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Fire detection and alarm systems —

Part 23: Visual alarm devices

Systèmes de détection et d'alarme d'incendie —

Partie 23: Dispositifs d'alarme visuels

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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 7240-23 was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting*, Subcommittee SC 3, *Fire detection and alarm systems*.

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 3: Audible alarm devices*

— *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 17: Short-circuit isolators*

— *Part 18: Input/output devices*

— *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 23: Visual alarm devices*

— *Part 24: Sound-system loudspeakers*

— *Part 25: Components using radio transmission paths*

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

— *Part 28: Fire protection control equipment*

Introduction

The purpose of a visual fire alarm device is to warn person(s) within, or in the vicinity of, a building of the occurrence of a fire emergency in order to enable such person(s) to take appropriate measures.

This part of ISO 7240 allows manufacturers to specify visual alarm devices in terms of the range at which the required illumination is met. Three classes of device are defined, one for ceiling mounted devices, one for wall mounted devices and an open class. The maximum range of the visual alarm device is tested by measuring the light output in a part of the hemisphere surrounding it to determine its light distribution. As the light output of some visual alarm devices can change over time due, for example, to the effect of self-heating, a specific test checks that the variation of light output over time is within acceptable limits.

This part of ISO 7240 gives common requirements for the construction and robustness of visual alarm devices as well as for their performance under climatic, mechanical and electrical interference conditions which are likely to occur in the service environment. Visual alarm devices can be classified in one of three application environment types.

Fire detection and alarm systems —

Part 23: Visual alarm devices

1 Scope

This part of ISO 7240 specifies the requirements, test methods and performance criteria for visual alarm devices in a fixed installation intended to signal a visual warning of a fire between a fire detection and alarm system and occupants in and around buildings.

This part of ISO 7240 specifies visual alarm devices for three types of application environment.

It is only applicable to pulsing or flashing visual alarm devices, for example xenon beacons or rotating beacons. It is not applicable to devices giving continuous light output.

This part of ISO 7240 is not intended to cover visual indicators, for example, on detectors or on the control and indicating equipment.

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 2813:1994, *Paints and varnishes — Determination of specular gloss of non-metallic paint films at 20 degrees, 60 degrees and 85 degrees*

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

ISO/CIE 23539:2005, *Photometry — The CIE system of physical photometry*

IEC 60068-1:1988, *Environmental testing — Part 1: General and guidance*

IEC 60068-2-1:2007, *Environmental testing — Part 2-1: Tests — Test A: Cold*

IEC 60068-2-2:2007, *Environmental testing — Part 2-2: Tests — Test B — Dry heat*

IEC 60068-2-6:2007, *Environmental testing — Part 2-6: Tests — Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27:2008, E*nvironmental testing — Part 2-27: Tests — Test Ea and guidance: Shock*

IEC 60068-2-30:2005, *Environmental testing — Part 2-30: Tests — Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-42:2003, *Environmental testing — Part 2-42: Tests — Test Kc: Sulphur dioxide test for contacts and connections*

IEC 60068-2-75:1997, *Environmental testing — Part 2-75: Tests — Test Eh: Hammer tests*

IEC 60068-2-78:2001, *Environmental testing — Part 2-78: Tests — Test Cab: Damp heat, steady state*

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

IEC 60695-11-10:2003, *Fire hazard testing — Part 11-10: Test flames — 50 W horizontal and vertical flame test methods*

IEC 60695-11-20:2003, *Fire hazard testing — Part 11-20: Test flames — 500 W flame test methods*

EN 50130-4:2011, *Alarm systems — Part 4: Electromagnetic compatibility — Product family standard: immunity requirements for components of fire, intruder, hold up, CCTV, access control and social alarm systems*

UL 94, *Standard for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances testing*

3 Terms, definitions and abbreviations

For the purposes of this document, the terms, definitions and abbreviations given in ISO 7240-1 and the following apply.

