SLOVENSKI STANDARD
SIST EN 54-12:2015

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Sistemi za odkrivanje in javljanje požara ter alarmiranje - 12. del: Dimni javljalniki - Linijski javljalniki z optičnim žarkom

Fire detection and fire alarm systems - Part 12: Smoke detectors - Line detectors using an optical beam

Brandmeldeanlagen - Teil 12: Rauchmelder - Linienförmiger Melder nach dem Durchlichtprinzip

Systèmes de détection et d'alarme incendie - Partie 12: Détecteurs de fumée - Détecteurs linéaires fonctionnant suivant le principe de la transmission d'un faisceau d'ondes optiques rayonnées

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Fire detection and fire alarm systems - Part 12: Smoke detectors - Line detectors using an optical beam

Systèmes de détection et d'alarme incendie - Partie 12: Détecteurs de fumée - Détecteurs linéaires fonctionnant suivant le principe de la transmission d'un faisceau d'ondes optiques rayonnées

Brandmeldeanlagen - Rauchmelder - Teil 12: Linienförmiger Melder nach dem Durchlichtprinzip

This European Standard was approved by CEN on 1 February 2015.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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Foreword

This document (EN 54-12:2015) has been prepared by Technical Committee CEN/TC 72 “Fire detection and fire alarm systems”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2015, and conflicting national standards shall be withdrawn at the latest by April 2019.

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

This document supersedes EN 54-12:2002.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of Regulation (EU) 305/2011.

For relationship with EU Regulations see informative Annex ZA, which is an integral part of this document.

EN 54-12 has been revised so as to align with the second answer to Mandate M/109. It includes new clauses and annexes as follows:

— Clause 6 Assessment and verification of constancy of performance (AVCP);

— Clause 7 Classification and designation;

— Clause 8 Marking, labelling and packaging;

— Annex H (informative) Information concerning the requirements for the response to slowly developing fires;

— Annex I (informative) Data supplied with line detectors using an optical beam.

The main technical changes are as follows:

— The definition of response value has been modified so that it relates the same smoke density for line detectors using an optical beam both with and without a separate reflector.

— Changes to the test conditions and requirements for the Tolerance to beam misalignment test and the Vibration (endurance) test.

EN 54, *Fire detection and fire alarm systems*, consists of the following parts:

— *Part 1: Introduction*;

— *Part 2: Control and indicating equipment*;

— *Part 3: Fire alarm devices — Sounders*;

— *Part 4: Power supply equipment*;

— *Part 5: Heat detectors — Point detectors*;

— *Part 7: Smoke detectors — Point detectors using scattered light, transmitted light or ionization;*

— *Part 10: Flame detectors — Point detectors*;

— *Part 11: Manual call points*;

— *Part 12: Smoke detectors — Line detectors using an optical light beam* [the present document];

— *Part 13: Compatibility assessment of system components*;

— *Part 14: Guidelines for planning, design, installation, commissioning, use and maintenance* [CEN Technical Specification];

— *Part 16: Voice alarm control and indicating equipment*;

— *Part 17: Short circuit isolators*;

— *Part 18: Input/output devices*;

— *Part 20: Aspirating smoke detectors*;

— *Part 21: Alarm transmission and fault warning routing equipment*;

— *Part 22: Resettable line-type heat detectors* [currently at acceptance stage];

— *Part 23: Fire alarm devices — Visual alarms devices*;

— *Part 24: Components of voice alarm systems — Loudspeakers*;

— *Part 25: Components using radio links*;

— *Part 26: Carbon monoxide detectors — Point detectors*;

— *Part 27: Duct smoke detectors*;

— *Part 28: Non-resettable line type heat detectors* [currently at drafting stage];

— *Part 29: Multi-sensor fire detectors — Point detectors using a combination of smoke and heat sensors*;

— *Part 30: Multi-sensor fire detectors — Point detectors using a combination of carbon monoxide and heat sensors;*

— *Part 31: Multi-sensor fire detectors — Point detectors using a combination of smoke, carbon monoxide and optionally heat sensors*;

— *Part 32: Planning, design, installation, commissioning, use and maintenance of voice alarm systems* [currently at acceptance stage].

