergency microphone control is operated, check that signals are broadcast to a pre-configured set of emergency loudspeaker zones, as specified in 13.1 e), unless 13.2 applies,

f) when the option of microphone priority is provided, check the requirements, as specified in 13.2.

17.2.2.8 Redundant power amplifiers

When redundant power amplifiers are provided, check the requirements, as specified in 14.14.

17.2.2.9 Test condition

Where a test function is fitted, test and restore at least two emergency loudspeaker zones (unless only one zone is provided).

Check that the operation of the test controls result in the correct indication on the s.s.c.i.e., that only the relevant parts of the system are tested and that, on restoration of the test, the function is restored.

17.3 Test schedule

17.3.1 General

One, two or three specimens may be supplied for testing. The tests to be applied are shown in Table 1.

Table 1 — Test schedule

Test	Operational or endurance	Clause number
Output power	Operational	17.4
Signal-to-noise ratio	Operational	17.5
Frequency response of s.s.c.i.e. without microphone(s)	Operational	17.6
Frequency response of s.s.c.i.e. with microphone(s) (if applicable)	Operational	17.7
Cold (operational)	Operational	17.8
Damp heat, steady state (operational)	Operational	17.9
Damp heat, steady state (endurance)	Endurance	17.10
Impact (operational)	Operational	17.11
Vibration, sinusoidal (operational)	Operational	17.12
Vibration, sinusoidal (endurance)	Endurance	17.13
Supply voltage variation (operational)	Operational	17.14
Electromagnetic compatibility (EMC) immunity test (operational)	Operational	17.15 [a]
[a] Visible and audible indications of a transitory nature are permitted during the application of conditioning.		

17.3.2 Tests for one specimen

If a single specimen is supplied for environmental testing, the specimen shall be subjected to all the operational tests, which may be carried out in any order. After the operational tests, the endurance tests shall be carried out on the same specimen in any order. Before and after each environmental test, a functional test shall be carried out.

The functional test after one environmental test may be taken as the functional test before the next environmental test.

17.3.3 Tests for two specimens

If two specimens are supplied for environmental testing, then the first test specimen shall be subjected to all the operational tests, which may be carried out in any order, followed by one of the endurance tests. The second specimen shall be subjected to the other endurance test. Before and after each environmental test, a functional test shall be carried out.

For the first specimen, the functional test after one environmental test may be taken as the functional test before the next environmental test.

17.3.4 Tests for three specimens

If three specimens are supplied for environmental testing, then one test specimen is subjected to all the operational tests, which may be carried out in any order. The second specimen shall be subjected to one of the endurance tests, and the third specimen shall be subjected to the other endurance test. Before and after each environmental test, a functional test shall be carried out.

For the first specimen, the functional test after one environmental test may be taken as the functional test before the next environmental test.

17.3.5 Environmental test requirements

During the tests of 17.8 to 17.15, the specimen shall not change status in any of the functional conditions, as specified in the corresponding subclauses, except when such a change is required by the test procedure or when the change is a result of a functional test.

Any mechanical damage to the specimen observed following the tests of 17.8, 17.9, 17.10, 17.11, 17.12 and 17.13 shall not jeopardize any mandatory function of this part of ISO 7240.

When subjected to the functional test, each specimen shall respond correctly (see 17.2).

17.4 Output power

17.4.1 Object

The object is to check that the s.s.c.i.e. output power is not less than the rating declared by the manufacturer.

17.4.2 Test procedure

17.4.2.1 General

Include the following components in the measurement:

a) minimum resistive load and maximum capacitive load, as specified by the manufacturer;

b) 1 kHz sinusoidal audio signal generator with a total harmonic distortion (THD) not exceeding 1 %;

c) an input load, as specified by the s.s.c.i.e. manufacturer, simulating the microphone impedance (if fitted and necessary for correct operation of the s.s.c.i.e.);

d) equipment required to measure the r.m.s. output voltage level;

e) equipment required to measure the THD;

f) any other equipment used during the operation of the s.s.c.i.e.

17.4.2.2 State of the specimen during conditioning

Mount the specimen as specified in 17.1.5 and connect it to suitable power-supply, monitoring and loading equipment, as specified in 17.1.3.

The specimen shall be in the quiescent condition.

17.4.2.3 Conditioning

Apply the following severity of conditioning:

— temperature: 40 °C ± 2 °C.

Precondition the specimen at the conditioning temperature (40 °C ± 2 °C) until temperature stability has been reached to prevent the formation of water droplets on the specimen.