3.1 Terms and definitions

3.1.1
coverage volume
volume within which the required illumination is achieved

3.1.2
class C visual alarm device
device intended for mounting on ceilings

3.1.3
class O visual alarm device
device where the mounting is specified by the manufacturer

3.1.4
class W visual alarm device
device intended for mounting on walls

3.1.5
normal axis
axis normal to the mounting plane which passes through the reference point

3.1.6
mode (of operation)
one of a possible number of pre-defined light outputs selected by means specified by the manufacturer

3.1.7
reference point
optical centre within or on the surface of the visual alarm device specified by the manufacturer

3.1.8
required illumination
illumination of 0,4 lm/m^2 on a surface perpendicular to the direction of the light emitted from the device

3.1.9
type A visual alarm device
device primarily intended for conditioned indoor applications

Note 1 to entry: In certain climates, a Type A visual alarm device may be suitable for some unconditioned indoor areas such as an enclosed attached garage or some protected outdoor areas such as under an awning.

3.1.10
type B visual alarm device
device primarily intended for unconditioned indoor or outdoor applications

Note 1 to entry: A Type B visual alarm device may be more suitable than a Type A visual alarm device for some conditioned indoor areas where high temperature and/or humidity are present.

3.1.11
type C visual alarm device
device primarily intended for harsh environment applications

Note 1 to entry: Type C visual alarm devices are specifically intended for use in extreme climates and areas were harsh environment exists, e.g. mining, including open-cast mining.

3.1.12
visual alarm device
v.a.d
device which generates a flashing light to signal to the occupants of a building that a fire condition exists

3.2 Abbreviations

a.c. alternating current

d.c. direct current

r.m.s. root mean square

v.a.d. visual alarm device

4 Requirements

4.1 Compliance

In order to comply with this part of ISO 7240, the v.a.d. shall meet the requirements of Clause 4, which shall be verified by visual inspection or engineering assessment, shall be tested as described in Clause 5 and shall meet the requirements of the tests.

4.2 Device class

4.2.1 The v.a.d shall meet the requirement for coverage volume of at least one of the following three classes:

a) '**C**', ceiling mounted devices;

b) '**W**', wall mounted devices;

c) '**O**', open class devices.

4.2.2 Class C devices shall be further specified as **C-x-y** (see 4.10 2 d) 1)), where:

— **x** is the maximum height, in metres, between 2,5 m and 10 m at which the device may be mounted, and

— **y** is the diameter, in metres, of the coverage cylindrical volume when the device is mounted at the ceiling height.

EXAMPLE **C-3-12** refers to a ceiling mounted device, with a maximum mounting height of 3 m, providing a cylindrical volume of 12 m diameter.

NOTE If a **C-3-12** is located at the centre of square, it corresponds to a square coverage range (8.49 × 8.49) m contained within a circle of 12 m diameter.

4.2.3 Class W devices shall be further specified as **W-x-y** (see 4.10 2 d) 2)), where:

— **x** is the maximum height of the devices on the wall, in metres, with a minimum value of 2,4 m, and

— **y** is the width of a square room, in metres, covered by the device.

EXAMPLE **W-2.4-6** refers to a wall mounted device, with a maximum mounting height of 2,4 m, providing a coverage volume of (2,4 × 6 × 6) m.

4.2.4 For class **O** devices the coverage volume in which the required illumination is achieved shall be specified (see 4.10 2 d) 3)).

4.3 Minimum and maximum effective light intensity

When tested in accordance with 5.4, the v.a.d. shall produce an effective light intensity of at least 1 cd for 70 % of all measurement points and shall not exceed 500 cd for any measurement points.

4.4 Light colour

The v.a.d. shall emit a white or red flashing light.

4.5 Light pattern and frequency of flashing

The flash rate of the v.a.d. shall be between 0,5 Hz and 2 Hz measured between the 10 % of peak values of consecutive leading edges of the pulses (P_{10L}).

NOTE The frequency of flashing may vary in different countries. Reference needs to be made to local regulations. Some countries have adopted the ISO 8201 temporal pattern.

The maximum on-time, measured between the 10 % of peak values of the leading edge (P_{10L}) and trailing edge (P_{10T}) of the pulse shall not exceed 0,2 s.

