SLOVENSKI STANDARD
oSIST prEN 54-12:2009

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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

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 72.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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Foreword

This document (prEN 54-12:2009) has been prepared by Technical Committee CEN/TC 72 “Fire detection and fire alarm systems”, the secretariat of which is held by BSI.

This document is currently submitted to the CEN Enquiry.

This document will supersede 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 EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

This standard has been prepared in cooperation with EURALARM (Association of European Manufacturers of Fire and Intruder Alarm Systems)

Information on the relationship between this European Standard and other standards of the EN 54 series is given in annex A of EN 54-1:1996

1 Scope

This European Standard specifies requirements, test methods and performance criteria for line smoke detectors utilising the attenuation and/or changes in attenuation of an optical beam, for use in fire detection systems installed in buildings.

This European Standard does not cover:

a) line smoke detectors designed to operate with separations between opposed components of less than 1 m;

b) line smoke detectors whose optical path length is defined or adjusted by an integral mechanical connection;

c) line smoke detectors 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 referenced documents are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 54-1:1996, *Fire detection and fire alarm systems — Part 1: Introduction*

EN 54-2:1997, *Fire detection and fire alarm systems — Part 2: Control and indicating equipment*

EN 54-2:1997/A1:2006, *Fire detection and fire alarm systems — Part 2: Control and indicating equipment*

EN 54-4:1997, *Fire detection and fire alarm systems — Part 4: Power supply equipment*

EN 54-4:1997/A1:2002, *Fire detection and fire alarm systems — Part 4: Power supply equipment*

EN 54-4:1997/A2:2006, *Fire detection and fire alarm systems — Part 4: Power supply equipment*

EN 54-7:2000; *Fire detection and fire alarm systems —Part 7: Point-type smoke detectors*

EN 54-7:2000/A1:2002; *Fire detection and fire alarm systems —Part 7: Point-type smoke detectors*

EN 54-7:2000/A2:2006; *Fire detection and fire alarm systems —Part 7: Point-type smoke detectors*

EN 50130-4:1995, *Alarm systems — Part 4: Electromagnetic compatibility — Product family standard:*

Immunity requirements for components of fire, intruder and social alarm systems

EN 50130-4/A1:1998, *Alarm systems — Part 4: Electromagnetic compatibility — Product family standard:*

Immunity requirements for components of fire, intruder and social alarm systems

EN 50130-4/A2:2003, *Alarm systems — Part 4: Electromagnetic compatibility — Product family standard:*

Immunity requirements for components of fire, intruder and social alarm systems

EN 60068-1:1994, *Environmental testing — Part 1: General and guidance*

EN 60068-2-1:2007, *Environmental testing — Part 2-1: Tests; Tests A: cold*

EN 60068-2-2:1993 +A1:1993, *Environmental testing – Part 2: Tests; Test B: dry heat*

EN 60068-2-27:1993, *Environmental testing – Part 2-27: Tests, Test Ea: shock*

EN 60068-2-30:2005, *Environmental testing – Part 2-30: Variant 1 test cycle and controlled recovery conditions: Damp heat, cyclic*

EN 60068-2-42:2003, *Environmental testing – Part 2-42: Tests, Test Kc: Sulphur dioxide, steady state*

EN 60068-2-6:1995, *Environmental testing – Part 2: Tests - Test Fc: Vibration, sinusoidal*

EN 60068-2-75:1997, *Environmental testing – Part 2-75: Tests, Test Eh for test Ehb: impact*

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

3 Terms and definitions

For the purposes of this European Standard the terms and definitions given in EN 54-1:1996 and the following apply.

3.1
line smoke 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 equation:

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

where

I_0 is the received intensity without reduction in intensity;

I is the received intensity after reduction in intensity.

3.8
response threshold value

Is given by the following equation :

$C = F * n_f / n_v$ 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, it's expressed in dB, of the reduction in intensity of the optical beam, defined by the following equation:
$F = 10 \log_{10}(I_0/ I)$
I_0 is the received intensity without reduction in intensity
I is the received intensity after reduction in intensity with the 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 the detector shall meet the requirements of this clause, which shall be verified by visual inspection or engineering assessment, shall be tested in accordance with clause 5 and shall meet the requirements of the tests.

4.2 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.

4.3 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.

4.4 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).

4.5 On-site adjustment of response threshold value

If there is provision for on-site adjustment of the response threshold 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.

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

4.6 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.

4.7 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.

4.8 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.

An assessment of the detector's response to slow increases in smoke density shall be made by analysis of the circuit/software, and/or simulations. If this is not possible a physical test may be carried out at the minimum rate of increase smoke density.

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

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 threshold value), the time for the detector to give an alarm does not exceed $1,6 \times C/R$ by more than 100 s; and

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

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

4.9 Marking

Each component (receiver, transmitter, transmitter - receiver) shall be clearly marked with the following information:

a) the number of this standard (i.e. EN 54-12);

b) the name or the trademark of the manufacturer or supplier;

c) the component designation (type or number);

   1) the wiring terminal designations;

   2) a mark or code (e.g. a 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), e) , and the base shall be marked with, at least c) (i.e. its own model designation) and d).

The information corresponding to a), b) and c) shall be marked clearly on each reflector.

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 shall be visible during installation and shall be accessible during maintenance.

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

NOTE Further marking requirements are defined in annex ZA

4.10 Documentation

4.10 General

Detectors shall either be supplied with sufficient technical, installation and maintenance data to ensure their correct installation and operation or, if all of these data are not supplied with each detector, reference to the appropriate data sheet be given on, or with each detector. These data shall include at least:

a) the maximum angular misalignment. If this is different for the transmitter, receiver or reflector or different for vertical or horizontal misalignment, this shall be stated;

b) the response threshold value of the detector in dB. If the response can be adjusted the minimum and maximum response threshold values, and any setting of response behaviour that does not comply with this standard, shall be stated; The recommended sensitivity settings corresponding to different separations shall be provided in the documentation from the manufacturer;

c) the minimum and maximum separation.