Terminate the s.s.c.i.e. output(s) with the minimum resistive and maximum capacitive load representing the loudspeaker lines and loudspeakers.

Adjust the power-supply equipment output to the nominal primary power source level.

Apply the 1 kHz sinusoidal signal to the input of the specimen and adjust the gain of the system until the rated r.m.s. output power is achieved.

Maintain this gain for 1 min.

17.4.2.4 Measurements during conditioning

Measure

a) the THD of the s.s.c.i.e. output signal(s) during the conditioning, and

b) the r.m.s. voltage of the sinusoidal signal at the beginning and end of the conditioning (see 17.4.2.3).

17.4.2.5 Final measurements

After 1 h recovery time at standard atmospheric conditions, measure the frequency response of the specimen in accordance with 17.6 or 17.7, as applicable.

17.4.2.6 Test requirements

During the conditioning (17.4.2.3), the output power, P, expressed in watts (W), as calculated in Equation (1), shall be not less than the power declared by the manufacturer.

$$P = \frac{V^2}{R} \tag{1}$$

where

V is the r.m.s. voltage of the sinusoidal signal, expressed in volts (V);

R is the minimum resistive load, expressed in ohms (Ω).

The THD measured during conditioning shall not exceed 10 %.

The frequency response measured after conditioning shall fall within the limits shown in Figure 1 or 2, as applicable.

17.5 Signal-to-noise ratio

17.5.1 Object

The object is to determine that the A-weighted signal-to-noise ratio of the s.s.c.i.e. output is within the required limits.

17.5.2 Test procedure

17.5.2.1 General

Include the following components in the measurement:

a) the minimum resistive and maximum capacitive load, as specified by the manufacturer, representing the loudspeaker lines and loudspeakers connected to the specimen, to at least two emergency loudspeaker zones (unless only one zone is provided);

b) 1 kHz sinusoidal signal generator;

c) equipment required to measure the r.m.s. output voltage level, with and without A-weighting (see IEC 60268-1);

d) any other equipment used during the operation of the s.s.c.i.e.

17.5.2.2 State of specimen during conditioning

Mount the specimen as specified in 17.1.5 and connect it to suitable power-supply, monitoring and loading equipment, as specified in 17.1.3.

The specimen shall be in the quiescent condition.

17.5.2.3 Conditioning

Adjust the output of the power-supply equipment to the minimum voltage specified by the manufacturer.

Apply the following signals to the specimen:

a) 1 kHz sinusoidal signal, such that the rated output power is measured at the output of the specimen [as measured in 17.4.2.1 b)], immediately followed by

b) no signal, with the inputs terminated with a load equivalent to the equipment design requirement.

17.5.2.4 Measurements during conditioning

Measure the A-weighted r.m.s. voltage of the output noise level.

17.5.3 Test requirements

The signal-to-noise ratio, S/N, where both S and N are expressed in decibels (dB), as calculated by Equation (2), shall be not less than 45 dB.

$$S/N = 20\log_{10}\frac{V_S}{V_N} \tag{2}$$

where

V_N is the r.m.s. output noise level, expressed in in volts (V);

V_S is the r.m.s. output signal, expressed in in volts (V).

17.6 Frequency response of s.s.c.i.e. without microphone(s)

17.6.1 Object

The object is to demonstrate that the frequency response of the s.s.c.i.e. with sound sources other than microphone(s) is within the required limits.

17.6.2 Test procedure

17.6.2.1 General

Include the following components in the measurement:

a) the s.s.c.i.e;

b) the minimum resistive and maximum capacitive load, as specified by the manufacturer, representing the loudspeaker lines and loudspeakers connected to the s.s.c.i.e., to at least two emergency loudspeaker zones (unless only one zone is provided);

c) a sinusoidal signal generator;

d) equipment required to perform the frequency response measurement (see IEC 60268-4:2004, 11.1);

e) any other equipment used during the operation of the s.s.c.i.e.

17.6.2.2 State of the specimen during conditioning

Mount the specimen as specified in 17.1.5 and connect it to suitable power-supply, monitoring and loading equipment, as specified in 17.1.3.

Adjust the manual controls, such as bass, treble and other equalizers that influence the frequency response, as recommended by the manufacturer.

Adjust the manual controls, such as bass, treble or other equalizers that influence the frequency response, to their flat response settings.

The specimen shall be in the quiescent condition.

17.6.2.3 Conditioning

In order to determine a reference input level for the frequency response measurement, generate a 1 kHz sinusoidal signal such that a level 10 dB below the measured output level, as measured in 17.4.2.6, is achieved.

