DRAFT INTERNATIONAL STANDARD

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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

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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 12239 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.

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 be provided. It is intended that the options shall 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.

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, being a smoke alarm where the detection of smoke occurs outside the smoke alarm enclosure

This edition also 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

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

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, comply with the applicable national standards, which should be consistent with 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 manufacturer's 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 should be used only for 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 parts of ISO 7240.

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 209, *Aluminium and aluminium alloys — Chemical composition*

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

ISO 7240-3, *Fire detection and alarm systems — Part 3: Audible alarm devices*

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

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

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

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

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

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

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

IEC 60068-2-6, *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, *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 61672-1:2002, *Electroacoustics — Sound level meters — Part 1: Specifications*

OECD, Recommendations for ionization chamber smoke detectors in implementation of radiation protection standards. Nuclear Energy Agency, Organization for Economic Co-operation and Development, Paris, France. 1977

3 Terms and definitions

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

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: These parameters are not concentrations *sensu stricto*, 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

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

3.4
Connectable device
A device not conforming to this document, the operation of which will not jeopardise 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
A smoke alarm incorporating within one mechanical housing more than one fire sensor, with each sensor independently signalling a fire alarm condition, e.g. ionisation and photoelectric

3.8
detachable smoke alarm
smoke alarm, which consists of two components:

- the head and the base, and
- 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 may 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 equation for *m* is given in Annex C

3.15
mains
AC supply from an electrical authority.

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
A smoke alarm incorporating within the 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
An 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, although 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}
<smoke alarm> 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 may comprise one or more parts such as a base (socket) and head (body)

3.26
temporary disablement facility
a means of temporarily disabling or desensitising 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

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 equation 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 be in sufficient detail for the design to be inspected and assessed for conformance with this document. Conformity assessment is the demonstration 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) meet the requirements of this Clause (4), which may be verified by visual inspection or engineering assessment;

b) tested as specified in Clause 5; and

c) meet the requirements of the 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, such as Carbon monoxide, 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

4.4 Response threshold value of detectors using scattered or transmitted light

Detectors using scattered or transmitted light shall conform to one of the two response threshold value bands specified in Table 1 and the corresponding end-of-test conditions for the test fires specified in 5.16.

Table 1 — Response threshold value for detectors using scattered or transmitted light

Band	Response threshold value in smoke tunnel (aerosol) dB/m	Test fires end-of-test conditions			
		TF2 dB/m	TF3 dB/m	TF4 dimensionless	TF5 dimensionless
1	*0,05 < m*	$m = 2$	$m = 2$	$y = 6$	$y = 6$
2	*0,2 < m*	$m = 2$	$m = 2$	$y = 6{,}5$	$y = 7{,}5$
NOTE 1 The smaller the *m* value, the higher the sensitivity of the detectors.					

4.5 Alarm condition

4.5.1 Aural indicator

4.5.1.1 Signal temporal pattern

The smoke alarm aural signal temporal pattern shall be either

a) the emergency evacuation signal defined in ISO8201, or

b) the auditory danger signal defined in ISO 7731.

Note The selection of the signal temporal pattern is related to the installation requirement of the smoke alarm and may be a requirement of national regulation.

4.5.1.2 Signal sound pressure level — Optional function

The alarm condition aural indicator shall commence sounding at a level not greater than 45 dBA, rising gradually to the maximum level of not more than 105 dBA over a period of between 3 s to 10 s (see 5.18 and 5.19).

4.5.1.3 Signal frequency characteristics — Optional function

The audible alarm signal shall have a fundamental frequency of 520 Hz with odd harmonics to approximate a square wave.

4.5.2 Visual indicators

4.5.2.1 Interconnectable smoke alarms – Optional Function

Interconnectable smoke alarms shall be provided with an integral red visual alarm condition indicator, by which the smoke alarm, when in alarm condition, may be identified. The indicator shall flash or be continuously illuminated when the alarm condition is present. Visual indicators shall not operate on interconnected smoke alarms that have not detected smoke. This visual indicator may also perform other additional functions, but the alarm condition indication needs to be distinct from any additional function.

4.5.2.2 Non-interconnectable smoke alarms

Smoke alarms that do not include an interconnection function shall be provided with an integral red visual alarm condition indicator. The indicator shall flash or be continuously illuminated when the alarm condition is present. The indicator may be combined with the fault condition visual indicator. The failure of any visual alarm condition indicator shall not prevent the alarm condition.

4.6 External main power source-on visual indicator

A smoke alarm intended for connection to the mains or mains derived supply shall be provided with an integral green visual indicator. The indicator shall be continuously illuminated when the external main

power is present. The failure of any visual external main power source-on indicator shall not prevent the alarm condition.

4.7 Fault condition visual indicator — Optional function

The smoke alarm shall be provided with an integral amber or yellow visual fault condition indicator. The indicator shall flash or be continuously illuminated when the fault condition is present. The indicator may be combined with the alarm condition visual indicator. The failure of any visual fault condition indicator shall not prevent the alarm condition.

4.8 Visual indicator visibility

All visual indicators shall be visible from a distance of at least 1m and from at least one point when the smoke alarm is mounted in an ambient light intensity of 500lux.

4.9 Smoke alarm signals

The following conditions shall apply to smoke alarms which employ features in addition to the requirements of this document.

— The audible alarm signal shall take precedence over any other signal, even when such other signal is initiated first.

— The audible alarm signal shall be distinctive from the signals of non-alarm condition functions. Use of a common sounder is permitted if distinctive signals are obtained.

— If an audible fault condition signal is provided, it shall be distinctive from the audible alarm signal but may be common to all functions employed.

— Any fault condition associated with features, in addition to the requirements of this document, shall not interfere with the operation and supervision of the smoke alarm.

4.10 Test facility

A test facility shall be provided to simulate the response of the sensing assembly to detect the presence of smoke. The test facility may be integral to the smoke alarm enclosure or remote to the smoke alarm.

The test facility shall be accessible from outside the smoke alarm when installed as specified in the installation instructions. Where the test facility is remote from the smoke alarm, it shall have the same functionality as the test facility integral to the smoke alarm itself and be labelled to identify the function of the control.

4.11 Means of calibration

The means of calibration shall not be readily adjustable after manufacture.

4.12 User-replaceable components

Except for batteries or fuses, a smoke alarm shall have no user-replaceable or serviceable components.

4.13 Main power source

4.13.1 General

The main power source of the smoke alarm may be internal or external to the smoke alarm housing.