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Sistemi za odkrivanje in javljanje požara ter alarmiranje - Kombinirani točkovni javljalniki požara

Fire detection and fire alarm systems - Point detectors using a combination of detected fire phenomena

Brandmeldeanlagen - Teil 15: Punktförmige Mehrfachsensormelder

Systemes de détection et d'alarme incendie - Partie 15 : Détecteurs ponctuels fonctionnant sur le principe d'une combinaison de phénomènes détectés

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Fire detection and fire alarm systems - Point detectors using a combination of detected fire phenomena

Systèmes de détection et d'alarme incendie - Partie 15 : Détecteurs ponctuels fonctionnant sur le principe d'une combinaison de phénomènes détectés

Brandmeldeanlagen - Teil 15: Punktförmige Mehrfachsensormelder

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Foreword

This document (prEN 54-15:2006) 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 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.

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

Part 13: Compatibility assessment of system components

Part 14: Guidelines for planning, design, installation, commissioning, use and maintenance

Part 15: Point type multi-sensor fire detectors

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: Line-type heat detectors

Part 23: Fire alarm devices - Visual alarms

Part 24: Components of voice alarm systems – Loudspeakers

Part 25: Components using radio links and system requirements

1. Scope

The European Standard prEN 54-15 specifies requirements, test methods and performance criteria for point-type multi-sensor fire detectors for use in fire detection systems installed in buildings (see EN 54-1:1996), incorporating in one mechanical enclosure sensors which detect more than one physical or chemical phenomenon of a real fire. The overall fire performance is determined utilising a combination of the detected phenomena. The allowed phenomena are: aerosol (i.e. smoke), heat, combustion gases and electromagnetic radiation.

Multi-sensor fire detectors with special characteristics and developed for specific risks are not covered by this standard.

NOTE 1 Tests are included to confirm that detectors do not rely solely on a direct line of sight between the fire and the detector.

NOTE 2 Certain types of detector contain radioactive materials. The national requirements for radiation protection differ from country to country and they are not specified in this standard.

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.

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

EN 54-5: 2000, *Fire detection and fire alarm system — Part 5: Heat detectors — Point detectors, + A1 2002*.

EN 54-7:2000, *Fire detection and fire alarm systems — Part 7: Smoke detectors – Point detectors using scattered light or ionization, + A1 2002*.

EN 54-10:2001, *Fire detection and fire alarm systems — Part 10: Flame detectors — Point 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 + A1:1998, A2:2003*.

EN 60068-2-1:1993, *Environmental testing — Part 2: Tests — Tests A: Cold, + A1:1993, A2:1994*.

EN 60068-2-6:1995, *Environmental testing — Part 2: Tests — Test Fc: Vibration (sinusoidal), + Corr.:1995*.

EN 60068-2-27:1993, *Basic environmental testing procedures – Part 2: Tests — Test Ea and guidance: Shock*.

IEC 60068-1:1988, *Environmental testing — Part 1: General and guidance.*

IEC 60068-2-3:1969, *Basic environmental testing procedures — Part 2: Tests — Test Ca: Damp heat, steady state, + A1:1984*.

IEC 60068-2-30:2005, *Environmental testing — Part 2: Tests — Test Db: Damp heat, cyclic (12 h + 12-hour cycle), +A1:1985*.

IEC 60068-2-42:2003, *Environmental testing — Part 2: Tests —Test Kc: Sulfur dioxide test for contacts and connections*.

IEC 60068-2-56:1988, *Environmental testing — Part 2: Tests — Test Cb: Damp heat steady state, primarily for equipment*.

ISO 209-1:1989, *Wrought aluminium and aluminium alloys — Chemical composition and forms of products — Part 1: Chemical composition*.

3. Terms and definitions

For the purposes of this standard, the terms and definitions given in EN 54-1:1996 and the following apply:

3.1 response threshold value
aerosol density in the proximity of the specimen at the moment that it activates an alarm signal

NOTE 1 See 5.1.5.

NOTE 2 The response threshold value may depend on signal processing in the detector and in the control and indicating equipment.

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 as described in clause 5 and shall meet the requirements of the tests.