Apply a sinusoidal signal at this reference input level from 125 Hz to 20 kHz in steps of 1/3 octave to the input of the s.s.c.i.e.

17.6.2.4 Measurements during conditioning

Measure the r.m.s. output value of the s.s.c.i.e. for each specified frequency. Record these levels as $L_{\mathrm{m}}(F_{\mathrm{m}})$.

17.6.3 Test requirements

The frequency response curve of $L_{\mathrm{m}}(F_{\mathrm{m}})$ shall fall within the limits shown in Figure 1.

17.7 Frequency response of s.s.c.i.e. with microphone(s)

17.7.1 Object

The object is to demonstrate that the frequency response of the s.s.c.i.e. with (a) microphone(s) is within the required limits.

17.7.2 Test procedure

17.7.2.1 General

Include the following components in the measurement:

a) the s.s.c.i.e., including a microphone, as specified by the manufacturer;

b) the minimum resistive and maximum capacitive load, as specified by the manufacturer, representing the loudspeaker lines connecting the s.s.c.i.e. to loudspeakers in at least two emergency loudspeaker zones (unless only one zone is provided);

c) a sinusoidal signal generator;

d) equipment required to perform the frequency-response measurement (see IEC 60268-4:2004,11.1).

If the microphone is physically incompatible with the equipment specified in IEC 60268-4, it is acceptable to use an alternative equivalent method.

17.7.2.2 State of the specimen during conditioning

Mount the specimen as specified in 17.1.5 and connect it to suitable power-supply, monitoring and loading equipment, as specified in 17.1.3.

Adjust manual controls, such as bass, treble and other equalizers, that influence frequency response as recommended by the manufacturer.

The specimen shall be in the quiescent condition.

17.7.2.3 Conditioning

In order to determine an acoustical reference input level for the frequency-response measurement, calibrate the system with a 1 kHz sinusoidal acoustical signal with a sound-pressure level of up to 104 dB. Apply this sound-pressure level at the entrance of the s.s.c.i.e. microphone at an incidence of 0°. Adjust the gain of the system until an output level 10 dB below the output level measured in 17.4.2.6 is achieved.

NOTE When testing systems using a close-talking microphone, a sound pressure level of 104 dB is normally used. With all other types of microphone a sound pressure level of 94 dB is normally used.

Apply acoustical sinusoidal signals in the frequency range 200 Hz to 10,0 kHz in steps of 1/3 octaves to the s.s.c.i.e. microphone for a duration long enough to measure the r.m.s. signal level at the output of the s.s.c.i.e. For each frequency, correct the measurement system such that the sound pressure level at the s.s.c.i.e. microphone does not deviate by more than $^{+2}_{-3}$ dB from the calibrated 1 kHz signal at the entrance of the microphone.

17.7.2.4 Measurements during conditioning

Measure the signal level at the output of the s.s.c.i.e. at the 1/3 octave centre frequency for each of the sinusoidal signals applied to the s.s.c.i.e. microphone. Measure these levels as the average true r.m.s. values over a period of at least 1 s as soon as a stable level can be measured.

NOTE This stabilizing process can take several seconds.

17.7.3 Test requirements

The frequency response shall fall within the limits shown in Figure 2.

17.8 Cold (operational)

17.8.1 Object

The object of the test is to demonstrate the ability of the equipment to function correctly at low ambient temperatures appropriate to the anticipated service environment.

17.8.2 Test procedure

17.8.2.1 General

Use the test procedures with gradual changes in temperature described in IEC 60068-2-1. Use Test Ad for heat-dissipating specimens (as defined in IEC 60068-2-1) and use Test Ab for non-heat-dissipating specimens.

17.8.2.2 Initial examination

Before conditioning, subject the specimen to the functional test specified in 17.2.

17.8.2.3 State of the specimen during conditioning

Mount the specimen as specified in 17.1.5 and connect it to suitable power-supply, monitoring and loading equipment, as specified in 17.1.3.

The specimen shall be in the quiescent condition.

17.8.2.4 Conditioning

Apply the following severity of conditioning:

— temperature: (-5 ± 3) °C;

— duration: 16 h.

17.8.2.5 Measurements during conditioning

Monitor the specimen during the conditioning period to detect any change in status. During the last hour of the conditioning period, subject the specimen to the functional test specified in 17.2.

17.8.2.6 Final measurements

After the recovery period, subject the specimen to the functional test specified in 17.2 and inspect it visually for mechanical damage both externally and internally.

