

---

---

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

*Systemes de detection et d'alarme d'incendie —*

*Partie 7: Détecteurs de fumée ponctuels utilisant le principe de la diffusion de la lumière, de la transmission de la lumière ou de l'ionisation*

Dit document mag slechts op een stand-alone PC worden geïnstalleerd. Gebruik op een netwerk is alleen toestaan als een aanvullende licentieovereenkomst voor netwerkgebruik met NEN is afgesloten. This document may only be used on a stand-alone PC. Use in a network is only permitted when a supplementary license agreement for us in a network with NEN has been concluded.



Reference number  
ISO 7240-7:2011(E)

© ISO 2011

Copyrighted  
Preview



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2011

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

Page

Foreword .....	v
Introduction .....	vii
1 Scope .....	1
2 Normative references .....	1
3 Terms and definitions .....	2
4 General requirements .....	2
4.1 Compliance .....	2
4.2 Response threshold value of detectors using scattered or transmitted light .....	2
4.3 Individual alarm indication .....	3
4.4 Connection of ancillary devices .....	3
4.5 Monitoring of detachable detectors .....	3
4.6 Manufacturer's adjustments .....	3
4.7 On-site adjustment of response behaviour .....	3
4.8 Protection against the ingress of foreign bodies .....	4
4.9 Response to slowly developing fires .....	4
4.10 Marking .....	4
4.11 Data .....	5
4.12 Requirements for software-controlled detectors .....	5
5 Tests .....	6
5.1 General .....	6
5.2 Repeatability .....	9
5.3 Directional dependence .....	10
5.4 Reproducibility .....	11
5.5 Variation in supply parameters .....	11
5.6 Air movement .....	12
5.7 Dazzling .....	13
5.8 Dry heat (operational) .....	13
5.9 Cold (operational) .....	14
5.10 Damp heat, steady state (operational) .....	15
5.11 Damp heat, steady state (endurance) .....	16
5.12 Sulfur dioxide (SO <sub>2</sub> ) corrosion (endurance) .....	17
5.13 Shock (operational) .....	18
5.14 Impact (operational) .....	19
5.15 Vibration, sinusoidal (operational) .....	20
5.16 Vibration, sinusoidal (endurance) .....	21
5.17 Electromagnetic compatibility (EMC) immunity tests (operational) .....	22
5.18 Fire sensitivity .....	22
6 Test report .....	24
<b>Annex A (normative) Smoke tunnel for response threshold value measurements .....</b>	<b>25</b>
<b>Annex B (normative) Test aerosol for response threshold value measurements .....</b>	<b>26</b>
<b>Annex C (normative) Smoke-measuring instruments .....</b>	<b>27</b>
<b>Annex D (normative) Apparatus for dazzling test .....</b>	<b>31</b>
<b>Annex E (normative) Apparatus for impact test .....</b>	<b>32</b>
<b>Annex F (normative) Fire test room .....</b>	<b>34</b>
<b>Annex G (normative) Smouldering (pyrolysis) wood fire (TF2) .....</b>	<b>36</b>

<b>Annex H</b> (normative) <b>Glowing smouldering cotton fire (TF3)</b> .....	<b>39</b>
<b>Annex I</b> (normative) <b>Flaming plastics (polyurethane) fire (TF4)</b> .....	<b>41</b>
<b>Annex J</b> (normative) <b>Flaming liquid (<i>n</i>-heptane) fire (TF5)</b> .....	<b>43</b>
<b>Annex K</b> (informative) <b>Information concerning the construction of the smoke tunnel</b> .....	<b>45</b>
<b>Annex L</b> (informative) <b>Compensation for detector drift</b> .....	<b>47</b>
<b>Annex M</b> (informative) <b>Information concerning the construction of the measuring ionization chamber (MC)</b> .....	<b>51</b>
<b>Annex N</b> (normative) <b>Detectors with more than one smoke sensor</b> .....	<b>53</b>
<b>Bibliography</b> .....	<b>55</b>

Orbeye  
Preview

## 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 7240-7 was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting*, Subcommittee SC 3, *Fire detection and alarm systems*.