4.2 Individual alarm indication

Each detector shall be provided with an integral red visual indicator, which shall be activated at the same time as the alarm and shall remain activated until the alarm condition is reset, to enable identification of the individual detector. Where other conditions of the detector can be visually indicated, they 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. The visual indicator shall be visible from a distance of 6 m directly below the detector, in an ambient light intensity up to 500 lux.

4.3 Connection of ancillary devices

Where 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 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.

4.5 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.

4.6 On-site adjustment of response behaviour

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

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

4.7 Protection against the ingress of foreign bodies

The detector shall be so designed that a sphere of diameter (1,3 ± 0,05) mm cannot pass into the sensor chamber(s).

NOTE 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 may introduce the danger of clogging by dust etc. It may therefore be necessary to take other precautions against false alarms due to the entry of small insects.

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.

Since it is not practical to make tests with very slow increases of the measured phenomena, an assessment of the detector's response to slowly developing fires 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 clause if this assessment shows that:

a) for any rate of increase in smoke density R of smoke of the composition produced by test fire TF2, which is greater than $A/4$ per hour (where A is the detector's initial uncompensated response threshold value), the time for the detector to give an alarm does not exceed 1,6 x A/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 N.

4.9 Marking

Each detector shall be clearly marked with the following information:

a) the number of this standard (i.e. EN 54-15);

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

c) the model designation (type or number);

d) the wiring terminal designations;

e) 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 e), and the base shall be marked with, at least c) (i.e. its own model designation) and d).

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 of the detector and shall be accessible during maintenance.

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

4.10 Data

Detectors shall either be supplied with sufficient technical, installation and maintenance data to enable their correct installation and operation[1)] or, if all of these data are not supplied with each detector, reference to the appropriate data sheet shall be given on, or with, each detector.

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 4.11.2, 4.11.3 and 4.11.4 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.

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;

[1)] 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.

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).

4.11.3 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 stabilise in the standard atmospheric conditions for testing as described in IEC 60068-1:1988+A1:1992 as follows:

a) temperature: (15 to 35) °C;

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

c) air pressure: (86 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, then 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 should be given in the test report.

5.1.3 Mounting arrangements

The specimen shall be mounted by its normal means of attachment in accordance with the manufacturer's instructions. If these instructions describe more than one method of mounting then 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 60068).

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

5.1.5 Measurement of response threshold values

5.1.5.1 Fire test room

The measurement of response threshold values shall be conducted in a rectangular room with a flat horizontal ceiling, and the following dimensions:

Length:	9 m to 11 m;
Width:	6 m to 8 m;
Height:	3,8 m to 4,2 m.

The fire test room shall be equipped with at least the following measuring instruments arranged as indicated in Annex B:

Measuring ionisation chamber (MIC);

Obscuration meter;

Temperature probe with a time constant not greater than 2 s, when measured in air with a mass flow equivalent to (0,8 ± 0,1) ms^{-1} at 25°C.

5.1.5.2 Test fires

The specimens shall be subjected to the test fires specified in the test procedure (see Annex C to Annex H). The type, quantity and arrangement of the fuel and the method of ignition are described in Annex C to Annex H, for each test fire, along with the end of test condition and the required profile curve limits.

In order to be a valid test fire, the development of the fire shall be such that the profile curves of *m* against *y* and *m* against time fall within the specified limits, up to the time when all of the specimens have generated an alarm signal or the end of test condition is reached, which ever is the earlier. If these conditions are not met then the test is invalid and shall be repeated. It is permissible, and may be necessary, to adjust the quantity, condition (e.g. moisture content) and arrangement of the fuel to obtain valid test fires. When the requirements in tests include a comparison of response threshold value from two different fire tests, no adjustment is allowed between the two tests.

5.1.5.3 Mounting of the specimens

The specimens shall be mounted on the fire test room ceiling in the designated area (see Annex B). The specimens shall be mounted in accordance with the manufacturer's instructions, such that they are in the orientation specified in the test procedure, relative to an assumed air flow from the centre of the room to the specimen.

Each specimen shall be connected to its supply and monitoring equipment, as described in 5.1.2, and shall be allowed to stabilize in its quiescent condition before the start of each test fire.

NOTE Detectors which dynamically modify their sensitivity in response to varying ambient conditions may require special reset procedures and/or stabilization times. The manufacturer's guidance should be sought in such cases to ensure that the state of the detectors at the start of each test is representative of their normal quiescent state.

