BS EN 54-29:2015

BSI Standards Publication

Fire detection and fire alarm systems

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

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National foreword

This British Standard is the UK implementation of EN 54-29:2015.

The UK participation in its preparation was entrusted to Technical Committee FSH/12/2, Fire detectors.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Foreword

This document (EN 54-29:2015) has been prepared by Technical Committee CEN/TC 72 "Fire detection and fire alarm systems", the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2015, and conflicting national standards shall be withdrawn at the latest by January 2017.

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

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

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

EN 54, *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 detector – Point detectors*

— *Part 11: Manual call points*

— *Part 12: Smoke detectors – Line detector using an optical light beam*

— *Part 13: Compatibility assessment of system components*

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

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

— *Part 17: Short circuit isolators*

— *Part 18: Input/output devices*

— *Part 20: Aspirating smoke detectors*

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

— *Part 22: Resettable Line-type heat detectors*

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

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

— *Part 25: Components using radio links and system requirements*

— *Part 26: Point fire detectors using carbon monoxide sensors*

— *Part 27: Duct smoke detectors*

— *Part 28: Non-resettable (digital) line type heat detectors*

— *Part 29: Point detectors using a combination of smoke and heat sensors*

— *Part 30: Point detectors using a combination of carbon monoxide and heat sensors*

— *Part 31: Point detectors using a combination of smoke, carbon monoxide and optionally heat sensors*

— *Part 32: Guidelines for the planning, design, installation, commissioning, use and maintenance of voice alarm systems*

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

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

Introduction

Multi-sensor fire detectors combining smoke and heat sensors complying with this document are general purpose fire detectors. Multi-sensor fire detectors can be used to achieve

— a high stability against deceptive phenomena,

— a response to a broad range of fires.

Compared to the standards for single phenomenon detectors, additional environmental tests were included to demonstrate a higher stability.

The response to a broad range of fires is shown by including the test fires TF1 and TF8 in addition to the test fires TF2 to TF5 which are used for detectors complying with EN 54-7.

The performance of single sensor components of a multi-sensor fire detector need not comply with the standards for single phenomena fire detectors (EN 54-5, EN 54-7) however the combined performance does need to meet the requirements of this standard.

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 54-1:2011), incorporating in one mechanical enclosure at least one optical or ionization smoke sensor and at least one heat sensor. The overall fire detection performance is determined utilizing the combination of the detected phenomena.

This European Standard provides for the assessment and verification of constancy of performance (AVCP) of point detectors using a combination of smoke and heat sensors to this European Standard.

Point detectors using a combination of smoke and heat sensors having special characteristics suitable for the detection of specific fire risks are not covered by this European Standard. The performance requirements for any additional functions are beyond the scope of this European Standard (e.g. additional features or enhanced functionality for which this European Standard does not define a test or assessment method).

NOTE 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 European Standard.

2 Normative references

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

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

EN 54-5:2000, *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 50130-4:2011, *Alarm systems - Part 4: Electromagnetic compatibility - Product family standard: Immunity requirements for components of fire, intruder, hold up, CCTV, access control and social alarm systems*

EN 60068-1:1994, *Environmental testing - Part 1: General and guidance (IEC 60068-1:1988)*

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

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

EN 60068-2-27:2009, *Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock (IEC 60068-2-27:2009)*

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

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

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

ISO 209:2007, *Aluminium and aluminium alloys — Chemical composition*

3 Terms and definitions

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

3.1
non-volatile memory
memory element which does not require the presence of an energy source for the retention of its content

3.2
site specific data
alterable data required for the detector to operate in a defined detector configuration

3.3
smoke response value
aerosol density in the proximity of a test specimen at the moment that it generates a reference signal in a smoke tunnel

3.4
heat response value
temperature in the proximity of a test specimen at the moment that it generates a reference signal in a heat tunnel

3.5
sensor
transducer, which is assigned to be receptive to one fire phenomenon and converts its information into an electrical output

4 Requirements

4.1 General

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

4.2 Nominal activation conditions/sensitivity

4.2.1 Individual alarm indication

The 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 when assessed as described in 5.2.1.

NOTE The alarm condition is reset manually at the control and indicating equipment (see EN 54–2:1997 as amended by EN 54–2:1997/A1:2006).