NOTE This list includes standards that are in preparation and other standards may be added. For current status of published standards refer to www.cen.eu .

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies requirements, test methods and performance criteria for line detectors using an optical beam that detect smoke by utilizing the attenuation and/or changes in attenuation of an optical beam, for use in fire detection and fire alarm systems installed in buildings (see EN 54-1:2011).

This European Standard provides for the assessment and verification of constancy of performance (AVCP) of line detectors using an optical beam to this EN.

This European Standard does not cover:

— line detectors using an optical beam designed to operate with separations between opposed components of less than 1 m;

— line detectors using an optical beam whose optical path length is defined or adjusted by an integral mechanical connection;

— line detectors using an optical beam with special characteristics, which cannot be assessed by the test methods in this European Standard.

NOTE The term “optical” is used to describe that part of the electromagnetic spectrum produced by the transmitter to which the receiver is responsive; this is not restricted to visible wavelengths.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 54-1:2011, *Fire detection and fire alarm systems — Part 1: Introduction*

EN 54-7:2000, *Fire detection and fire alarm systems — Part 7: Smoke detectors — Point detectors using scattered light, transmitted light or ionization*

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*

EN 60064:1995, *Tungsten filament lamps for domestic and similar general lighting purposes — Performance requirements (IEC 60064:1993, modified)*

EN 60068-1:2014, *Environmental testing — Part 1: General and guidance (IEC 60068-1:2013)*

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

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

EN 60068-2-6:2008, *Environmental testing — Part 2-6: Tests — Test Fc: Vibration (sinusoidal) (IEC 60068-2-6:2007)*

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

EN 60068-2-75:2014, *Environmental testing — Part 2-75: Tests — Test Eh: Hammer tests (IEC 60068-2-75:2014)*

EN 60068-2-78:2013, *Environmental testing — Part 2-78: Tests — Test Cab: Damp heat, steady state (IEC 60068-2-78:2012)*

EN 60081:1998, *Double-capped fluorescent lamps — Performance specifications (IEC 60081:1997)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 54-1:2011 and the following apply.

3.1
line detector using an optical beam
detector consisting at least of a transmitter and a receiver, and which may include reflector(s), for the detection of smoke by the attenuation and/or changes in attenuation of an optical beam

3.2
transmitter
component from which the optical beam emanates

3.3
receiver
component which receives the optical beam

3.4
optical path length
total distance traversed by the optical beam between the transmitter and the receiver

3.5
opposed component
component [transmitter and receiver or transmitter-receiver and reflector(s)] of the beam detector whose position determines the optical path

3.6
separation
physical distance between the opposed components [transmitter and receiver or transmitter-receiver and reflector(s)]

3.7
attenuation
value "A", expressed in dB, of the reduction in intensity of the optical beam at the receiver, defined by the following formula:

$$A = 10 \log_{10}(I_0/I)$$

where

I_0 is the received intensity without reduction in intensity;

I is the received intensity after reduction in intensity

3.8
response value
level of attenuation at which an alarm signal is produced

Note 1 to entry: This value, denoted C, is given by the following formula:

$$C = F * n_f / n_v \text{ dB}$$

where

F is the value of the filter obscuration when an alarm signal is generated by a specimen when tested in accordance with 5.1.5. F is expressed in dB and is defined by the following formula:

$F = 10 \log_{10}(I_0/ I)$

I_0 is the received intensity without reduction through filter F

I is the received intensity after reduction in intensity after a single pass through filter F

n_f is the number of times the beam passes through the filter

n_v is the number of times the beam passes through the protected volume

4 Requirements

4.1 Compliance

In order to comply with this standard line detectors using an optical beam shall meet the requirements of this clause, which shall be verified by visual inspection or engineering assessment and shall be tested in accordance with Clause 5 and shall meet the requirements of the tests.