If the light emitted consists of groups of several pulses and if the time between the P_{10T} of one pulse and the P_{10L} of the next pulse is less than 0,04 s then the pulses shall be considered as a single event.

Any set of multiple pulses shall not exceed 0,2 s between the P_{10L} of the first peak to the P_{10T} of the last peak.

A set of pulses where the minimum value does not drop below 10 % of the peak value is considered as a single pulse and shall not exceed 0,2 s between P_{10L} and P_{10T}.

4.6 Durability

The v.a.d. shall be rated for at least 100 h operation. No limitation on duty factor or maximum on-time shall prevent the device from operating the 1 h ‘on’ 1 h ‘off’ cycle required by the test procedure described in 5.5.

NOTE This requirement does not apply to the capacity of batteries which may be used within a v.a.d as a means of local storage of operating power. The capacity and charging requirements of such batteries need to meet the requirements of the system.

4.7 Construction

4.7.1 Provision for external conductors

The v.a.d. shall provide space within its enclosure for entry and termination of external conductors. Entry holes for conductors or cables shall be provided or the location where such holes are to be made shall be indicated by providing a template or some other suitable means.

Terminals for connecting external conductors to the v.a.d. shall be designed so that the conductors are clamped between metal surfaces without being damaged.

4.7.2 Materials

The v.a.d. shall be constructed of material(s) capable of withstanding the tests specified in 5.2 to 5.19. In addition, the material(s) of plastic enclosures shall meet the following flammability requirements:

a) IEC 60695-11-10, Class V-2 or HB75 for devices operating from a voltage source less than or equal to 30 V r.m.s. or 42,4 V d.c. and consuming less than 15 W of power;

b) IEC 60695-11-20, Class 5VB for devices operating from a voltage source greater than 30 V r.m.s. or 42,4 V d.c. and/or consuming more than 15 W of power.

NOTE Verification of conformance to 4.7.2 a) and 4.7.2 b) can be carried out by examination of a Certificate of Conformity or equivalent (see Annex D).

4.7.3 Ingress protection

The degree of protection provided by the enclosure of the v.a.d shall meet the following requirements:

a) for a Type A v.a.d.: Code IP21C of IEC 60529:2001;

b) for a Type B v.a.d.: Code IP33C of IEC 60529:2001;

c) For a Type C v.a.d.: Code IP53C of IEC 60529:2001.

4.7.4 Access

Means shall be provided to limit access for removal of parts or the whole device, e.g. special tool, codes, hidden screws, seals.

4.8 Manufacturer's adjustments

It shall not be possible to change the manufacturer's settings except by special means (e.g. the use of a special code or tool) or by breaking removing a seal.

4.9 On-site adjustment of mode or behaviour

If there is provision for on-site adjustment of the behaviour of the v.a.d.:

a) for each setting at which compliance with this part of ISO 7240 is claimed, the v.a.d. shall comply with the requirements of this part of ISO 7240 and access to the adjustment means shall only be possible by the use of a code or special tool or by removing the v.a.d. from its base or mounting, and

b) any setting(s) at which compliance with this part of ISO 7240 is not claimed, shall only be accessible by the use of a code or special tool and it shall be clearly marked on the v.a.d. or in the associated data that when these setting(s) are used, the v.a.d. does not comply with this part of ISO 7240.

NOTE These adjustments may be carried out at the v.a.d. or at the control and indicating equipment.

4.10 Marking and data

4.10.1 Marking

Each v.a.d. shall be clearly marked with the following information:

a) number of this International Standard (i.e. ISO 7240-23:2012);

b) environment Type [i.e. Type A, Type B or Type C (see definitions in Clause 3)];

c) device class (see 4.2);

d) name or trademark of the manufacturer or supplier;

e) manufacturer or supplier model designation (type or number of the v.a.d.);

f) terminal designations;

g) a mark(s) or code(s) (e.g. serial number or batch code), by which the manufacturer can identify, at least, the date or batch and place of manufacture and the version number(s) of any software contained within the device.

For a detachable v.a.d., the detachable part shall be marked with a), b), c), d), e) and g), and the base shall be marked with, at least e) (i.e. its own model designation) and f).