17.9 Damp heat, steady state (operational)

17.9.1 Object

The object is to demonstrate the ability of the equipment to function correctly at high relative humidity (without condensation) which can occur for short periods in the service environment.

17.9.2 Test procedure

17.9.2.1 General

Use the test procedure described in IEC 60068-2-78.

17.9.2.2 Initial examination

Before conditioning, subject the specimen to the functional test specified in 17.2.

17.9.2.3 State of the specimen during conditioning

Mount the specimen as specified in 17.1.5 and connect it to suitable power-supply, monitoring and loading equipment, as specified in 17.1.3.

The specimen shall be in the quiescent condition.

17.9.2.4 Conditioning

Apply the following severity of conditioning:

— temperature: 40 °C ± 2 °C;

— relative humidity: 93 % $^{+2}_{-3}$ %;

— duration: 4 days.

Precondition the specimen at the conditioning temperature (40 °C ± 2 °C) until temperature stability has been reached to prevent the formation of water droplets on the specimen.

17.9.2.5 Measurements during conditioning

Monitor the specimen during the conditioning period to detect any change in status. During the last hour of the conditioning period, subject the specimen to the functional test specified in 17.2.

17.9.2.6 Final measurements

After the recovery period, subject the specimen to the functional test specified in 17.2 and inspect it visually for mechanical damage both externally and internally.

17.10 Damp heat, steady state (endurance)

17.10.1 Object

The object is to demonstrate the ability of the equipment to withstand the long-term effects of humidity in the service environment (e.g. changes in electrical properties due to absorption, chemical reactions involving moisture, galvanic corrosion, etc.).

17.10.2 Test procedure

17.10.2.1 General

Use the test procedure described in IEC 60068-2-78.

17.10.2.2 Initial examination

Before conditioning, subject the specimen to the functional test specified in 17.2.

17.10.2.3 State of the specimen during conditioning

Mount the specimen in accordance with 17.1.5 and connect the specimen to suitable power-supply equipment, as specified in 17.1.3.

Do not supply the specimen with power during the conditioning.

17.10.2.4 Conditioning

Apply the following severity of conditioning:

— temperature: 40 °C ± 2 °C;

— relative humidity: 93 % $^{+2}_{-3}$ %;

— duration: 21 days.

Precondition the specimen at the conditioning temperature (40 °C ± 2 °C) until temperature stability has been reached, to prevent the formation of water droplets on the specimen.

17.10.2.5 Final measurements

After the recovery period, subject the specimen to the functional test specified in 17.2 and inspect it visually for mechanical damage both externally and internally.

17.10.3 Test requirements

No alarm or fault signals shall be given during the conditioning period.

17.11 Impact (operational)

17.11.1 Object

The object is to demonstrate the immunity of the equipment to mechanical impacts upon the surface that it can sustain in the normal service environment and that it can reasonably be expected to withstand.

17.11.2 Test procedure

17.11.2.1 General

Apply the test apparatus and procedure described in IEC 60068-2-75.

17.11.2.2 Initial examination

Before conditioning, subject the specimen to the functional test specified in 17.2.

17.11.2.3 State of the specimen during conditioning

Mount the specimen as specified in 17.1.5 and connect it to suitable power-supply, monitoring and loading equipment, as specified in 17.1.3.

The specimen shall be in the quiescent condition.

17.11.2.4 Conditioning

Apply impacts to all surfaces of the specimen that are accessible at access level 1.

For all such surfaces, three blows shall be applied to any point(s) considered likely to cause damage to or impair the operation of the specimen.

Care should be taken to ensure that the results from a series of three blows do not influence subsequent series. In case of doubt, the defect shall be disregarded and a further three blows shall be applied to the same position on a new specimen.

Apply the following severity of conditioning:

— impact energy: (0,5 ± 0,04) J;

— number of impacts per point: 3.

17.11.2.5 Measurements during conditioning

Monitor the specimen during the conditioning periods to detect any changes in functional condition and to ensure that the results of three blows do not influence subsequent series.

17.11.2.6 Final measurements

After the conditioning, subject the specimen to the functional test, as specified in 17.2 and inspect it visually for mechanical damage both externally and internally.

17.11.3 Test requirements

No alarm or fault signals shall be given during the conditioning period or the additional 2 min.

The impact shall not detach any components or subassemblies from their mounting.

17.12 Vibration, sinusoidal (operational)

17.12.1 Object

The object is to demonstrate the immunity of the equipment to vibrations at levels appropriate to the service environment.

