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2021-11

Smoke alarms using scattered light, transmitted light or ionization

Dispositifs d'alarme de fumée fonctionnant suivant le principe de la diffusion de la lumière, de la transmission de la lumière ou de l'ionisation

Reference number
ISO 12239:2021(E)

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 21 *Equipment for fire protection and firefighting*, Subcommittee SC 3, *Fire detection and alarm systems.*

This third edition cancels and replaces the second edition (ISO 12239:2010), which has been technically revised.

The main changes compared to the previous edition are as follows:

— This edition recognizes the introduction of combination and multi-criteria smoke alarms: smoke alarms that within the one housing provide multiple fire sensors.

— This edition recognizes the technology for open smoke alarms: smoke alarms where the detection of smoke occurs outside the smoke alarm enclosure.

— This edition permits the inclusion of a sensor within the smoke alarm that is unrelated to fire detection, e.g. carbon monoxide sensor.

— This edition introduces new requirements for:

  a) smoke alarms that derive their main power from the mains or a mains-derived source;

  b) external power supply equipment;

  c) temporary disablement facility;

  d) smoke alarms utilizing radio frequency links;

  e) assessment of wall-mounted smoke alarms.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

This document for smoke alarms is drafted on the basis of functions that are to be provided on all smoke alarms covered by this document, and optional functions with requirements which may additionally be provided. It is intended that the options will be used for specific applications, as recommended in application guidelines.

Each optional function is included as a separate entity, with its own set of associated requirements, in order to permit smoke alarms covered by this document with different combinations of functions to conform to this document.

Additional functions can also be provided, even if not specified in this document.

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Smoke alarms using scattered light, transmitted light or ionization

IMPORTANT — Certain types of smoke alarms contain radioactive materials. The national requirements for radiation protection differ from country to country and they are not specified in this document. Such smoke alarms should, however, take into consideration the applicable national standards, which should take into consideration the recommendations of the Nuclear Energy Agency (NEA) of the Organization for Economic Co-operation and Development (OECD).

1 Scope

This document specifies requirements, test methods, performance criteria and manufacturers' instructions for smoke alarms that operate using scattered light, transmitted light or ionization, and are intended for household or similar residential applications.

For the testing of other types of smoke alarms, or smoke alarms working on different principles, this document is recommended only as guidance. Smoke alarms with special characteristics and developed for specific risks are not covered by this document.

This document allows, although it does not require, the inclusion within the smoke alarm of facilities for the following:

— visual fault condition indication;

— extended temperature-range operation;

— interconnection with other similar smoke alarms or accessories;

— temporary disablement;

— alarm silencing;

— signal frequency characteristics;

— standby power source low condition silence;

— smoke alarms with voice;

— smoke alarms using radio frequency links;

— response to slowly developing fires (drift compensation).

Where such facilities are included, this document specifies applicable requirements.

This document does not cover devices intended for incorporation in systems using separate control and indicating equipment. Such systems are specified in the ISO 7240 series.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 209, *Aluminium and aluminium alloys — Chemical composition*

ISO 2919, *Radiological protection — Sealed radioactive sources — General requirements and classification*

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

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

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

ISO 8201, *Alarm systems — Audible emergency evacuation signal — Requirements*

IEC 60065:2005, *20014, Audio, video and similar electronic apparatus — Safety requirements*

IEC 60068-1, *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 60068-2-42, *Environmental testing — Part 2-42: Tests — Test Kc: Sulphur dioxide test for contacts and connections*

IEC 60068-2-78:2012, *Environmental testing — Part 2-78: Tests — Test Cab: Damp heat, steady state*

IEC 60950-1:2005, *Information technology equipment — Safety — Part 1: General requirements*

IEC 61000-4-3, *Electromagnet compatibility (EMC) — Part 4-3: Testing and measurement techniques — Radiated radio-frequency, electromagnetic field immunity test*

IEC 61672-1:2002, *Electroacoustics — Sound level meters — Part 1: Specifications*

IEC 62599-2, *Alarm systems - Part 2: Electromagnetic compatibility - Immunity requirements for components of fire and Security alarm systems*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
aerosol density
smoke density
amount of particulates per volume as described operationally by one of two parameters:

— m (3,14)

— y (3,28)

Note 1 to entry: Strictly speaking, these parameters are not concentrations, but represent values which are proportional to the concentration and have been shown to function in lieu of a true concentration value for the purposes of these tests.