5.1.5.4 Initial conditions

Before each test fire the room shall be ventilated with clean air until it is free from fire products, and so that the conditions listed below can be obtained.

The ventilation system shall then be switched off and all doors, windows and other openings shall be closed. The air in the room shall then be allowed to stabilize, and the following conditions shall be obtained before the test is started:

Air temperature T:	(23 ± 5) °C;
Air movement:	negligible;
Smoke density (ionization):	$y \leq 0{,}05$;
Smoke density (optical):	$m \leq 0{,}02$ dB m^{-1};

NOTE 1 The equations for m and y are given in Annex A.

NOTE 2 The stability of the air and temperature affects the flow of fire products within the room. This is particularly important for the test fire TF2, which produces low thermal lift for the fire products. It is therefore recommended that the difference between the temperature near the floor and the ceiling is < 2 K, and that local heat sources that can cause convection currents (e.g. lights and heaters) should be avoided. If it is necessary for people to be in the room at the beginning of a test fire, they should leave as soon as possible, taking care to produce the minimum disturbance to the air.

NOTE 3 For certain detectors it may be necessary to stabilise the initial conditions of additional parameters (e.g. CO concentration). The manufacturer's guidance should always be sought concerning special requirements for detectors with gas sensors that could be significantly influenced by the normally occurring contaminations in a fire test room.

5.1.5.5 Recording of the fire parameters and response values

During each test fire the following fire parameters shall be recorded continuously or at least once per second (see Table 1).

Table 1 – Fire parameters

Parameter	Symbol	Units
Temperature change	ΔT	K
Smoke density (ionization)	y	Dimensionless
Smoke density (optical)	m_a	dB m^{-1}

The alarm signal given by the supply and monitoring equipment shall be taken as the indication that a specimen has responded to the test fire.

For each specimen the smoke density m_a (dB m^{-1}) shall be recorded at the moment of response and taken as the response threshold value.

5.1.6 Provision for tests

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

a) for the test schedule specified in Table 2: 27 detectors, including base if necessary;
for the alternative test schedule described in Table 3 (see 5.1.8): 13 detectors, including base if necessary;

b) the data specified in 4.10.

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

5.1.7 Test schedule

The specimens shall be tested in accordance with the test schedule specified in Table 2. The specimen shall be numbered 1 to 27 arbitrarily.

Table 2 — Test schedule

Clause	Test	Specimen [a]	Specimen orientation	Test fires	Fire testing which may be combined
5.2	Fire sensitivity (part 1) and directional dependence	1 to 8	2 at 0° [b] 2 at 90° 2 at 180° 2 at 270°	TF 2 and TF 5	
5.3	Fire sensitivity (part 2)	6 from 1 to 8	Same as 5.2	TF 1, TF 3, TF 4 and TF 8	
5.4	Repeatability and response after alarm reset	2 from 1 to 8	Same as 5.2	TF 2 and TF 5	5.4, 5.5, 5.7
5.5	Variation in supply parameters	9 to 10	Least sensitive	TF 2 and TF 5	5.4, 5.5, 5.7
5.6	Air movement (gusts)	10	4 different	no TF required	
5.7	Dazzling (non-alarm and performance)	10 and 11	2 different	TF 2 and TF 5	5.4, 5.5, 5.7
5.8	Dry heat (operational)	12	Least sensitive orientation	TF 2 and TF 5	
5.9	Cold (operational)	13	Least sensitive orientation	TF 2 and TF 5	5.9, 5.10, 5.14, 5.15, 5.16, 5.17, 5.18
5.10	Damp heat, steady state (endurance)	14	Least sensitive orientation	TF 2 and TF 5	5.9, 5.10, 5.14, 5.15, 5.16, 5.17, 5.18
5.11	Damp heat, cyclic (operational)	15	Least sensitive orientation	no TF required	
5.12	Low humidity, steady state (operational)	16 and 17	Least sensitive orientation	TF 2 and TF 5	5.12 and 5.13
5.13	High humidity, steady state (operational)	18 and 19	Least sensitive orientation	TF 2 and TF 5	5.12 and 5.13
5.14	Sulphur dioxide (SO2) corrosion (endurance)	20	Least sensitive orientation	TF 2 and TF 5	5.9, 5.10, 5.14, 5.15, 5.16, 5.17, 5.18