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Sistemi za odkrivanje in javljanje požara ter alarmiranje - 27. del: Dimni javljalnik za nadzor prezračevalnih kanalov

Fire detection and fire alarm systems - Part 27: Duct smoke detectors

Brandmeldeanlagen - Teil 27: Rauchmelder zur Überwachung von Lüftungsleitungen

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Fire detection and fire alarm systems - Part 27: Duct smoke detectors

Brandmeldeanlagen - Teil 27: Rauchmelder zur Überwachung von Lüftungsleitungen

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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Contents

Page

Foreword.....	3
Introduction	4
1 Scope	6
2 Normative references	6
3 Terms, abbreviated terms and definitions	7
4 Requirements	8
5 Test methods	11
Annex A (normative) Aerosol tunnel arrangement for response measurements	28
Annex B (normative) Test aerosol for response threshold value measurements	29
Annex C (normative) Smoke measuring instruments	30
Annex D (normative) Apparatus for dazzling test	34
Annex E (normative) Fire test room and working volume arrangements for fire tests	35
Annex F (normative) Smouldering (pyrolysis) wood fire (TF2D)	37
Annex G (normative) Flaming plastics (polyurethane) fire (TF4D)	40
Annex H (normative) Low temperature black smoke (decaline) liquid fire (TF8D)	42
Annex I (informative) Information concerning the construction of the tunnel for fire tests	44
Annex J (informative) Information concerning the construction of the measuring ionization chamber	46
Annex ZA (informative) Clauses of this European Standard addressing the provisions of the EU Construction Products Directive (89/106/EEC)	48

Foreword

This document (prEN 54-27:2008) 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 EC Directive(s).

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

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

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

Part 26: Point fire detectors using carbon monoxide sensors

Part 27: Duct smoke detectors

Introduction

Duct smoke detectors (DSD) are used as part of a fire detection and fire alarm system or as a stand alone actuator for a fire protection system to sample the environment within air ducts of a building. Detection of smoke will release a signal to the connected control and indicating equipment and may be used as a signal to an air-handling system to prevent the spread of smoke within the building.

A DSD is required to function satisfactorily not only in the event of a fire, but also during and after exposure to conditions likely to be met in practice such as corrosion, vibration, direct impact, indirect shock and electromagnetic interference. Some tests specified are intended to assess the performance of the DSD under such conditions.

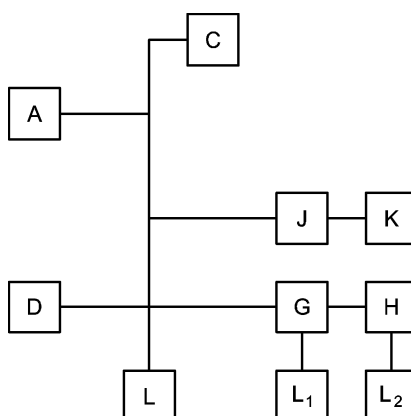
The performance of DSD is assessed from results obtained in specific tests. This document is not intended to place any other restrictions on the design and construction of such equipment.

A stand alone system is given in Figure 1. An example for a configuration of a fire detection and fire alarm system is given in Figure 2, see also EN 54-1.

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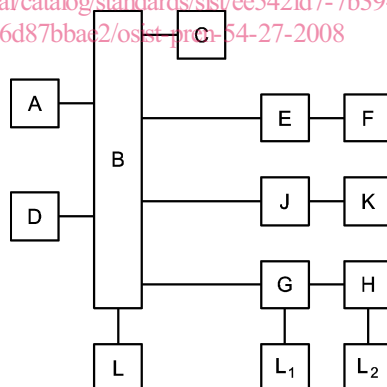


Key

- | | | | |
|---|------------------------------------|----------------|---------------------------------|
| A | Fire detector(s), e.g. DSD | J | Fault warning routing equipment |
| C | Fire alarm device(s) | K | Fault warning receiving station |
| D | Manual call point(s) | L | power supply equipment |
| G | Control for fire protection system | L ₁ | power supply for G |
| H | Fire protection system | L ₂ | power supply for item H |