4.2 Operational reliability

4.2.1 Individual alarm indication

Each detector shall be provided with an integral red visible indicator, by means of which each individual detector which releases an alarm can be identified, until the alarm condition is reset. To confirm this, the detector shall be assessed in accordance with 5.2.1.

4.2.2 Connection of ancillary devices

If the detector provides for connections to ancillary devices (e.g. remote indicators, control relays), open or short-circuit failures of these connections shall not prevent the correct operation of the detector. To confirm this, the detector shall be assessed in accordance with 5.2.2.

4.2.3 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). To confirm this, the detector shall be assessed in accordance with 5.2.3.

4.2.4 On-site adjustment of response value

If there is provision for on-site adjustment of the response value of the detector then:

a) for each setting, at which the manufacturer claims compliance with this standard, the detector shall comply with the requirements of this standard, and access to the adjustment means shall only be possible by the use of a code or special tool or by removing the detector from its base or mounting;

b) any setting(s), at which the manufacturer does not claim compliance with this standard, shall only be accessible 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 these setting(s) are used, the detector does not comply with this standard.

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

To confirm this, the detector shall be assessed in accordance with 5.2.4.

4.2.5 Protection against ingress of foreign bodies

The detector shall be designed so that a sphere of diameter (1,3 ± 0,05) mm cannot pass into any enclosure containing active opto-electronic components, when the detector is in operational condition. To confirm this, the detector shall be assessed in accordance with 5.2.5.

4.2.6 Monitoring of detachable detectors and connections

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.

If there are cables connecting separate parts of the detector, then a means shall be provided for a remote monitoring system (e.g. the control and indicating equipment) to detect a short or open circuit on those cables, in order to give a fault signal. To confirm this, the detector shall be assessed in accordance with 5.2.6.

4.2.7 Requirements for software controlled detectors (when provided)

4.2.7.1 General

For detectors which rely on software control the requirements of 4.2.7.2, 4.2.7.3 and 4.2.7.4 shall be met. To confirm this, the detector shall be assessed in accordance with 5.2.7.

4.2.7.2 Software documentation

4.2.7.2.1 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 standard 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 detector;

   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.

To enable correct operation of the detectors, these data should describe the requirements for the correct processing of the signals from the detector. This may be in the form of a full technical specification of these signals, a reference to the appropriate signalling protocol or a reference to suitable types of control and indicating equipment etc.

4.2.7.2.2 The manufacturer shall have available detailed design documentation, which only needs to be provided if required by the testing authority. 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).

4.2.7.3 Software design

In order to ensure the reliability of the detector, 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 error in the program operation;

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

4.2.7.4 The storage of programs and data

The program necessary to comply with this standard 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 detector.

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

4.3 Nominal activation conditions/sensitivity

4.3.1 Reproducibility

The sensitivity of the detector shall not vary unduly from specimen to specimen and there is a need to establish response value data for comparison with the response values measured after the environmental tests. To confirm this, the detector shall be tested in accordance with 5.3.1.

4.3.2 Repeatability

The detector shall demonstrate a stable behaviour with respect to its sensitivity even after a number of alarm conditions. To confirm this, the detector shall be tested in accordance with 5.3.2.

4.3.3 Tolerance to beam misalignment

The operation of the detector should not be affected when subject to small angular inaccuracies in alignment (within the maximum stated by the manufacturer) resulting from installation and/or movement in the structure of a building. To confirm this, the detector shall be tested in accordance with 5.3.3.

4.3.4 Rapid changes in attenuation

The detector shall produce alarm or fault signals, within an acceptable time, after a sudden large sustained increase in beam attenuation. To confirm this, the detector shall be tested in accordance with 5.3.4.