4.2.2 Response to slowly developing fires

The detector may incorporate provision for “drift compensation”, for example to compensate for sensor drift due to the build up of dirt in the detector, If such drift compensation is included, then it shall not lead to a significant reduction in the detector's sensitivity to slowly developing fires when assessed as specified in 5.2.2.

4.2.3 Repeatability of smoke response

The detector shall have stable behaviour with respect to its sensitivity to smoke after a number of alarm conditions. To confirm this, the detector shall be assessed in accordance with 5.2.3.

4.2.4 Directional dependence of smoke response

The sensitivity of the detector to smoke shall not be unduly dependent on the direction of airflow around it. To confirm this, the detector shall be assessed in accordance with 5.2.4.

4.2.5 Directional dependence of heat response

The heat sensitivity of the detector shall not be unduly dependent on the direction of airflow around it. To confirm this, the detector shall be assessed in accordance with 5.2.5.

4.2.6 Lower limit of heat response

The detector shall not be more sensitive to heat alone, without the presence of smoke, than is permitted in EN 54-5:2000 as amended by EN 54-5:2000/A1:2002. To confirm this, the detector shall be assessed in accordance with 5.2.6.

4.2.7 Reproducibility of smoke response

The sensitivity of the detector to smoke shall not vary unduly from specimen to specimen. To confirm this, the detector shall be assessed in accordance with 5.2.7.

4.2.8 Reproducibility of heat response

The heat sensitivity of the detector shall not vary unduly from specimen to specimen. To confirm this, the detector shall be assessed in accordance with 5.2.8.

4.2.9 Air movement

The sensitivity of the detector shall not be unduly affected by the rate of the airflow and that it is not unduly prone to false alarms in draughts or in short gusts. To confirm this, the detector shall be assessed in accordance with 5.2.9.

4.2.10 Dazzling

The sensitivity of the detector shall not be unduly influenced by the close proximity of artificial light sources. To confirm this, the detector shall be assessed in accordance with 5.2.10. This test is only applicable to detectors using optical smoke sensors, as ionization chamber detectors are considered unlikely to be influenced.

4.3 Operational reliability

4.3.1 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.

4.3.2 Monitoring of detachable detectors

For detachable detectors, 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.

4.3.3 Manufacturer's adjustments

It shall not be possible to change the manufacturer's settings except by special means (e.g. the use of a special code or tool) or by breaking or removing a seal.

4.3.4 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.

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

4.3.5 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 smoke 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.

4.3.6 Software controlled detectors

4.3.6.1 General

For detectors which rely on software control in order to fulfil the requirements of this standard, the requirements of 4.3.6.2, 4.3.6.3 and 4.3.6.4 shall be met.

4.3.6.2 Software documentation

4.3.6.2.1 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);

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

4.3.6.2.2 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).

4.3.6.3 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.

4.3.6.4 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.

4.4 Tolerance to supply parameters

4.4.1 Variation in supply parameters

Within the specified range(s) of the supply parameters, the sensitivity of the detector shall not be unduly dependent on these parameters (e.g. voltage). To confirm this, the detector shall be assessed in accordance with 5.4.1.

4.5 Performance parameters under fire conditions

4.5.1 Fire sensitivity

The detector shall have adequate sensitivity to incipient type fires that may occur in buildings. To confirm this, the detector shall be assessed in accordance with 5.5.1.

4.6 Durability of nominal activation conditions/sensitivity

4.6.1 Temperature resistance

4.6.1.1 Dry heat (operational)

The detector shall function correctly at high ambient temperatures. To confirm this, the detector shall be assessed in accordance with 5.6.1.1.

4.6.1.2 Cold (operational)

The detector shall function correctly at low ambient temperatures. To confirm this, the detector shall be assessed in accordance with 5.6.1.2.

4.6.2 Humidity resistance

4.6.2.1 Damp heat, cyclic (operational)

The detector shall function correctly at a high level of relative humidity with short period of condensation. To confirm this, the detector shall be assessed in accordance with 5.6.2.1.

4.6.2.2 Damp heat steady-state (endurance)

The detector shall be capable of withstanding long term exposure to a high level of continuous humidity. To confirm this, the detector shall be assessed in accordance with 5.6.2.2.