3.2
alarm condition
audible signal specified by the manufacturer as indicating the existence of a fire

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3.3
alarm-silence facility
means of temporarily silencing or desensitizing a smoke alarm after smoke has been detected

3.4
connectable device
device not conforming to this document, the operation of which will not jeopardize the performance of the connected smoke alarm(s)

3.5
audible alarm signal
audible signal intended to indicate an alarm condition

3.6
battery-low condition
combination of battery voltage and series resistance which results in a fault warning

3.7
combination smoke alarm
smoke alarm incorporating within one mechanical housing more than one fire sensor, with each sensor independently signalling a fire alarm condition, e.g. ionization and photoelectric

3.8
detachable smoke alarm
smoke alarm which consists of two components, the head and the base, and which allows them to be separated from each other for maintenance without damaging any of the components

3.9
fault condition
condition in which the smoke alarm is affected by an adverse condition of a component

3.10
fault warning
audible signal specified by the manufacturer as indicating the existence of an actual or incipient fault that may prevent an alarm condition

3.11
free-field conditions
conditions where there are a minimal number of sound wave or radio frequency wave reflecting or absorbing surfaces

3.12
interconnectable smoke alarm
smoke alarm which can be interconnected with other smoke alarms to provide a common alarm condition

3.13
least sensitive orientation
point of rotation, relative to air flow, about the vertical axis where a smoke alarm produces the maximum response threshold value

3.14
m
absorbance index
measured light attenuation characterizing the concentration of particulates in smoke or an aerosol

Note 1 to entry: The formula for *m* given in Annex C applies.

3.15
mains
AC supply from an electrical authority

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3.16
main power source
source of power intended to supply the smoke alarm

3.17
most sensitive orientation
point of rotation, relative to air flow, about the vertical axis where a detector produces the minimum response threshold value

3.18
multi-criteria smoke alarm
smoke alarm incorporating within one mechanical housing a smoke sensor plus one or more additional sensors with all sensors separately monitored for the presence or absence of an output signal relating to fire development where the individual signal from each sensor is evaluated to determine when an alarm condition is reached

3.19
non-removable power source
internal power source, main or standby, integrated or fixed within the smoke alarm such that it is not intended as user-replaceable or serviceable

3.20
normal condition
condition in which the smoke alarm is supplied with power but is not giving either an alarm condition or a fault condition, but is able to give such signals if the occasion arises

3.21
open smoke alarm
optical smoke alarm with the sensing volume(s) outside its enclosure

3.22
radio frequency link
means of communication between at least two smoke alarm devices, using radio frequency wave propagation

3.23
response threshold
A_{th}
aerosol density in the proximity of the specimen at the moment that it generates an alarm condition, when tested as specified in 5.1.5

3.24
standby power source
source of power intended to supply the smoke alarm in the event that the main power source is unavailable

3.25
smoke alarm
device containing within one housing all the components, with or without an internal power source, necessary for detecting smoke and generating an alarm condition and which can comprise one or more parts such as a base (socket) and head (body)

3.26
temporary disablement facility
means of temporarily disabling or desensitizing a smoke alarm when it is in the normal condition

3.27
type A smoke alarm
type A
smoke alarm that does not contain radioactive materials

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3.28
type B smoke alarm
type B
smoke alarm containing radioactive materials

3.29
y
dimensionless variable, reflecting the change in the current flowing in an ionization chamber as a known function of the concentration of particulates in the smoke or aerosol

Note 1 to entry: The formula for *y* is given in Annex C.

4 General requirements

4.1 Conformity

The manufacturer shall submit documentation which gives an overview of the product's design, components, materials and reliability prediction. This documentation shall contain sufficient detail for the design to be inspected and assessed for conformance with this document. Conformity assessment is the demonstration that the mandatory requirements relating to the product are fulfilled.

Combination and multi-criteria smoke alarms shall include a smoke sensor and irrespective of any additional sensor functionality, shall be tested to the requirements of this document.

Open smoke alarms shall be tested to the requirements of this document and the relevant clauses of ISO 7240-7.

The smoke alarm shall be resettable and:

a) shall meet the requirements of this Clause 4, which may be verified by visual inspection or engineering assessment;

b) shall be tested as specified in Clause 5;

c) shall meet the requirements of these tests; and

d) have a stated service life of at least 10 years under normal conditions of use.

4.2 Optional and additional functions

If an optional function is included, all the corresponding requirements shall be met.

Additional functions may be provided, even if not specified in this document. Where provided, such functions shall not jeopardize any function required by this document. Where non-fire sensors share functions of the smoke alarm such as the alarm sounder and visual alarm indicator, the indication shall be distinguishable from the smoke alarm indication.

NOTE Each optional function is included in a separate clause, with its own set of associated requirements, in order to permit smoke alarms covered by this document to have different combinations of functions and still conform to this document.

4.3 Smoke alarm type

The smoke alarm shall be one or both of the following types:

a) Type A

b) Type B

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