Figure 1 — Example for a stand alone system configuration

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Key

- | | | | |
|---|------------------------------------|----------------|---------------------------------|
| A | Fire detector(s), e.g. DSD | H | Fire protection system |
| B | Control and indicating equipment | J | Fault warning routing equipment |
| C | Fire alarm device(s) | K | Fault warning receiving station |
| D | Manual call point(s) | L | power supply equipment |
| E | Fire alarm routing equipment | L ₁ | power supply for G |
| F | Fire alarm receiving equipment | L ₂ | power supply for item H |
| G | Control for fire protection system | | |

Figure 2 — Example for a configuration of a fire detection and fire alarm system

1 Scope

This document specifies requirements, test methods and performance criteria for fire detectors which detect smoke in air ducts in buildings as a part of a fire detection and fire alarm system or as an actuator for a fire protection system.

For the testing of other types of smoke detectors, or smoke detectors working on different principles, this document can be used only for guidance.

Duct smoke detectors with special characteristics and developed for specific risks are not covered by this document.

NOTE Certain types of detector contain radioactive materials. The national requirements for radiation protection differ from member state to member state and 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, *Fire detection and fire alarm systems — Part 1: General and definition*

EN 54-7, *Fire detection and fire alarm systems — Part 7: Point-type smoke detectors using scattered light, transmitted light or ionisation*

EN 54-13, *Fire detection and fire alarm systems — Part 13: Compatibility assessment of system components*

EN 54-20, *Fire detection and fire alarm systems — Part 20: Aspirating smoke detectors*

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

EN 60068-1, *Environmental testing — Part 1: General and guidance (IEC 60068-1:1988 + Corrigendum 1988 + A1:1992)*

EN 60068-2-1, *Environmental testing — Part 2: Tests. Tests A: cold (IEC 60068-2-1:1990)*

EN 60068-2-2, *Basic environmental testing procedures — Part 2: Tests. Tests B: dry heat (IEC 60068-2-2:1974 + IEC 60068-2-2A:1976)*

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

EN 60068-2-27, *Basic environmental testing procedures — Part 2: Tests — Test Ea and guidance: Shock (IEC 60068-2-27:1987)*

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

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

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

EN 60950-1, Information technology equipment — Safety — Part 1: General requirements (IEC 60950-1:2005, modified)

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

3 Terms, abbreviated terms and definitions

3.1 Definitions

For the purposes of this document, the terms and definitions given in EN 54-1, EN 54-13 and the following apply.

3.1.1

duct smoke detector

fire detector that monitors the air in a duct to detect smoke

NOTE The combination with additional sensors for different fire phenomena is possible.

3.1.2

response threshold value

aerosol concentration in the proximity of the specimen at the moment that it generates a signal which indicates the presence of smoke

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

3.1.3

type 1 DSD

point smoke detector approved to EN 54-7 mounted inside the duct

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3.1.4

type 2 DSD

point smoke detector approved to EN 54-7 mounted inside the duct with additional electrical components

3.1.5

type 3 DSD

point smoke detector approved to EN 54-7 mounted outside the duct with additional mechanical means to sample the smoke

3.1.6

type 4 DSD

point smoke detector approved to EN 54-7 mounted outside the duct with additional mechanical means to sample the smoke and with additional electrical components

3.1.7

type 5 DSD

ASD approved to EN 54-20

3.1.8

type 6 DSD

other types of DSD not complying with type 1 to type 5

NOTE This type 6 DSD includes detectors based on EN 54-7 or EN 54-20 with modified sensitivity settings.

3.2 Abbreviated terms

— ASD aspirating smoke detector

prEN 54-27:2008 (E)

- CIE control and indicating equipment
- DSD duct smoke detector
- FDAS fire detection and fire alarm system
- FPS fire protection system

4 Requirements**4.1 General**

Duct smoke detectors shall incorporate at least one smoke sensor. The combination with additional sensors for different fire phenomena can be used.

If additional fire sensors for different fire phenomena are implemented in a DSD, these sensors shall be approved in accordance with the corresponding EN 54 standards.