4.6.3 Shock and vibration resistance

4.6.3.1 Shock (operational)

The detector shall function correctly when submitted to mechanical shocks which are likely to occur in the service environment. To confirm this, the detector shall be assessed in accordance with 5.6.3.1.

4.6.3.2 Impact (operational)

The detector shall function correctly when submitted to mechanical impacts which it may sustain in the normal service environment. To confirm this, the detector shall be assessed in accordance with 5.6.3.2.

4.6.3.3 Vibration, sinusoidal (operational)

The detector shall function correctly when submitted to vibration at levels appropriate to its normal service environment. To confirm this, the detector shall be assessed in accordance with 5.6.3.3.

4.6.3.4 Vibration, sinusoidal (endurance)

The detector shall be capable of withstanding long exposure to vibration at levels appropriate to the service environment. To confirm this, the detector shall be assessed in accordance with 5.6.3.4.

4.6.4 Electrical stability

4.6.4.1 EMC, immunity (operational)

The detector shall operate correctly when submitted to electromagnetic interference. To confirm this, the detector shall be assessed in accordance with 5.6.4.1.

4.6.5 Resistance to chemical agents

4.6.5.1 SO_2 corrosion (endurance)

The detector shall be capable of withstanding the corrosive effects of sulphur dioxide as an atmospheric pollutant. To confirm this, the detector shall be assessed in accordance with 5.6.5.1.

5 Test and assessment and sampling methods

5.1 General

5.1.1 Atmospheric conditions for tests

Unless otherwise stated in a test procedure, the testing shall be carried out after the test specimen has been allowed to stabilize in the standard atmospheric conditions for testing as described in EN 60068-1:1994 as follows:

— temperature: (15 to 35) °C;

— relative humidity: (25 to 75) %;

— air pressure: (86 to 106) kPa.

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 a 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 an alarm or fault signal to be recognized. 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 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, for each test the method evaluated to be most unfavourable shall be chosen.

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 smoke response value

The specimen, for which the smoke response value is to be measured, shall be installed in the smoke tunnel, 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 (5.2.4), unless otherwise specified in the test procedure.

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

The air velocity in the proximity of the specimen shall be (0,2 ± 0,04) m s^{-1} during the measurement, unless otherwise specified in the test procedure.

Unless otherwise specified in the test procedure, the air temperature in the tunnel shall be (23 ± 5) °C and shall not vary by more than 5 K for all the measurements on a particular detector type.

The specimen shall be connected to its supply and monitoring equipment as described in 5.1.2, and shall be allowed to stabilize 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:

$$0{,}015 \leq \frac{\Delta m}{\Delta t} \leq 0{,}1 \qquad \text{dB m}^{-1}\ \text{min}^{-1}$$

for detectors using scattered or transmitted light, or

$$0{,}05 \leq \frac{\Delta y}{\Delta t} \leq 0{,}3 \qquad \text{min}^{-1}$$

for detector using ionization.

NOTE 1 These ranges are intended to allow the selection of a convenient rate, depending upon the detector's sensitivity, to get a response in a reasonable time.

NOTE 2 The formulae for *m* and *y* are given in Annex C.

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

The aerosol density at the moment that the specimen gives an alarm shall be recorded as *m* (dB m^{-1}) for detectors using scattered or transmitted light, or as *y* for detectors using ionization (see Annex C). For detectors using both optical and ionization smoke sensors, the measured aerosol density shall be recorded as *m* (dB m^{-1}). This shall be taken as the response value.

5.1.6 Measurement of heat response value

The specimen for which the heat response value is to be measured shall be installed in a heat tunnel, as specified in Annex D, 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 (see 5.2.5), unless otherwise specified in the test procedure.

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

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.

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 EN 54–5:2000, Table 4, as amended by EN 54–5:2000/A1:2002 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 (s).

5.1.7 Provision for tests

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

a) for detachable detectors; 22 detector heads and bases; for non-detachable detectors; 22 specimens.

b) The data required in 4.3.6.2.

NOTE 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 manufacturer's normal production with regard to their construction and calibration.

This implies that the mean response value of the 22 specimens found in the reproducibility tests, 5.2.7 and 5.2.8 should also represent the production mean, and that the limits specified in the reproducibility tests should also be applicable to the manufacturer's production.

