SLOVENSKI STANDARD
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Sistemi za odkrivanje in javljanje požara ter alarmiranje - 30. del: Večsenzorski javljalniki požara - Točkovni javljalniki s senzorjema za zaznavanje ogljikovega monoksida in toplote

Fire detection and fire alarm systems - Part 30: Multi-sensor fire detectors - Point detectors using a combination of carbon monoxide and heat sensors

Brandmeldeanlagen - Teil 30: Mehrfachsensor-Brandmelder - Punktförmige Melder mit kombinierten CO- und Wärmesensoren

Système de détection et d'alarme incendie - Partie 30: Détecteurs d'incendie multicapteurs - Détecteurs ponctuels combinant l'utilisation de capteurs de monoxyde de carbone et de capteurs de chaleur

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Fire detection and fire alarm systems - Part 30: Multi-sensor fire detectors - Point detectors using a combination of carbon monoxide and heat sensors

Système de détection et d'alarme incendie - Partie 30: Détecteurs d'incendie multicapteur - Détecteurs ponctuels utilisant une combinaison de capteurs de monoxide de carbone et de température

Brandmeldeanlagen - Teil 30: Mehrfachsensor-Brandmelder - Punktförmige Melder mit kombinierten CO- und Wärmesensoren

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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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Foreword

This document (prEN 54-30:2009) 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 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.

Introduction

Carbon monoxide (CO) is a product of the incomplete combustion of carbon-based materials. CO fire detectors can react promptly to smouldering fires involving carbonaceous materials because CO does not depend solely on convection, but also moves by diffusion. CO fire detectors might be better suited to applications where other fire detection techniques are prone to false alarms, for example due to dust, steam and cooking vapours. Detectors based on the use of CO sensors alone are covered by EN 54-26.

Some fires may not produce a sufficient amount of CO to trigger an alarm condition from a detector complying with EN 54-26. These are typically free-burning, open, well ventilated fires. The inclusion of heat sensing combined with CO sensing can increase the sensitivity of such a detector to these types of fires.

A number of different methods for sensing CO are suitable. However, most sensors will also be influenced by other gases and phenomena. Tests have therefore been included in the test schedule to assess cross-sensitivity to substances normally present in the service environment that may affect the performance of the detector.

Test Fires TF2, TF3, TF4 and TF5 from EN 54-7 have been included to verify the detection performance. TF4 and TF5 specifically demonstrate the influence of the heat sensor(s). For these Test Fires, the CO level and, where applicable, the temperature is used as test validity criteria.

Detectors may have modes of operation, in which only one fire phenomenon is evaluated. This standard does not include tests for additional alarm outputs corresponding to the sensing of only one fire phenomenon. Reference should be made to other parts of EN 54 which may cover such modes of operation or outputs.

1 Scope

This European Standard 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), incorporating in one mechanical enclosure at least one carbon monoxide sensor and at least one heat sensor. The overall fire detection performance is determined utilizing the combination of the detected phenomena.

Multi-sensor fire detectors having special characteristics suitable for the detection of specific fire risks are not covered by this standard. The performance requirements for any additional functions are beyond the scope of this standard (e.g. additional features or enhanced functionality for which this standard does not define a test or assessment method).

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 54-5:2000, *Fire detection and fire alarm systems — Part 5: Heat detectors – Point detectors*
EN 54-5:2000/A1:2002, *Fire detection and fire alarm systems — Part 5: Heat detectors – Point detectors*

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

EN 54-7:2000/A1:2002, *Fire detection and fire alarm systems — Part 7: Smoke detectors — Point detectors using scattered light, transmitted light or ionization*
EN 54-7:2000/A2:2006, *Fire detection and fire alarm systems — Part 7: Smoke detectors — Point detectors using scattered light, transmitted light or ionization*

EN 54-26, *Fire detection and fire alarm systems — Part 26: Point fire detectors using carbon monoxide sensors*

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 50130-4:1995/A1:1998, *Alarm systems — Part 4: Electromagnetic compatibility — Product family standard: immunity requirements for components of fire, intruder and social alarm systems*
EN 50130-4:1995/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; Test A: Cold*

EN 60068-2-2:1993, Environmental testing — Part 2-2: Tests; Tests B; Dry heat
EN 60068-2-2:1993/A1:1993, Environmental testing — Part 2-2: Tests; Tests B; Dry heat

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

EN 60068-2-27:1993, *Environmental testing, Test methods, Environmental testing procedures — Part 2-27: Tests; Test Ea & Guidance: Shock*

EN 60068-2-30:2005, *Environmental testing — Part 2–30: Tests; Test Db: Damp heat, cyclic (12+12 hour cycle)*

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

EN 60068-2-75:1997, *Environmental testing — Part 2-75: Tests — Test Eh: Hammer*

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

EN ISO 9001:2000, *Quality management systems – Requirements (ISO 9001:2000)*

3 Terms and definitions

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

3.1
CO response threshold value
CO concentration in the proximity of the specimen at the moment that it generates an alarm signal, when tested as described in 5.1.5

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

3.2
rate-sensitive
behaviour of a detector that depends on the rate of change of CO concentration

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, by which the individual detector that released an alarm, can be identified, until the alarm condition is reset. 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 Rate-sensitive CO response

The CO response threshold value of the detector may depend on the rate of change of CO concentration in the vicinity of the detector. Such behaviour may be incorporated in the detector design to improve the discrimination between ambient CO levels and those generated by a fire. If such rate sensitive behaviour is included then it shall not lead to a significant reduction in the detector's sensitivity to fires, nor to a significant increase in the probability of false alarm.