17.12.2 Test procedure

17.12.2.1 General

Use the test procedure described in IEC 60068-2-6.

The vibration operational test may be combined with the vibration endurance test, so that the specimen is subjected to the operational test conditioning followed by the endurance test conditioning in each axis.

17.12.2.2 Initial examination

Before conditioning, subject the specimen to the functional test specified in 17.2.

17.12.2.3 State of the specimen during conditioning

Mount the specimen as specified in 17.1.5 and in accordance with IEC 60068-2-47 and connect it to suitable power-supply, monitoring and loading equipment, as specified in 17.1.3.

The specimen shall be tested in the quiescent condition.

17.12.2.4 Conditioning

Subject the specimen to vibration in each of the three mutually perpendicular axes in turn, one of which is perpendicular to the plane of mounting of the specimen.

Apply the following severity of conditioning:

a) frequency range: 10 Hz to 150 Hz;

b) acceleration amplitude: 0,981 m/s^2 (0,1 g_n);

c) number of axes: 3;

d) number of sweep cycles per axis: 1 for each functional condition.

17.12.2.5 Measurements during conditioning

Monitor the specimen during the conditioning periods to detect any changes in functional conditions.

17.12.2.6 Final measurements

After the conditioning, subject the specimen to the functional test specified in 17.2 and inspect it visually for mechanical damage both externally and internally.

17.12.3 Test requirements

No alarm or fault signals shall be given during the conditioning period or the additional 2 min.

The vibration shall not detach any components or subassemblies from their mounting.

17.13 Vibration, sinusoidal (endurance)

17.13.1 Object

The object is to demonstrate the ability of the equipment to withstand the long-term effects of vibration at levels appropriate to the environment.

17.13.2 Test procedure

17.13.2.1 General

Use the test procedure described in IEC 60068-2-6.

The vibration endurance test may be combined with the vibration operational test, so that the specimen is subjected to the operational test conditioning followed by the endurance test conditioning in each axis in turn.

17.13.2.2 Initial examination

Before conditioning, subject the specimen to the functional test specified in 17.2.

17.13.2.3 State of the specimen during conditioning

Mount the specimen in accordance with 17.1.5 and connect the specimen to suitable power-supply equipment, as specified in 17.1.3.

The specimen shall not be supplied with power during the conditioning.

17.13.2.4 Conditioning

Subject the specimen to vibration in each of the three mutually perpendicular axes in turn, one of which shall be perpendicular to the plane of mounting of the specimen.

Apply the following severity of conditioning:

a) frequency range: 10 Hz to 150 Hz;

b) acceleration amplitude: 4,905 m/s^2 (0,5 g_n);

c) number of axes: 3;

d) number of sweep cycles: 20 per axis.

17.13.2.5 Final measurements

After conditioning, subject the specimen to the functional test specified in 17.2 and inspect it visually for mechanical damage both externally and internally.

17.13.3 Test requirements

No alarm or fault signals shall be given during the conditioning period or the additional 2 min.

The vibration shall not detach any components or subassemblies from their mounting.

17.14 Supply voltage variation (operational)

17.14.1 Object

The object is to demonstrate the ability to function correctly over the anticipated range of supply voltage conditions.

17.14.2 Test procedure

17.14.2.1 General

Subject the specimen to each of the specified power-supply conditions until temperature stability is reached and the functional test specified in 17.2 has been conducted.

NOTE No reference can be made to another accepted International Standard at the date of publication of this part of ISO 7240.

17.14.2.2 Initial examination

Before conditioning, subject the specimen to the functional test specified in 17.2.

17.14.2.3 State of the specimen during conditioning

Mount the specimen in accordance with 17.1.5 and connect the specimen to suitable power-supply equipment, as specified in 17.1.3

The specimen shall be in the quiescent condition.

17.14.2.4 Conditioning

Apply the following conditions:

a) maximum input voltage as specified by the manufacturer or, for an s.s.c.i.e. with integrated power-supply equipment, the conditions specified in Table 1 of ISO 7240-4:2003;

b) minimum input voltage as specified by the manufacturer or, for an s.s.c.i.e. with integrated power-supply equipment, the conditions specified in Table 1 of ISO 7240-4:2003.

NOTE Compatibility between the s.s.c.i.e. and any specific type of power-supply equipment requirs that the range of input voltages specified for the s.s.c.i.e. include the range of output voltages recorded for the power-supply equipment in the tests of ISO 7240-4.

17.14.2.5 Measurements during conditioning

Monitor the specimen at the supply voltage conditions until temperature stability is reached and subject the specimen to the functional test specified in 17.2 at each voltage condition.