5.1.8 Test schedule

The specimens shall be tested according to the following test schedule (see Table 1). After the reproducibility test, the six least sensitive specimens to smoke (i.e. those with the highest smoke response values) shall be numbered 17 to 22, by decreasing sensitivity, and the others shall be numbered 1 to 16 arbitrarily.

Table 1 — Test schedule

Test	Clause	Specimen No(s)
Repeatability of smoke response	5.2.3	one chosen arbitrarily
Directional dependence of smoke response	5.2.4	one chosen arbitrarily
Directional dependence of heat response	5.2.5	one chosen arbitrarily
Lower limit of heat sensitivity	5.2.6	1
Reproducibility of smoke response	5.2.7	all specimens
Reproducibility of heat response	5.2.8	all specimens
Air movement	5.2.9	2
Dazzling	5.2.10	3
Variation in supply parameters	5.4.1	3
Fire sensitivity	5.5.1	17, 18, 19, 20, 21, 22
Dry heat (operational)	5.6.1.1	4
Cold (operational)	5.6.1.2	5
Damp heat, cyclic (operational)	5.6.2.1	6
Damp heat, steady-state (endurance)	5.6.2.2	7
Shock (operational)	5.6.3.1	8
Impact (operational)	5.6.3.2	9
Vibration, sinusoidal (operational)	5.6.3.3	10
Vibration, sinusoidal (endurance)	5.6.3.4	10
Electrostatic discharge (operational) Radiated electromagnetic fields (operational) Conducted disturbances induced by electromagnetic fields (operational) Fast transient bursts (operational) Slow high energy voltage surge (operational)	5.6.4.1	11 [a] 12 [a] 13 [a] 14 [a] 15 [a]
Sulphur dioxide SO_2 corrosion (endurance)	5.6.5.1	16

[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 EN 50130–4:2011, Clause 4).

5.2 Nominal activation conditions/sensitivity

5.2.1 Individual alarm indication

A visual inspection of a specimen shall be conducted to verify that the detector meets the requirements for individual alarm indication as specified in 4.2.1.

The specimen shall be checked for adequate visibility in an ambient light intensity of 500 lux.

5.2.2 Response to slowly developing fires

The behaviour of the multi-sensor fire detector to slowly developing fires shall be assessed to meet the requirements of 4.2.2.

Since it is not practical to make tests with very slow increases in smoke density, the assessment of the detector's response to slow increases in smoke density 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 4.2.2 if this assessment shows that:

a) for any rate of increase in smoke density *R*, which is greater than *A*/4 per hour (where *A* is the detector's initial uncompensated response 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 value of the detector to exceed its initial value by a factor greater than 1,6.

NOTE Further information about the assessment is given in Annex P.

5.2.3 Repeatability of smoke response

5.2.3.1 Object

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

5.2.3.2 Test procedure

The smoke response 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 smoke response value shall be designated y_{max} or m_{max}, the minimum value shall be designated y_{min} or m_{min}.

5.2.3.3 Requirements

a) The ratio of the smoke response values y_{max}: y_{min} or m_{max}: m_{min} shall be not greater than 1,6.

b) The lower smoke response value y_{min} shall be not less than 0,2 or m_{min} shall be not less than 0,05 dB m^{-1}.

5.2.4 Directional dependence of smoke response

5.2.4.1 Object

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

5.2.4.2 Test procedure

The smoke response value of the specimen to be tested shall be measured eight times as described in 5.1.5, the specimen being rotated 45° 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 smoke response value shall be designated y_{max} or m_{max}, the minimum value shall be designated y_{min} or m_{min}.

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

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

5.2.4.3 Requirements

a) The ratio of the smoke response values y_{max}: y_{min} or m_{max}: m_{min} shall be not greater than 1,6.

b) The lower smoke response value y_{min} shall be not less than 0,2 or m_{min} shall be not less than 0,05 dB m^{-1}.

5.2.5 Directional dependence of heat response

5.2.5.1 Object of test

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

5.2.5.2 Test procedure

The heat response value of the specimen shall be tested eight times as specified in 5.1.6 at a rate of rise of air temperature of 10 K/min, the specimen being rotated about a vertical axis by 45° between each measurement, so that the measurements are taken for eight different orientations relative to the direction of airflow. The specimen shall be stabilized at 25 °C before each measurement.

The heat response value at each of the eight orientations shall be recorded.