This second edition cancels and replaces the first edition (ISO 7240-7:2003), 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 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 20: Aspirating smoke detectors
- Part 21: Routing equipment
- Part 22: Smoke-detection equipment for ducts
- Part 24: Sound-system loudspeakers
- Part 25: Components using radio transmission paths
- 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
- Part 28: Fire protection control equipment

A part 23 dealing with visual alarm devices and a part 29 dealing with video fire detectors are under development.

Review  
DRAFT

## Introduction

This part of ISO 7240, drawn up by ISO/TC 21/SC 3, is based on a draft prepared by the European Committee for Standardization's CEN/TC 72, *Automatic fire detection systems*.

A fire detection and alarm system is required to function satisfactorily not only in the event of fire, but also during and after exposure to conditions it is likely to meet in practice, including corrosion, vibration, direct impact, indirect shock and electromagnetic interference. Specific tests are intended to assess the performance of the smoke detectors under such conditions.

This part of ISO 7240 is not intended to place any other restrictions on the design and construction of such detectors.

This edition of ISO 7240-7 introduces a requirement that smoke detectors that operate on the scattered or transmitted light principle be marked with one of two possible nominal response threshold value bands. This marking provides for a clearer choice of response values so that the risk of unwanted alarms can be decreased in installations where unfavourable environmental conditions are present.

**NOTE** For some test fires, smoke detectors that operate on the scattered or transmitted light principle and that have been factory set to the upper response threshold value band can fall outside one of the classification limits given in ISO/TS 7240-9.

This edition of ISO 7240-7 introduces additional requirements for smoke detectors with more than one smoke sensor.

Voorbeeld  
Preview



# Fire detection and alarm systems —

Part 7:

## Point-type smoke detectors using scattered light, transmitted light or ionization

### 1 Scope

This part of ISO 7240 specifies requirements, test methods and performance criteria for point-type smoke detectors that operate using scattered light, transmitted light or ionization, for use in fire detection and alarm systems installed in buildings (see ISO 7240-1). This part of ISO 7240 also covers point smoke detectors that incorporate more than one smoke sensor operating on these principles. Additional requirements and test methods for such detectors are given in Annex N.

For the testing of other types of smoke detectors, or smoke detectors working on different principles, this part of ISO 7240 can be used only for guidance. Smoke detectors with special characteristics, developed for specific risks, are not covered.

NOTE Certain types of detector contain radioactive materials. The national requirements for radiation protection differ from country to country and are not specified in this part 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 7240-1, *Fire detection and alarm systems — Part 1: General and definitions*

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 60068-2-27, *Environmental testing — Part 2-27: Tests — Test Ea and guidance: Shock*

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*

EN 50130-4:1995 + A1:1998 + A2:2003, *Alarm systems — Part 4: Electromagnetic compatibility — Product family standard: Immunity requirements for components of fire, intruder and social alarm systems*

### 3 Terms and definitions

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

#### 3.1

##### **aerosol density**

smoke density

number of particulates per volume as described operationally by one of two parameters:

- $m$  (3.3), an absorbance index, used in the testing of smoke detectors using scattered or transmitted light;
- $y$  (3.5), a dimensionless variable, used in the testing of smoke detectors using ionization

NOTE 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

##### **least sensitive orientation**

point of rotation, relative to air flow, about the vertical axis where a detector produces the maximum response threshold value

#### 3.3

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

NOTE The equation for  $m$  is given in Annex C.

#### 3.4

##### **response threshold value**

$A_{th}$   
(smoke detector) aerosol density in the proximity of the specimen at the moment that it generates an alarm signal, when tested as specified in 5.15.

NOTE The response threshold value can depend on signal processing in the detector and in the control and indicating equipment.

#### 3.5

$y$   
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 The equation for  $y$  is given in Annex C.