17.14.2.6 Final measurements

After the conditioning, subject the specimen to the functional test specified in 17.2.

17.14.3 Test requirements

No alarm or fault signals shall be given during the conditioning period.

The equipment shall satisfy the requirements of 17.2.

17.15 Electromagnetic compatibility (EMC), immunity tests (operational)

17.15.1 Object

The object is to demonstrate the capability of the equipment to comply with the EMC immunity requirements in its normal service environment.

17.15.2 Test procedure

17.15.2.1 General

The test apparatus and the test procedures shall be as described in EN 50130-4.

17.15.2.2 State of the specimen during conditioning

Mount the specimen in accordance with 17.1.5 and connect the specimen to suitable power-supply equipment, as specified in 17.1.3.

17.15.2.3 Conditioning

Apply the conditions specified in EN 50130-4 for the following tests:

a) mains-supply voltage variations; these tests are included because they should be applied to power-supply equipment housed in the s.s.c.i.e. (see 10.4.1 of ISO 7240-4:2003) or if the s.s.c.i.e. includes other mains inputs for which these tests are applicable;

b) mains-supply voltage dips and interruptions;

c) electrostatic discharge;

d) radiated electromagnetic fields;

e) conducted disturbances induced by electromagnetic fields;

f) fast transient burst;

g) slow high-energy voltage surges.

17.15.2.4 Measurement during conditioning

Monitor the specimen during the conditioning period to detect any alarm or fault signals.

17.15.2.5 Final measurements

For the tests of 17.2.2.3, the criteria for compliance specified in EN 50130-4 and the following shall apply.

a) The functional test called for in the initial and final measurements shall be the functional test described in 17.2.

b) The required operating condition shall be as described in 17.1.3 and the equipment shall be tested in the quiescent condition.

c) The connections to the various inputs and outputs shall be made with unscreened cables, unless the manufacturer's installation data specifies that only screened cables shall be used.

d) In the electrostatic discharge test, the discharges shall be applied to parts of the equipment accessible at access level 2.

e) In the fast transient-burst test, the transients shall be applied to the a.c. mains lines by the direct injection method and to the other inputs, signal, data and control lines by the capacitive clamp method.

f) If the equipment has a number of identical types of inputs or outputs, then the tests of 17.15.2.3 e), f), and g), and if applicable a) and b), shall be applied to one of each type.

17.15.3 Test requirements

No alarm or fault signals shall be given during the conditioning period.

18 Test report

The test report shall contain, as a minimum, the following information:

a) identification of the test specimen;

b) reference to this part of ISO 7240 (i.e. 7240-16:2007);

c) environmental classification of the s.s.c.i.e.;

d) results of assessment of the requirements of this part of ISO 7240;

e) results of the tests and any other data as specified in the individual tests;

f) conditioning period and the conditioning atmosphere;

g) temperature and relative humidity in the test room throughout the test;

h) details of the supply and monitoring equipment and the response criteria;

i) details of any deviation from this part of ISO 7240 or from the International Standards to which reference is made, and details of any operations regarded as optional.

Annex A
(informative)

Use of optional functions

A.1 General

An s.s.c.i.e. that is connected to an emergency-detection system provides the warning function for that system. This part of ISO 7240 specifies mandatory functions and optional functions. It is necessary that an s.s.c.i.e. complying with this part of ISO 7240 fulfil the requirements of all of the mandatory functions. Configurations of sound systems for emergency purposes vary widely to suit different applications. The most important criteria for defining the system configuration are the applicable design aspects contained in ISO 7240-19, including requirements for audibility and intelligibility, or other national regulations. For different applications, this part of ISO 7240 provides a number of optional functions that can be selected by s.s.e.p. designers to achieve the required level of functionality. Manufacturers should be aware of the design requirements to ensure that the s.s.c.i.e. includes sufficient functions to satisfy the likely design requirements.

A.2 Example of a simple sound system for emergency purposes

A simple s.s.e.p. may include a recorded message that is activated on instruction from the emergency detection system. In such a system, there might not be any emergency microphones or manual controls and the s.s.e.p. would broadcast only one message at a time. In this case, only a single audio channel is required.

A.3 Example of a more complex sound system for emergency purposes

A more complex s.s.e.p. may include the following:

a) several recorded emergency messages;

b) emergency microphones;

c) controls for selecting emergency-loudspeaker zones;

d) indicators for s.s.e.p. zone status (activated, fault, disabled);

e) several emergency-loudspeaker zones.