Where any marking on the device uses symbols or abbreviations not in common use then these shall be explained in the data supplied with the device.

The marking need not be discernible when the device is installed and ready for use but shall be visible during installation and shall be accessible during maintenance.

The markings shall not be placed on screws or other easily removable parts of the device.

4.10.2 Data

The information required in 4.10.1, together with the following, shall be supplied with the device, or shall be given in a data sheet or technical manual identified on, or with each device:

a) rated supply voltages or voltage ranges (a.c. or d.c.);

b) power and current consumption;

c) supply frequency ranges, where relevant;

d) the coverage characteristics:

1) for class C devices, the information shall clearly show or state:

   i) the maximum allowable height of the device above the floor level, given in metres, i.e. parameter **x** in the class specification as described in 4.2.2,

   ii) the cylindrical volume with its central axis extending vertically downwards from the device,

   iii) the diameter of the above cylindrical volume, given in metres, i.e. parameter **y** in the specification of the class as described in 4.2.2;

2) for class W devices, the information shall clearly show or state:

   i) the device correct orientation,

   ii) features of the device used to align the device to the orientation given in 4.10.2 d 2) i),

   iii) the maximum allowable mounted height of the device, given in metres, i.e parameter **x** in the specification of the class as described in 4.2.3,

   iv) the cuboid volume with its vertical side equal to the height at which the device is mounted and with the device in the centre of one top edge,

   v) the length of the other two sides of the cuboid, given in metres, i.e. parameter **y** in the specification of the class as described in 4.2.3;

3) for class O devices, the information shall clearly show or state:

   i) the recommended mounting position of the device,

   ii) any specific requirement for mounting the device in a particular orientation, and how this orientation can be identified on the device,

iii) any restrictions on the minimum and maximum allowable mounted height,

iv) the volumetric shape, its dimensions and how it is related to the device;

e) the light pattern and frequency of flashing;

f) IP Code to IEC 60529:2001;

g) any other information necessary to allow correct installation, operation and maintenance of the device.

4.11 Additional requirements for software controlled visual alarm devices

4.11.1 General

For a v.a.d. which relies on software control in order to fulfil the requirements of this part of ISO 7240, the requirements of 4.11.2, 4.11.3 and 4.11.4 shall be met.

4.11.2 Software documentation

4.11.2.1 The manufacturer shall submit documentation which gives an overview of the software design. This documentation shall be in sufficient detail for the design to be inspected for compliance with this part of ISO 7240 and shall include at least the following:

a) a functional description of the main program flow (e.g. as a flow diagram or structogram) including:

1) a brief description of the modules and the functions that they perform,

2) the way in which the modules interact,

3) the overall hierarchy of the program,

4) the way in which the software interacts with the hardware of the v.a.d.,

5) the way in which the modules are called, including any interrupt processing.

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 designation, by which the software and its version can be uniquely identified.

4.11.2.2 The manufacturer shall prepare and maintain detailed design documentation. This shall be available for inspection in a manner that respects the manufacturers' rights for confidentiality. It shall comprise at least the following:

a) an overview of the whole system configuration, including all software and hardware components;

b) a description of each module of the program, containing at least:

1) the name of the module,

2) a description of the tasks performed,

3) a description of the interfaces, including the type of data transfer, the valid data range and the checking for valid data;

c) full source code listings, as hard copy or in machine-readable form (e.g. ASCII-code), including all global and local variables, constants and labels used, and sufficient comment for the program flow to be recognized;

d) details of any software tools used in the design and implementation phase (e.g. CASE-tools, compilers).

NOTE This detailed design documentation may be reviewed at the manufacturers' premises.

4.11.3 Software design

In order to ensure the reliability of the v.a.d., the following requirements for the software design shall apply:

a) the design of the interfaces for manually and automatically generated data shall not permit invalid data to cause error in the program operation;

b) the software shall be designed to avoid the occurrence of deadlock of the program flow.