4.3.5 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 detector's sensitivity to slowly developing fires. To confirm this, the detector shall be assessed in accordance with 5.3.5.

The detector shall be deemed to meet the requirements of this clause if:

a) for any rate of increase in smoke density R, which is greater than C/4 per hour (where C is the detector's initial uncompensated response value), the time for the detector to give an alarm does not exceed 1,6 × C/R by more than 100 s;

b) the range of compensation is limited such that, throughout this range, the compensation does not cause the response value of the detector to exceed its initial value by a factor greater than 1,6;

c) a fire signal cannot be cancelled by a fault which is caused by the detector reaching the compensation limit.

NOTE Further information about the assessment of these requirements is given in Annex H.

4.3.6 Optical path length dependence

The response value of the detector shall not change significantly when it is installed with the minimum and maximum optical path length stated by the manufacturer. To confirm this, the detector shall be tested in accordance with 5.3.6.

4.3.7 Stray light

The detector shall be immune to false alarms caused by stray light generated by artificial light sources. The response value of the detector shall not change significantly when subject to stray light. To confirm this, the detector shall be tested in accordance with 5.3.7.

4.4 Tolerance to supply voltage - Variation in supply parameters

Within the specified range(s) of the supply parameters (e.g. voltage) the sensitivity of the detector shall not be unduly dependent on these parameters. To confirm this, the detector shall be tested in accordance with 5.4.

4.5 Performance parameters under fire conditions - Fire sensitivity

The detector shall demonstrate adequate sensitivity to a broad spectrum of smoke types as required for general application in fire detection systems for buildings. To confirm this, the detector shall be tested in accordance with 5.5.1.

4.6 Durability of nominal activation conditions/sensitivity

4.6.1 Temperature resistance

4.6.1.1 Dry heat (operational)

The detector shall function correctly at high ambient temperatures, which may occur for short periods in the service environment. To confirm this, the detector shall be tested in accordance with 5.6.1.1.

4.6.1.2 Cold (operational)

The detector shall function correctly at low ambient temperatures appropriate to the anticipated service environment. To confirm this, the detector shall be tested in accordance with 5.6.1.2.

4.6.2 Humidity resistance

4.6.2.1 Damp heat, steady-state (operational)

The detector shall function correctly at high relative humidity (without condensation), which may occur for short periods in the anticipated service environment. To confirm this, the detector shall be tested in accordance with 5.6.2.1.

4.6.2.2 Damp heat, steady-state (endurance)

The detector shall withstand the long term effects of humidity in the service environment (e.g. changes in electrical properties of materials, chemical reactions involving moisture, galvanic corrosion). To confirm this, the detector shall be tested in accordance with 5.6.2.2.

4.6.3 Vibration resistance

4.6.3.1 Vibration (endurance)

The detector shall withstand the long term effects of vibration at levels appropriate to the service environment. To confirm this, the detector shall be tested in accordance with 5.6.3.1.

4.6.3.2 Impact (operational)

The detector shall withstand mechanical impacts upon its surface, which it may sustain in the normal service environment and which it can reasonably be expected to withstand. To confirm this, the detector shall be tested in accordance with 5.6.3.2.

4.6.4 Electrical stability - Electromagnetic Compatibility (EMC), Immunity tests (operational)

The detector shall be immune to Electromagnetic influences. To confirm this, the detector shall be tested in accordance with 5.6.4.

4.6.5 Corrosion resistance - Sulphur dioxide (SO_2) corrosion (endurance)

The detector shall withstand the corrosive effects of sulphur dioxide as an atmospheric pollutant. To confirm this, the detector shall be tested in accordance with 5.6.5.

5 Testing, assessment and sampling methods

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 as described in EN 60068-1 as follows:

a) temperature: (15 to 35) °C;

b) relative humidity: (25 to 75) %;

c) air pressure: (86 to 106) kPa.