This s.s.e.p., which can broadcast different messages in separate emergency loudspeaker zones and the emergency microphone, is also able to access selected zones, so several audio channels are required.

A complex s.s.e.p. may have manual controls for activating messages in multiple emergency-loudspeaker zones.

A.4 Optional functions

Optional functions and their relevant subclause numbers are listed in Table A.1.

Table A.1 — Optional functions

Option	See clause or subclause
Alert signal	7.2
Audible warning	7.5
Delay before entering the voice-alarm condition	7.6
Phased evacuation	7.7
Silencing of the voice-alarm condition with a manual control	7.8.2
Reset of the voice-alarm condition with a manual control	7.9.2
Output to alarm devices	7.10
Voice-alarm condition output signal	7.11
Faults related to the transmission path to the emergency detection system	8.2.6.1
Faults related to emergency-loudspeaker zones	8.2.6.2
Disabled condition	9
Disablement-condition output	9.4
Test condition	10
Manual mode control	11
Indication of emergency-loudspeaker zones in the fault-warning condition	11.3
Indication of emergency-loudspeaker zones in the disabled condition	11.4
Interface to external control device(s)	12
Emergency microphone	13
Microphone priority	13.2
Microphone emergency-loudspeaker-zone control	13.3
Redundant power amplifiers	14.14

In addition, alternatives are offered in this part of ISO 7240. Examples of these are

— automatic or manual reset of the fault-warning condition,

— indications by means of separate light-emitting indicators, or on an alphanumeric display, and

— access level 1 or 2 for certain functions.

The choice of an alternative is up to the manufacturer. They are considered equivalent solutions in this part of ISO 7240 and should not be called up in national regulations.

Annex B
(informative)

Common indications, controls and outputs when the s.s.c.i.e. and the c.i.e. are combined

B.1 Common indications

B.1.1 Fault condition

The following indications may be shared in a combined s.s.c.i.e. and c.i.e.:

a) the indication that the equipment is powered [refer to ISO 7240-2:2003, 5.4, and to 5.4 of this part of ISO 7240];

b) the general fault-warning condition [refer to ISO 7240-2:2003, 9.2.1 a), and to 8.2.1 a) of this part of ISO 7240];

c) the failure of a common power supply [refer to ISO 7240-2:2003, 9.2 4.b), and to 8.2.4 a) of this part of ISO 7240];

d) the indication of earth fault [refer to ISO 7240-2:2003, 9.2.4 c), and to 8.2.4 b) of this part of ISO 7240];

e) the rupture of fuses [refer to ISO 7240-2:2003, 9.2.4 d), and to 8.2.4 c) of this part of ISO 7240];

f) the failure of transmission paths [refer to ISO 7240-2:2003, 9.2.4 e), and to 8.2.4 d) of this part of ISO 7240];

g) a system fault (refer to ISO 7240-2:2003, 9.5 and to 8.3 of this part of ISO 7240).

B.1.2 Audible warning

The audible warning may be the same for the combined s.s.c.i.e. and c.i.e. (refer to ISO 7240-2:2003, 8.4 and 9.6, and to 7.5 and 8.4 of this part of ISO 7240).

B.1.3 General disablement

The indication of general disablement may be common for a combined s.s.c.i.e. and c.i.e. [refer to ISO 7240-2:2003, 10.2 a), and to 9.2 a) of this part of ISO 7240].

B.2 Common controls

The following controls may be shared for a combined s.s.c.i.e. and c.i.e.:

h) the manual silencing of the audible warning;

i) the manual operation of resetting from a fault-warning condition.

B.3 Common outputs

The fault output may be the same for the combined s.s.c.i.e. and c.i.e.

Annex C
(informative)

Interface between the s.s.c.i.e. and the emergency-detection system

The transmission link between the s.s.c.i.e. and an emergency-detection system (e.g. a fire-detection system) is normally supervised by the emergency-detection system, so that the emergency-detection system has some method of determining whether the signals transmitted across the transmission path to the s.s.c.i.e. are received by the s.s.c.i.e.

The input/output interface between the emergency-detection system and the s.s.c.i.e. is an essential part of the s.s.c.i.e. because it is the transmission path used to initiate a voice-alarm condition. The voice-alarm condition may also be silenced, restarted and reset from the emergency-detection system. In addition, a fault-warning condition on the s.s.c.i.e. may also be transmitted to the emergency-detection system.