The manufacturer shall specify whether the DSD can directly be used as an actuator for a fire protection system, i.e. stand-alone system or as a part of a FDAS.

The requirements of this clause shall be applied for all six types of DSD. The relevant tests for the different types of DSD are described in Clause 5.

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4.2 Compliance

To comply with this standard the DSD shall meet the requirements of Clause 4 which shall be verified by visual inspection or engineering assessment and shall be tested as described in Clause 5 and shall meet the requirements of the tests.

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4.3 Visual alarm indication

Each DSD shall be provided with a red visual indicator, by which the DSD can be identified when the associated detector releases an alarm, until the alarm condition is reset manually. Where other conditions of the DSD can be visually indicated, they shall be clearly distinguishable from the alarm indication, except when the DSD is switched into a service mode. The visual indicator shall be visible from outside of the duct from a distance of 6 m in an ambient light intensity up to 500 lx in at least one direction from the DSD.

4.4 Additional visual indication

If the DSD is used as an actuator for a FPS, i.e. stand-alone system then the DSD shall be provided with additional indicators yellow for "fault" and green for "power on". Additional indicators may be integral part of the DSD or remote from DSD.

For operated DSD the additional visual indicator shall be visible from outside of the duct from a distance of 6 m in an ambient light intensity up to 500 lx in at least one direction from the DSD.

4.5 Alarm resetting for stand alone systems

If the DSD is used as an actuator for a FPS, i.e. stand-alone system then the DSD shall be provided with means for manual resetting. Means for resetting may be integral part of the DSD or remote from DSD.

4.6 Connection of ancillary devices

Each DSD shall be provided with means of the connection for at least one remote visual alarm indicator.

For all connections to ancillary devices (remote indicators, control relays etc.), open- or short-circuit failures of these connections shall not prevent the correct operation of the DSD.

4.7 Power supply

4.7.1 If the DSD is part of the FDAS, the DSD shall be supplied by a power supply complying with EN 54-4.

The DSD shall signal a fault to the CIE, if the power fails.

NOTE This power supply may be common to the control and indicating equipment.

4.7.2 If the DSD is used as an actuator for a FPS, i.e. stand-alone system, then the DSD shall signal the fault to the FPS, if the power fails. In this case a power supply complying with EN 54-4 is not required. This power supply shall fulfil the safety requirements as given in EN 60950-1.

4.8 Monitoring of detachable detectors

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

4.9 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.

4.10 On-site adjustment of response behaviour

If there is provision for on-site adjustment of the response behaviour of the DSD then:

- a) for all of the settings, at which the manufacturer claims compliance with this standard, the DSD 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;
- 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 DSD or in the associated data, that if these setting(s) are used, the DSD does not comply with this standard.

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

4.11 Response to slowly developing fires

For DSD the requirements as given in EN 54-7 and EN 54-20 respectively shall be applied.

4.12 Marking

Each DSD shall be clearly marked with the following information:

- a) the number of this standard (i.e. EN 54-27:xxxx);
- b) the name or trademark of the manufacturer or supplier;
- c) the model designation (name or number);
- d) the wiring terminal designations;

prEN 54-27:2008 (E)

- 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 DSD.

A removable detector head within the DSD, if applicable, shall be at least marked with b), c) and e).

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 DSD and shall be accessible during maintenance.

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

4.13 Data

Either the DSD shall be supplied with sufficient technical, installation and maintenance data to enable correct installation and operation or, if all of this data is not supplied with each DSD unit, reference to the appropriate data sheet shall be given on, or with each DSD unit. These data shall include at least:

- a) the range of operating duct air velocities;
- b) the range of applicable duct dimensions;
- c) the operating temperature range;
- d) the operating voltage range;
- e) the model designation (name or number) of all suitable removable detector heads, if applicable.

4.14 Requirements for software controlled DSD**4.14.1 General**

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The requirements of 4.14.2, 4.14.3 and 4.14.4 shall be met for DSD which rely on software control in order to fulfil the requirements of this document.