### 4 General requirements

#### 4.1 Compliance

In order to comply with this part of ISO 7240, the detector shall meet the requirements of this clause, which shall be verified by visual inspection or engineering assessment, shall be tested as specified in Clause 5 (and, for detectors with more than one smoke sensor, Annex N) and shall meet the requirements of the tests.

#### 4.2 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 5.18.

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

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	$0,05 < m < 0,3$	$m = 2$	$m = 2$	$y = 6$	$y = 6$
2	$0,2 < m < 0,6$	$m = 2$	$m = 2$	$y = 6,5$	$y = 7,5$

NOTE The smaller the  $m$  value, the higher the sensitivity of the detectors.

### 4.3 Individual alarm indication

Each detector shall be provided with an integral red visual indicator by which the individual detector releasing an alarm can be identified, until the alarm condition is reset. Where other conditions of the detector may be visually indicated, these shall be clearly distinguishable from the alarm indication, except when the detector is switched into a service mode. For detachable detectors, the indicator may be integral with the base or the detector head.

NOTE The alarm condition is reset manually at the control and indicating equipment (see EN 54-2).

The visual indicator shall be visible from a distance of 6 m in an ambient light intensity up to 500 lx at an angle of up to

- 5° from the axis of the detector in any direction,
- 45° from the axis of the detector in at least one direction.

### 4.4 Connection of ancillary devices

The detector may provide for connections to ancillary devices (remote indicators, control relays, etc.), but open- or short-circuit failures of these connections shall not prevent the correct operation of the detector.

### 4.5 Monitoring of detachable detectors

For detachable detectors, a means shall be provided for a remote monitoring system (e.g. the control and indicating equipment) to detect the removal of the head from the base, in order to give a fault signal.

### 4.6 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 or removing a seal.

### 4.7 On-site adjustment of response behaviour

If there is provision for on-site adjustment of the response behaviour of the detector, then

- for all of the settings at which the manufacturer claims compliance, the detector shall comply with the requirements of this part of ISO 7240 and access to the adjustment means shall be possible only by the use of a code or special tool, or by removing the detector from its base or mounting,
- any setting or settings at which the manufacturer does not claim compliance with this part of ISO 7240 shall be accessible only by the use of a code or special tool, and it shall be clearly marked on the detector or in the associated data that if this setting or these settings are used, the detector does not comply with this part of ISO 7240.

These adjustments may be carried out at the detector or at the control and indicating equipment.

#### 4.8 Protection against the ingress of foreign bodies

The detector shall be so designed that a sphere of diameter greater than  $(1,3 \pm 0,05)$  mm cannot pass into the sensor chamber or chambers.

NOTE 1 This requirement is intended to restrict the access of insects into the sensitive parts of the detector. It is known that this requirement is not sufficient to prevent the access of all insects; however, it is considered that extreme restrictions on the size of access holes can introduce the danger of clogging by dust, etc. It can, therefore, be necessary to take other precautions against false alarms due to the entry of small insects.

NOTE 2 For detectors that do not have physical protection against ingress of foreign bodies, the resistance of the detector against the adverse effect of such ingress needs to be proven by the manufacturer.

#### 4.9 Response to slowly developing fires

The provision of "drift compensation" (e.g. to compensate for sensor drift due to the build-up of dirt in the detector) shall not lead to a significant reduction in the sensitivity of the detector to slowly developing fires (see Annex L).

Since it is not practical to make tests with very slow increases in smoke density, an assessment of the response of the detector to slow increases in smoke density shall be made by analysis of the circuit/software, and/or physical tests and simulations.

The detector shall be deemed to meet the requirements of this subclause if this assessment shows the following:

- a) that for any rate of increase in smoke density  $R$ , which is greater than 25 % of the initial uncompensated response threshold value of the detector,  $A_{th,u}$ , per hour, the time for the detector to give an alarm does not exceed  $1,6 \times (A_{th,u} \cdot R)$  by more than 100 s;
- b) that the total compensation  $C_t$  is limited such that  $C_t < 0,6 A_{th,u}$  throughout this range, and that the fully compensated response threshold value  $A_{th,c}$  does not exceed its initial value  $A_{th,u}$  by a factor greater than 1,6.