The maximum heat response value shall be designated as T_{max}; the minimum value as T_{min}.

The maximum heat response value and the minimum heat response value orientations shall be recorded. The orientation for which the maximum response time was measured is referred to as the *least sensitive* heat orientation. The orientation for which the minimum response time was measured is referred to as the *most sensitive* heat orientation.

5.2.5.3 Requirements

The ratio of the heat response values T_{max} : T_{min} shall not be greater than 1,6.

5.2.6 Lower limit of heat sensitivity

5.2.6.1 Object of the test

To confirm that detectors are not more sensitive to heat alone, without the presence of smoke, than is permitted in EN 54-5:2000 as amended by EN 54-5:2000/A1:2002.

5.2.6.2 Test procedure

Measure the heat response value of the specimen to be tested, in its most sensitive orientation, using the methods described in EN 54-5:2000, 5.3 and 5.4, as amended by EN 54-5:2000/A1:2002. For the purposes of these tests, the test parameters for Class A1 detectors according to EN 54-5:2000 as amended by EN 54-5:2000/A1:2002 shall be used.

NOTE The minimum static response temperature needs to be greater than that which is required to comply with the operational heat test (see 5.6.1.1).

5.2.6.3 Requirements

In the test for static response temperature (EN 54-5:2000, 5.3 as amended by EN 54-5:2000/A1:2002), the specimen shall not give an alarm signal at a temperature less than the minimum static response temperature specified in EN 54-5:2000, Table 1, as amended by EN 54-5:2000/A1:2002 for a Class A1 detector according to EN 54-5:2000 as amended by EN 54-5:2000/A1:2002.

The specimen shall not give an alarm signal at each rate of rise of air temperature in a time less than the lower response time limits specified in EN 54-5:2000, Table 4, as amended by EN 54-5:2000/A1:2002 for a Class A1 detector according to EN 54-5:2000 as amended by EN 54-5:2000/A1:2002.

5.2.7 Reproducibility of smoke response

5.2.7.1 Object

To show that the sensitivity of the detector to smoke does not vary unduly from specimen to specimen and to establish smoke response value data for comparison with the smoke response values measured after the environmental tests.

5.2.7.2 Test procedure

The smoke response value of each of the test specimens shall be measured as described in 5.1.5.

The mean of these smoke response values shall be calculated and shall be designated $\overline{y}$ or $\overline{m}$.

The maximum smoke response value shall be designated y_{max} or m_{max}, the minimum value shall be designated y_{min} or m_{min}.

5.2.7.3 Requirements

a) The ratio of the smoke response values y_{max}: $\overline{y}$ or m_{max}: $\overline{m}$ shall be not greater than 1,33 and the ratio of the smoke response values $\overline{y} : y_{min}$ or $\overline{m} : m_{min}$ shall not be greater than 1,5.

b) The lower smoke response value y_{min} shall be not less than 0,2 or m_{min} shall be not less than 0,05 dB m^{-1}.

5.2.8 Reproducibility of heat response

5.2.8.1 Object of the test

To show that the heat sensitivity of the detector does not vary unduly from specimen to specimen and to establish heat response value data for comparison with the heat response values measured after the environmental tests.

5.2.8.2 Test procedure

Measure the heat response value of each of the test specimens as specified in 5.1.6 at a rate of rise of air temperature of 20 K/min and record the heat response value.

Designate the maximum heat response value as T_{max}; the minimum value as T_{min}.

5.2.8.3 Requirements

The ratio of the heat response values $T_{\text{max}} : T_{\text{min}}$ shall not be greater than 1,3.

5.2.9 Air movement

5.2.9.1 Object of test

To show that the sensitivity of the detector is not unduly affected by the rate of the air flow, and that it is not unduly prone to false alarms in draughts or in short gusts.

5.2.9.2 Test procedure

The smoke response value of the specimen to be tested shall be measured as described in 5.1.5 in the most and least sensitive orientations, and shall be appropriately designated as $y_{(0,2)\text{max}}$ and $y_{(0,2)\text{min}}$ or $m_{(0,2)\text{max}}$ and $m_{(0,2)\text{min}}$.