NOTE If DSD contains software components which have been already assessed and approved in accordance with EN 54 standards, the test results can be taken into account.

4.14.2 Software documentation

4.14.2.1 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.

4.14.2.2 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 etc.).

4.14.3 Software design

In order to ensure the reliability of the DSD, 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.

4.14.4 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 DSD, 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 as follows:

- a) temperature: 15 °C to 35 °C;

prEN 54-27:2008 (E)

- b) relative humidity: 25 % to 75 %;
- c) air pressure: 86 kPa to 106 kPa.

The temperature and humidity shall be substantially constant for each environmental test where the standard atmospheric conditions are applied.

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.

Where a DSD has different sensitivity settings, the following shall apply for test in accordance with Table 1:

- a) for the reproducibility test of 5.3 the highest and lowest sensitivity settings shall be used;
- b) the fire sensitivity test of 5.17 shall be carried out at the lowest sensitivity setting;
- c) for all other tests in Table 1 the sensitivity of the specimen shall be set at the highest sensitivity setting.

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 EN 60068).

If a specific tolerance or deviation limit is not specified in a requirement or test procedure, then a tolerance of 5 % shall be applied.

5.1.5 Response threshold value

The specimen for which the response threshold value is to be measured shall be installed in the aerosol tunnel, described in Annex A, in its normal operating position, by its normal means of attachment.

NOTE 1 This measurement can only be taken where the sampling apparatus of the DSD can fit inside the aerosol tunnel. Where the sampling apparatus is too large, it will be necessary to agree other arrangements with the manufacturer.

Before commencing each measurement, the aerosol tunnel shall be purged to ensure that the tunnel and the specimen are free from the test aerosol.

Unless otherwise specified in the test procedure, the air temperature in the tunnel shall be $(23 \pm 5) ^\circ\text{C}$ and shall not vary by more than 5 K for all the measurements on a particular DSD type.

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

The test aerosol, as described in Annex B, shall be introduced into the tunnel such that the rate of increase of aerosol density is as follows:

- for DSD incorporating detectors using scattered or transmitted light, in decibels per metre per minute:

$$0,015 \leq \frac{\Delta m}{\Delta t} \leq 0,1$$

- for DSD incorporating detectors using ionization, per minute:

$$0,05 \leq \frac{\Delta y}{\Delta t} \leq 0,3$$

NOTE 2 These ranges are intended to allow the selection of a convenient rate, depending upon the sensitivity of the DSD, so that a response can be obtained in a reasonable time.

The rate of increase in aerosol density shall be similar for all measurements on a particular DSD type.

The tests on the DSD specimen shall be conducted at the air velocity of $1 \text{ m/s} \pm 0,2 \text{ m/s}$.

The response threshold value for types 1 to 4 DSD is the aerosol density (m or y) at the moment that the specimen gives an alarm. This shall be recorded as m , expressed in decibels per metre, for detectors using scattered or transmitted light, or as y for detectors using ionization (see Annex C).

For type 5 DSD the response threshold value N shall be measured in accordance with EN 54-20.

For type 6 DSD either of the above methods can be used to determine the response threshold value.

Designate the greater of the response threshold value as y_{\max} or m_{\max} or N_{\max} ; the lesser as y_{\min} or m_{\min} or N_{\min} .

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5.1.6 Provision for tests

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

- a) 12 specimens;
- b) data required in 4.11.

The specimens submitted shall be deemed representative of the manufacturer's normal production with regard to their construction and calibration. This implies that the mean response threshold value of the twelve specimens, found in the reproducibility test (see 5.3) should also represent the production mean, and that the limits specified in the response threshold value test should also be applicable to the manufacturer's production.

5.1.7 Test schedule

The specimens shall be tested in accordance with the following test schedule (see Table 1). After the reproducibility test, the least sensitive specimen (i.e. this with the highest response threshold) for the lowest sensitivity setting shall be numbered 12 and the others 1 to 11 arbitrarily.

If DSD contains components which have been already tested and approved in accordance with EN 54 standards, the test results can be taken into account. In Table 1 it is defined which tests are carried out for the different types of DSD.