#### 4.10 Marking

Each detector shall be clearly marked with the following information:

- a) reference to this part of ISO 7240 (i.e. ISO 7240-7);
- b) name or trademark of the manufacturer or supplier;
- c) model designation (type or number);
- d) for detectors using scattered or transmitted light, the response threshold value band,  
EXAMPLE (0,05 to 0,3) dB/m or (0,2 to 0,6) dB/m.
- e) wiring terminal designations;
- f) some 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 detector.

For detachable detectors, the detector head shall be marked with a), b), c) and f), and the base shall be marked with, at least, c) and e).

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

The markings shall be visible during installation of the detector and shall be accessible during maintenance.

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

# Bestelformulier

# NEN

## Stuur naar:

NEN Standards Products & Services  
t.a.v. afdeling Klantenservice  
Antwoordnummer 10214  
2600 WB Delft

## NEN Standards Products & Services

Postbus 5059  
2600 GB Delft

Vlinderweg 6  
2623 AX Delft

T (015) 2 690 390  
F (015) 2 690 271

[www.nen.nl/normshop](http://www.nen.nl/normshop)

## Ja, ik bestel

\_\_\_ ex. ISO 7240-7:2011 en Automatische brandmeldinstallaties - Deel 7: <font face=Arial>Rookmelders - Puntmelders werkend volgens het strooilicht-, verduisterings- of ionisatieprincipe</font> € 147.90

**Wilt u deze norm in PDF-formaat? Deze bestelt u eenvoudig via [www.nen.nl/normshop](http://www.nen.nl/normshop)**

### Gratis e-mailnieuwsbrieven

Wilt u op de hoogte blijven van de laatste ontwikkelingen op het gebied van normen, normalisatie en regelgeving? Neem dan een gratis abonnement op een van onze e-mailnieuwsbrieven. [www.nen.nl/nieuwsbrieven](http://www.nen.nl/nieuwsbrieven)

### Retourneren

Fax: (015) 2 690 271  
E-mail: [klantenservice@nen.nl](mailto:klantenservice@nen.nl)  
Post: NEN Standards Products & Services,  
t.a.v. afdeling Klantenservice  
Antwoordnummer 10214,  
2600 WB Delft  
(geen postzegel nodig).

## Gegevens

Bedrijf / Instelling \_\_\_\_\_

T.a.v. \_\_\_\_\_ O M O V

E-mail \_\_\_\_\_

Klantnummer NEN \_\_\_\_\_

Uw ordernummer \_\_\_\_\_

BTW nummer \_\_\_\_\_

Postbus / Adres \_\_\_\_\_

Postcode \_\_\_\_\_

Plaats \_\_\_\_\_

Telefoon \_\_\_\_\_

Fax \_\_\_\_\_

**Factuuradres** (indien dit afwijkt van bovenstaand adres)

Postbus / Adres \_\_\_\_\_

Postcode \_\_\_\_\_

Plaats \_\_\_\_\_

Datum \_\_\_\_\_

Handtekening \_\_\_\_\_

### Voorwaarden

- De prijzen zijn geldig tot 31 december 2016, tenzij anders aangegeven.
- Alle prijzen zijn excl. btw, verzend- en handelingskosten en onder voorbehoud bij o.m. ISO- en IEC-normen.
- Bestelt u via de normshop een pdf, dan betaalt u geen handeling en verzendkosten.
- Meer informatie: telefoon (015) 2 690 391, dagelijks van 8.30 tot 17.00 uur.
- Wijzigingen en typfouten in teksten en prijsinformatie voorbehouden.
- U kunt onze algemene voorwaarden terugvinden op: [www.nen.nl/leveringsvoorwaarden](http://www.nen.nl/leveringsvoorwaarden).