NOTE Additional information may be required by organisations certifying that the detectors produced by a manufacturer conform to the requirements of this standard. The manufacturer shall supply documents that provide the information as requested in point b.

4.11 Additional requirements for software controlled detectors

4.11.1 General

For detectors which rely on software control in order to fulfil the requirements of this standard, the requirements of 4.9.2, 4.9.3 and 4.9.4 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 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.

NOTE 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.

4.11.2.2 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;

4) 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;

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

4.11.3 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.

4.11.4 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.

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 as described in EN 60068-1 as follows:

— temperature: 15 °C to 35 °C;

— relative humidity: 25 % to 75 %;

— air pressure: 86 kPa to 106 kPa.

NOTE If variations in these parameters have a significant effect on a measurement, then such variations should be kept to a minimum during a series of measurements carried out as part of one test on one specimen.

5.1.2 Operating conditions for tests

If a test method requires a specimen to be operational, the specimen shall be connected to suitable supply and monitoring equipment with characteristics as required by the manufacturer's data. Unless otherwise specified in the test method, the supply parameters applied to the specimen shall be set within the manufacturer's specified range(s) and shall remain substantially constant throughout the tests. The value chosen for each parameter shall normally be the nominal value, or the mean of the specified range.

If a test procedure requires a specimen to be monitored to detect any alarm or fault signals, then connections shall be made to any necessary ancillary devices (e.g. through wiring to an end-of-line device for conventional detectors) to allow a fault signal to be recognised.

NOTE The details of the supply and monitoring equipment and the alarm criteria used shall be given in the test report.

5.1.3 Mounting arrangements

The specimen shall be mounted by its normal means of attachment and aligned in accordance with the manufacturer's instructions. If these instructions describe more than one method of mounting, the method considered to be most unfavourable shall be chosen for each test.

5.1.4 Tolerances

Unless otherwise stated, the tolerances for the environmental test parameters shall be as given in the basic reference standards for the test (e.g. the relevant Part of IEC/EN 60068).

If a requirement or a test procedure does not specify a tolerance or deviation limits, deviation limits of ± 5 % shall be applied.

5.1.5 Measurement of response threshold value

5.1.5.1 General

The specimen, for which the response threshold value is to be measured, shall be installed on the measuring bench, conforming to annex A, in its normal operating position, by its normal means of attachment in accordance with 5.1.3.

The specimen shall be connected to its supply and monitoring equipment in accordance with 5.1.2, and shall be allowed to stabilize for at least 15 min. unless otherwise specified by the manufacturer.

The response threshold value shall be recorded as *C*.

5.1.5.2 Operating conditions

On a rigid support assemble the receiver at a longitudinal distance of at least 500 mm from the transmitter or the transmitter - receiver at the same distance from the reflector (see Figure A.1), then place a filter holder as close as possible to the front of the receiver, adjusting the filter holder so that the whole beam passes through the filter. This filter holder shall be used to mount the filters used during the measurement of response threshold value.

The height *h* separating the axis of the optical beam above the support shall be 10 times the diameter (or the vertical dimension) of the optical system of the receiver.

Adjustment for path length or alignment, if required, shall be carried out in accordance with the manufacturer's instructions.

Unless otherwise stated in a test procedure, the response threshold value shall be measured with a simulated maximum separation carried out using means agreed by the manufacturer.

5.1.5.3 Measurements

The response threshold value is determined by the value of the lowest value test filter required to give an alarm within 30 s after introduction in the beam. The minimum resolution for optical density filters shall be in accordance with Table A.1 (see annex A).

5.1.6 Provision for tests

The following shall be provided for testing compliance with this standard:

a) seven detectors;

b) the documentation required in 4.10

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

NOTE This implies that the mean response threshold value of the seven specimens, found in the reproducibility test should also represent the production mean, and that the limits specified in the reproducibility test should also be applicable to the manufacturer's production.

5.1.7 Test schedule

The specimens shall be tested in accordance with the test schedule in Table 1. After the reproducibility test, the two least sensitive specimens (i.e. those with the highest response thresholds) shall be numbered 6 and 7, and the others shall be numbered 1 to 5.

Table 1 — Test Schedule

Test	Clause	Specimen N°(s)
Reproducibility	5.2	all specimens
Repeatability	5.3	2
Tolerance to beam misalignement	5.4	1
Variation of supply parameters	5.5	1
Rapid changes in attenuation	5.6	1
Optical path length dependence	~~5.7~~	~~1~~
Fire sensitivity	5.8	6 and 7
Stray light	5.9	6
Dry heat (operational)	5.10	3
Cold (operational)	5.11	3
Damp heat, steady state (operational)	5.12	2
Damp heat, steady state (endurance)	5.13	2
Vibration (endurance)	5.14	7
Electromagnetic compatibility (EMC), immunity tests (operational)	5.15	4 [a] 6 [a]
Sulphur dioxide SO_2 corrosion (endurance)	5.16	5
Impact (operational)	5.17	1

[a] In the interests of test economy, it is permitted to use the same specimen for more than one EMC test. In that case, intermediate functional test(s) on the specimen(s) used for more than one test may be deleted, and the functional test conducted at the end of the sequence of tests. However it should be noted that in the event of a failure, it may not be possible to identify which test exposure caused the failure (see clause 4 of EN 50130-4:1995).