Since it is not practical to make tests with all possible rates of increase in CO concentration, an assessment of the detector's rate sensitivity 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 for constant temperatures between the lower and upper limits of the temperature range as defined by the manufacturer:

a) for any rate of increase in CO concentration less than 1 µl/l per minute the detector will signal an alarm condition before the CO concentration reaches 60 µl/l, and;

b) the detector does not signal an alarm condition when subjected to a step change in CO concentration of 10 µl/l, superimposed on a background level between 0 and 3 µl/l.

4.8 Position of the heat sensors

Detector shall be constructed such that, at least, part of the heat sensing element(s) of its heat sensor(s) shall not be less than 15 mm from the mounting surface of the detector.

4.9 Marking

Each detector shall be clearly marked with the following information:

a) the number and date of this standard (i.e. EN 54-30:xxxx);

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 marking 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 this data is not supplied with each detector, reference to the appropriate data sheet shall be given on, or with each detector.

NOTE Additional information may be required by organisations certifying that detectors produced by a manufacturer conform to the requirements of this standard.

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 Design overview

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);

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1) To enable correct operation of the detectors, this 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.

c) a designation, by which the software and its version can be uniquely identified.

4.11.3 Design detail

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).

4.11.4 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.

4.11.5 The storage of programs and data

The program necessary to comply with this standard and any pre-set 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 Test 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 60068-1:1994 as follows:

— temperature: (15 to 35) °C;

— relative humidity: (25 to 75) %;

— 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.

The ambient concentration of CO shall not exceed 3 µl/l.

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 and in its normal orientation in accordance with the manufacturer's instructions. If these instructions describe more than one method of mounting, or more than one acceptable orientation, 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 EN 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 CO response threshold value

The specimen, for which the CO response threshold value is to be measured, shall be installed in the gas test chamber, described in Annex A, in its normal operating position, by its normal means of attachment. The orientation of the specimen, relative to the direction of airflow, shall be the least sensitive orientation, as determined in the directional dependence test, unless otherwise specified in the test procedure.

Before commencing each measurement, the gas test chamber shall be purged with clean air to ensure that the concentration of CO in the gas test chamber is less than 1,5 µl/l.

The air velocity in the proximity of the specimen shall be (0,2 ± 0,04) m/s during the measurement, unless otherwise specified in the test procedure.

Unless otherwise specified in the test procedure, the air temperature in the gas test chamber shall be (23 ± 5)°C and shall not vary by more than 5 K for all the measurements.

The specimen shall be connected to its supply and monitoring equipment as described in 5.1.2, and shall be allowed to stabilise for a period of at least 15 min, unless otherwise specified by the manufacturer.

CO shall be introduced into the gas test chamber such that the rate of increase of CO concentration is between 1 µl/l per minute and 6 µl/l per minute, unless otherwise specified in the test procedure. For detectors with a rate sensitive behaviour, the manufacturer may specify a rate of increase within this range to ensure that the measured CO response threshold value is representative of the static CO response threshold value of the detector.

The rate of increase in CO concentration shall be similar for all measurements on a particular detector type.

The CO concentration at the moment that the specimen gives an alarm shall be recorded as S (µl/l). This shall be taken as the CO response threshold value.

5.1.6 Measurement of heat response threshold value

Where detectors comply with EN 54-5:2000 as amended by EN 54-5:2000/A1:2002, the response times measured in those tests may be used as the heat response values for the purposes of this standard.

The specimen for which the temperature response value is to be measured shall be installed in a heat tunnel, as specified in Annex E, in its normal operating position, by its normal means of attachment. The orientation of the specimen, relative to the direction of airflow, shall be the least sensitive one, as determined in the directional dependence test (5.4), unless otherwise specified in the test procedure.

The specimen shall be connected to its supply and indicating equipment as specified in 5.1.2, and allow it to stabilize for at least 15 min.

Before the test, the temperature of the air stream and the specimen shall be stabilized to (25 ± 2) °C. The air stream shall be maintained at a constant mass flow equivalent to a velocity of (0,8 ± 0,1) m/s at 25 °C.

The air temperature shall be increased at a rate specified in the test until either an alarm signal has been generated or a designated signal specified by the manufacturer is produced by the heat sensor. This signal shall be routed via any applicable amplification circuit and algorithm hardware.