4.11.4 Storage of programme and data

The program necessary to comply with this part of ISO 7240 and any preset data, such as manufacturer's settings, shall be held in non-volatile memory. Writing to areas of memory containing this program and data shall only be possible by the use of some special tool or code and shall not be possible during normal operation of the v.a.d.

Site-specific data shall be held in memory which will retain data for at least two weeks without external power to the v.a.d, unless provision is made for the automatic renewal of such data, following loss of power, within 1 h of power being restored.

4.12 Synchronization — Optional function

Where v.a.d. have a provision for synchronising signals with that of at least one other v.a.d. the maximum difference between v.a.d. shall be less than 0,05 s.

NOTE 1 Light flashing at rates of 3 Hz or more may cause seizure in people with photosensitive epilepsy. To prevent this, the pulse-rate of v.a.d.s placed in the same open space may need to be synchronized.

NOTE 2 This synchronization can be achieved by internal circuitry, the addition of a trigger wire connected between devices or by other means defined by the manufacturer.

When power interruption is used for synchronisation purposes, this shall not adversely affect the visual warning signal.

5 Tests

5.1 General

5.1.1 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 stabilize in the standard atmospheric conditions for testing described in IEC 60068-1, as follows:

— temperature: 15 °C to 35 °C;

— relative humidity: 25 % to 75 %;

— air pressure: 86 kPa to 106 kPa.

The temperature and humidity shall be substantially constant for each test where these standard atmospheric conditions are applied.

5.1.2 Operating conditions for tests

If a test method requires a specimen to be giving the visual alarm signal, then the specimen shall be connected to suitable power supply equipment as specified in the data provided by the manufacturer. Where, in order to be giving the visual alarm signal, a v.a.d. also requires the application of a control signal or signals, this shall be provided in accordance with the manufacturer's specification.

If a test method requires a specimen to be in the quiescent state, then the specimen shall not be supplied with power unless it is a v.a.d. of the types which have electronic circuits for analysing control signals and triggering the visual alarm signal, in which case the specimen shall be connected to suitable power supply and control equipment as specified in the data provided by the manufacturer and the control signals shall be arranged so that the specimen is in a non-signalling state.

Unless otherwise specified in the test procedure, the supply parameters applied to the specimen shall be set within the manufacturer's specified range(s) and shall remain constant throughout the tests. The value chosen for each parameter shall be the nominal value, or the mean of the specified range.

If different light levels for operation under different conditions are declared (see 4.10.2), then, unless otherwise specified by the test procedure, the tests shall be conducted under one selected mode of operation only. Selection of the mode of operation shall be made with the aim to use that which consumes the most power. This shall normally be the brightest mode and/or the mode with the highest frequency of flashing.

NOTE All modes of operation and all voltage ranges are tested in 5.4.

5.1.3 Mounting arrangements

Unless otherwise specified, the specimen shall be mounted by its normal means of attachment in accordance with the manufacturer's instructions on a flat rigid backing board. If these instructions describe more than one method of mounting then the method considered to be most unfavourable shall be chosen for each test.

5.1.4 Tolerances

The tolerances for the environmental test parameters shall be 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 ± 5 % shall be applied.

5.1.5 Provision for tests

The following shall be provided for testing compliance with this part of ISO 7240:

a) eight specimens of Type A or 10 specimens of Type B or Type C with any mounting, bases, boxes or accessories etc.;

b) any equipment, such as a control and indicating equipment, as may be necessary for the correct operation of the v.a.d. in accordance with the manufacturer's specification;

c) the data required in 4.10.2.

The specimens submitted shall be deemed representative of the manufacturer's normal production with regard to their construction and settings.

The details of the power supply equipment used and/or the equipment used for generating the control signal(s) should be given in the test report.

5.1.6 Test schedule

The specimens shall be tested and inspected according to the schedule given in Table 1.

All the specimens shall be first submitted to the reproducibility test described in 5.2. On completion of the reproducibility test, the specimen with the least bright light level shall be numbered 1 and the rest arbitrarily numbered from 2 to 8 for Type A or 2 to 10 for Type B or for Type C.

Unless otherwise required by the test procedure, the mode of operation selected for conducting the reproducibility test shall be used for the other tests.