The measurements shall then be repeated but with an air velocity in the proximity of the detector of (1 ± 0,2) m s^{-1}. The smoke response values in these tests shall be designated $y_{(1,0)\text{max}}$ and $y_{(1,0)\text{min}}$ or $m_{(1,0)\text{max}}$ and $m_{(1,0)\text{min}}$.

Additionally, for detectors using ionization, the specimen to be tested shall be subjected, in its most sensitive orientation, to an aerosol-free air flow at a velocity of (5 ± 0,5) m s^{-1} for a period of not less than 5 min and not more than 7 min, and then, at least 10 min later, to a gust at a velocity of (10 ± 1) m s^{-1} for a period of not less than 2 s and not more than 4 s. The specimen shall be monitored during the exposure to aerosol-free air to detect any alarm or fault signals.

NOTE These exposures can be generated by plunging the specimen to be tested into an airflow with the appropriate velocity for the required time.

5.2.9.3 Requirements

For detectors using ionization the following shall apply:

$$0,625 \le \frac{\left[y_{(0,2)\text{max}} + y_{(0,2)\text{min}}\right]}{\left[y_{(1,0)\text{max}} + y_{(1,0)\text{min}}\right]} \le 1,6 .$$

And the detector shall emit neither a fault signal nor an alarm during the test with aerosol-free air.

For detectors using optical smoke sensors the following shall apply:

$$0,625 \le \frac{\left[m_{(0,2)\text{max}} + m_{(0,2)\text{min}}\right]}{\left[m_{(1,0)\text{max}} + m_{(1,0)\text{min}}\right]} \le 1,6 ;$$

5.2.10 Dazzling

5.2.10.1 Object of test

To show that the sensitivity of the detector is not unduly influenced by the close proximity of artificial light sources. This test is only applicable to detectors using optical smoke sensors, as ionization chamber detectors are considered unlikely to be influenced.

5.2.10.2 Test procedure

Install the dazzling apparatus, described in Annex E in the smoke tunnel described in Annex A. Install the specimen in the dazzling apparatus in the least sensitive orientation and connect it to its supply and monitoring equipment. Then apply the following test procedure:

a) measure the smoke response value as described in 5.1.5;

b) switch the four lamps simultaneously ON for 10 s and then OFF for 10 s, 10 times;

c) switch the four lamps ON again and after at least 1 min measure the smoke response value, as described in 5.1.5, with the lamps ON;

d) then switch the four lamps OFF.

Repeat the above procedure but with the detector rotated 90°, in one direction (either direction can be chosen), from the least sensitive orientation for smoke as measured in 5.2.4.

For each orientation, the maximum smoke response value shall be designated m_{max} and the minimum smoke response value shall be designated m_{min}.

5.2.10.3 Requirements

During the periods when the switching sequences are being conducted and when the lamps are all ON for at least 1 min, the specimen shall not emit either an alarm or fault signal.

For each orientation, the ratio of the smoke response values $m_{max} : m_{min}$ shall be not greater than 1,6.

5.3 Operational reliability

5.3.1 Connection of ancillary devices

A visual inspection of a specimen shall be conducted to verify that the detector meets the requirements for the connection of ancillary devices specified in 4.3.1.

5.3.2 Monitoring of detachable detectors

A visual inspection of a specimen shall be conducted to verify that the detector meets the requirements for the monitoring of detachable detectors specified in 4.3.2.

5.3.3 Manufacturer's adjustments

A visual inspection of a specimen shall be conducted to verify that the detector meets the requirements for manufacturer's adjustments specified in 4.3.3.

5.3.4 On-site adjustment of behaviour

A visual inspection of a specimen shall be conducted to verify that the detector meets the requirements for on-site adjustment of response behaviour specified in 4.3.4.

5.3.5 Protection against the ingress of foreign bodies

An inspection of a specimen shall be conducted to verify that the detector meets the requirements for the protection against the ingress of foreign bodies specified in 4.3.5.

5.3.6 Software controlled devices

For detectors that rely on software for their operation, an assessment of the documentation provided by the manufacturer shall be conducted to verify that the device complies with the requirements specified in 4.3.6.

5.4 Tolerance to supply parameters

5.4.1 Variation in supply parameters

5.4.1.1 Object

To show that, within the specified range(s) of the supply parameters (e.g. voltage), the sensitivity of the detector is not unduly dependent on these parameters.