NOTE If the detector is not capable of giving an alarm signal from heat alone, it will be necessary for the manufacturer to provide special means by which the designated heat response signal can be evaluated. For example, it may be acceptable to provide a supplementary output that varies with temperature, or specially modified software to indicate when the air temperature has caused an internal threshold to be reached. In such cases the special means should preferably be chosen such that the nominal heat response value corresponds to a response time between the minimum and maximum times given in Table 4 of EN 54-5:2000 as amended by EN 54-5:2000/A1:2002-5 for a class A2 detector.

The heat response value shall be assessed as the time taken from the start of the temperature increase to the point at which the heat response signal specified by the manufacturer is produced, or the detector gives an alarm signal.

The measured heat response value shall be recorded as T.

5.1.7 Provision for tests

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

a) for detachable detectors; twenty six detector heads and bases; for non-detachable detectors; twenty six specimens.

b) the data required in 4.10.

NOTE 1 Detachable detectors comprise at least two parts; a base (socket) and a head (body). If the specimens are detachable detectors, then the two, or more, parts together are regarded as a complete detector.

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

NOTE 2 This implies that the mean response threshold value of the twenty six specimens found in the reproducibility tests, 5.6 and 5.7 should also represent the production mean, and that the limits specified in the reproducibility test should also be applicable to the full sensitivity range anticipated during production.

5.1.8 Test schedule

The specimens shall be tested according to the following test schedule (see Table 1). After the reproducibility of CO response test, the four least sensitive specimens (i.e. those with the highest CO response thresholds) shall be numbered 23 to 26, and the others shall be numbered 1 to 22 arbitrarily.

Table 1 — Test schedule

Test	Clause	Specimen No(s)
Repeatability of CO response	5.2	one chosen arbitrarily
Directional dependence of CO response	5.3	one chosen arbitrarily
Directional dependence of heat response	5.4	one chosen arbitrarily
Lower limit of heat response	5.5	1
Reproducibility of CO response	5.6	all specimens
Reproducibility of heat response	5.7	all specimens
Long term stability (operational)	5.8	2
Variation in supply parameters	5.9	3
Air movement	5.10	4
Dry heat (operational)	5.11	5
Dry heat (endurance)	5.12	6
Cold (operational)	5.13	7
Damp heat, cyclic (operational)	5.14	8
Damp heat, steady state (operational)	5.15	9
Damp heat, steady state (endurance)	5.16	10
Low humidity steady state (operational)	5.17	11
Sulphur dioxide SO_2 corrosion (endurance)	5.18	12
Shock (operational)	5.19	13
Impact (operational)	5.20	14
Vibration, sinusoidal (operational)	5.21	14
Vibration, sinusoidal (endurance)	5.22	15
Exposure to chemical agents at environmental concentrations	5.23	16
Exposure to high levels of carbon monoxide	5.24	17
Electromagnetic Compatibility (EMC), immunity tests (operational)	5.25[a]	
— Electrostatic discharge (operational)		18
— Radiated electromagnetic fields (operational)		19
— Conducted disturbances induced by electromagnetic fields (operational)		20
— Fast transient bursts (operational)		21
— Slow high energy voltage surge (operational)		22
Fire sensitivity	5.26	23, 24, 25, 26

[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 can 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 as amended by EN 54130-4:1995/A1:1998 and EN 54130-4:1995/A2:2003).

5.2 Repeatability of CO response

5.2.1 Object

To show that the detector has stable behaviour with respect to its sensitivity to CO even after a number of alarm conditions.

5.2.2 Test procedure

The response threshold value of the specimen to be tested shall be measured as described in 5.1.5 six times.

The specimen's orientation relative to the direction of airflow is arbitrary, but it shall be the same for all six measurements.

The maximum response threshold value shall be designated S_{max}, the minimum value shall be designated S_{min}.

5.2.3 Requirements

The detector shall be deemed to comply with the requirements of this sub-clause if:

a) the ratio of the response threshold values S_{max} : S_{min} shall be not greater than 1,6; and

b) the lower response threshold value S_{min} shall be not less than 25 µl/l.

5.3 Directional dependence of CO response

5.3.1 Object

To confirm that the sensitivity of the detector to CO is not unduly dependent on the direction of airflow around the detector.

5.3.2 Test procedure

The response threshold value of the specimen to be tested shall be measured eight times as described in 5.1.5, the specimen being rotated 45º. about its vertical axis between each measurement, so that the measurements are taken for eight different orientations relative to the direction of air flow.

The maximum response threshold value shall be designated S_{max}, the minimum value shall be designated S_{min}

The orientations, for which the maximum and minimum response threshold values were measured, shall be noted.

In the following tests the orientation for which the maximum response threshold was measured is referred to as the least sensitive orientation, and the orientation for which the minimum response threshold was measured is referred to as the most sensitive orientation.

5.3.3 Requirements

The detector shall be deemed to comply with the requirements of this sub-clause if:

a) the ratio of the response threshold values S_{max} : S_{min} shall not be greater than 1,6; and

b) the lower response threshold value S_{min} shall not be less than 25 µl/l.