Annex D
(informative)

Explanation of access levels

This part of ISO 7240 defines access levels for the indications and controls relating to mandatory functions. In some cases, alternatives are offered (e.g. access level 1 or 2). This is because either may be appropriate under different operational circumstances. The purpose of the different access levels is not defined by this part of ISO 7240. However, in general they are expected to be used as follows:

a) Access level 1: By members of the general public or persons having a general responsibility for safety supervision who can be expected to investigate and initially respond to an emergency alarm or a fault warning;

b) Access level 2: By persons having a specific responsibility for safety and who are competent and authorized to operate the s.s.c.i.e. in the

- quiescent condition,
- voice-alarm condition,
- fault-warning condition,
- disabled condition, or
- test condition;

c) Access level 3: By persons who are competent and authorized to

- re-configure the site-specific data held within the s.s.c.i.e. or controlled by it (e.g. labelling, zoning, alarm organization, stored messages and tones), and
- maintain the s.s.c.i.e. in accordance with the manufacturer's published instructions and data;

d) Access level 4: By persons who are competent and authorized by the manufacturer either to repair the s.s.c.i.e. or to alter its firmware, thereby changing its basic mode of operation.

The minimum requirements for accessibility are defined in 14.6. 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

- mechanical keys,
- a keyboard and codes, and
- access cards.

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

- mechanical keys,
- tools, and
- an external programming device.

It may 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 s.s.c.i.e. 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 may be desirable, in certain circumstances, that the s.s.c.i.e. has additional access levels within access level 2 or access level 3 (e.g. 2A and 2B) that would permit different classes of authorized user to have access to a selected group of controls or functions. This is not forbidden by this part of ISO 7240. The exact configuration depends on the type of installation, the way the s.s.c.i.e. is used and the complexity of the functions provided.

Annex E
(informative)

Design requirements for software-controlled s.s.c.i.e.

The s.s.c.i.e. may incorporate software-controlled elements that are required to fulfil the mandatory requirements of this part of ISO 7240, but that are supplied to the manufacturer. A good example is an alphanumeric display module; but there are many possibilities, including both physical modules and embedded software (e.g. operating systems). Such elements can be traded world-wide as commodity items and detailed software documentation (and, for that matter, details of the hardware design) might not be available to the s.s.c.i.e. manufacturer. It is not the intention of this part of ISO 7240 to forbid the use of appropriate technology and, in such cases, the detailed requirements for documentation and design of 15.2 and 15.3 may be relaxed at the discretion of the testing authority. However, it is expected that products from third parties that are designed and produced exclusively for an s.s.c.i.e. are fully documented and fulfil the requirements. It is the manufacturer's responsibility to ensure that the element is of proven reliability and is suitable for the application. Proven reliability can be assumed if the components under question are freely available on the market and there is sufficient field experience (e.g. $\geqslant$ 1 year). The interface with the main application has to be clearly and comprehensively specified and this documentation has to be available to the testing authority.

Program monitoring is discussed in 15.4. The program is the software necessary for the s.s.c.i.e. to carry out mandatory functions (including any declared options with requirements). It is necessary that the execution of the entire program be monitored; this may include software that runs in more than one processor and software in elements supplied to manufacturer. It is the responsibility of the manufacturer and the testing authority to agree on the necessary level of monitoring, but in the case of an alphanumeric display module, it is considered to be sufficient to routinely check that data written to the module can be read back from it.

It is required in 15.4.5 that, in the event of a failure of program execution, the s.s.c.i.e. shall enter a safe state. The safe state is defined by the manufacturer, but it is expected that it does not result in the false activation of mandatory outputs nor give a false impression to a user that the s.s.c.i.e. remains operational when it does not. In practice, it may be acceptable either to stop or to restart the program execution automatically. If there is a possibility that the memory might have been corrupted, the restart procedure should check the contents of this memory and, if necessary, re-initialize the running data to ensure that the s.s.c.i.e. enters a safe operating state. Even if program execution is successfully restarted, it is important that the user be made aware of the incident. For this reason, it can be advantageous for the s.s.c.i.e. to be capable of automatically recording details of the restart event. In any event, it is necessary that the system fault indication be latched until manual intervention.

In 15.5.1, it is required that all executable code and data necessary to comply with this part of ISO 7240 be held in a memory that is capable of continuous, non-maintained, reliable operation for a period of at least 10 years. In the existing state of the art, memory with moving mechanical parts is not considered sufficiently reliable. The use of tapes or magnetic or optical data discs for the storage of programs and data is, therefore, not considered to be acceptable at the time of publication of this part of ISO 7240.

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