5.4.1.2 Test procedure

The smoke response value of the specimen shall be measured as described in 5.1.5, at the upper and lower limits of the supply parameter (e.g. voltage) range(s) specified by the manufacturer.

The maximum smoke response value shall be designated y_{max} or m_{max}, the minimum value shall be designated y_{min} or m_{min}.

The heat response value of the specimen shall be tested as specified in 5.1.6 at a rate of rise of air temperature of 20 K/min at the upper and lower limits of the supply parameter (e.g. voltage) range(s) specified by the manufacturer.

The maximum heat response value shall be designated as T_{max}; the minimum value as T_{min}.

NOTE For conventional detectors the supply parameter is the dc voltage applied to the detector. For other types of detector (e.g. analogue addressable) signal levels and timing might need to be considered. If necessary the manufacturer may be requested to provide suitable supply equipment to allow the supply parameters to be changed as required.

5.4.1.3 Requirements

a) The ratio of the smoke response values y_{max}: y_{min} or m_{max}: m_{min} shall be not greater than 1,6.

b) The lower smoke response value y_{min} shall be not less than 0,2 or m_{min} shall be not less than 0,05 dB m^{-1}.

c) The ratio of the heat response values T_{max} : T_{min} shall be no greater than 1,3.

5.5 Performance parameters under fire conditions

5.5.1 Fire sensitivity

5.5.1.1 Object

To show that the detector has adequate sensitivity to a broad spectrum of fire types as required for general application in fire detection systems for buildings.

5.5.1.2 Principle

The specimens are mounted in a standard fire test room (see Annex G) and are exposed to a series of test fires designed to produce smoke and heat.

5.5.1.3 Test procedure

5.5.1.3.1 Fire test room

The fire sensitivity tests 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 the following measuring instruments arranged as indicated in Annex G:

a) Measuring ionization chamber (MIC);

b) Obscuration meter;

c) Temperature probe.

5.5.1.3.2 Test Fires

The specimens shall be subjected to six test fires, TF1, TF2, TF3, TF4, TF5 and TF8 as described in Annex H, Annex I, Annex J, Annex K, Annex L, Annex M including the type, quantity and arrangement of the fuel and the method of ignition 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 t 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, whichever 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.

5.5.1.3.3 Mounting of the specimens

The six specimens (Nos. 17, 18, 19, 20, 21, 22) shall be mounted on the fire test room ceiling in the designated area (see Annex G). The specimens shall be mounted in accordance with the manufacturer's instructions. The specimens 19, 20, 21 and 22 shall be mounted in the least sensitive orientation for smoke and the specimens 17 and 18 in the least sensitive orientation for heat relative to an assumed airflow 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.

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.

5.5.1.3.4 Initial conditions

Before each test fire the room shall be ventilated with clean air until it is free from smoke 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: $T = (23 \pm 5)$ °C;
— Air movement: negligible;
— Smoke density (ionization): $y \leq 0{,}05$;

— Smoke density (optical): $m \leq 0{,}02$ dB m^{-1};

The stability of the air and temperature gradients affect the flow of smoke within the room. This is particularly important for test fires, which produce low thermal lift for the smoke (e.g. TF2, TF3 and TF8). The difference between the temperature near the floor and the ceiling should therefore be < 2 K, and 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.

5.5.1.3.5 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.

Table 2 — Test parameters

Parameter	Symbol	Units
Temperature change	ΔT	K
Smoke density (ionization)	y	Dimensionless
Smoke density (optical)	m	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.

The time of response of each specimen shall be recorded along with the fire parameters y, m and ΔT at the moment of response.

5.5.1.4 Requirements

All six specimens shall generate an alarm signal, in each test fire, before the specified end of test condition is reached.

5.6 Durability of nominal activation conditions/sensitivity

5.6.1 Temperature resistance

5.6.1.1 Dry heat (operational)

5.6.1.1.1 Object

To demonstrate the ability of the detector to function correctly at high ambient temperatures appropriate to the anticipated service environment.

5.6.1.1.2 Test procedure

The specimen to be tested shall be installed in the smoke tunnel described in Annex A, in its least sensitive orientation for smoke, with an initial air temperature of (23 ± 5) °C, and shall be connected to its supply and monitoring equipment.

The air temperature in the smoke tunnel shall then be increased to (55 ± 2) °C, at a rate not exceeding 1 K min^{-1}, and maintained at this temperature for 2 h.

The smoke response value shall then be measured as described in 5.1.5 but with the temperature at (55 ± 2) °C.

The greater of the smoke response value measured in this test and that measured for the same specimen in the reproducibility test shall be designated y_{max} or m_{max}, and the lesser shall be designated y_{min} or m_{min}.

NOTE The minimum static response temperature according to EN 54–5:2000 as amended by EN 54-5:2000/A1:2002 needs therefore to be greater than (55 ± 2) °C.

5.6.1.1.3 Requirements

a) No alarm or fault signal shall be given during the period that the temperature is increasing to the conditioning temperature or during the conditioning period until the smoke response value is measured.

b) The ratio of the smoke response values y_{max}: y_{min} or m_{max}: m_{min} shall be not greater than 1,6.

c) The lower smoke response value y_{min} shall be not less than 0,2 or m_{min} shall be not less than 0,05 dB m^{-1}.

5.6.1.2 Cold (operational)

5.6.1.2.1 Object

To demonstrate the ability of the detector to function correctly at low ambient temperatures appropriate to the anticipated service environment.

5.6.1.2.2 Test procedure

5.6.1.2.2.1 Reference

The test apparatus and procedure shall be as described in EN 60068-2-1:2007, Test Ab and as described below.

5.6.1.2.2.2 State of the specimen during conditioning

The specimen shall be mounted as described in 5.1.3 and shall be connected to supply and monitoring equipment as described in 5.1.2.

5.6.1.2.2.3 Conditioning

The following conditioning shall be applied:

— Temperature: (−10 ± 3) °C;
— Duration: 16 h.

NOTE Test Ab specifies rates of change of temperature of ≤ 1 K min^{-1} for the transitions to and from the conditioning temperature.

5.6.1.2.2.4 Measurement during conditioning

The specimen under test shall be monitored for alarm or fault signals.

5.6.1.2.2.5 Final measurements

After a recovery period of between 1 h and 2 h at standard atmospheric conditions (see 5.1.1), the smoke response value of the specimen shall be measured as described in 5.1.5.

The greater of the smoke response value measured in this test and that measured for the same specimen in the reproducibility test shall be designated y_{max} or m_{max}, and the lesser shall be designated y_{min} or m_{min}.

Then the heat response value of the specimen shall be tested as specified in 5.1.6 at a rate of rise of air temperature of 20 K/min.

The greater of the heat response value measured in this test and that measured for the same specimen in the reproducibility test shall be designated T_{max}, and the lesser shall be designated T_{min}.

5.6.1.2.3 Requirements

a) No alarm or fault signal shall be given during the transition to the conditioning temperature or during the period at the conditioning temperature.

b) The ratio of the smoke response values y_{max}: y_{min} or m_{max}: m_{min} shall be not greater than 1,6.

c) The ratio of the heat response values T_{max} : T_{min} shall be no greater than 1,3.

d) The lower smoke response value y_{min} shall be not less than 0,2 or m_{min} shall be not less than 0,05 dB m^{-1}.

5.6.2 Humidity resistance

5.6.2.1 Damp heat, cyclic (operational)

5.6.2.1.1 Object

To demonstrate the ability of the detector to function correctly at high relative humidity, with condensation, which can occur for short periods in the anticipated service environment.

5.6.2.1.2 Test procedure

5.6.2.1.2.1 Reference

The test apparatus and procedure shall be as described in EN 60068-2-30:2005, using the Variant 1 test cycle and controlled recovery conditions, and as described below.

5.6.2.1.2.2 State of the specimen during conditioning

The specimen to be tested shall be mounted as described in 5.1.3 and shall be connected to supply and monitoring equipment as described in 5.1.2.

5.6.2.1.2.3 Conditioning

The following severity of conditioning shall be applied:

— Lower temperature: (25 ± 3) °C
— Upper temperature: (40 ± 2) °C
— Relative Humidity:
  — at lower temperature ≥ 95 %
  — at upper temperature (93 ± 3) %
— Number of cycles 2

5.6.2.1.2.4 Measurements during conditioning

The specimen shall be monitored during the conditioning period to detect any alarm or fault signals.

5.6.2.1.2.5 Final measurements

After a recovery period of between 1 h and 2 h at standard atmospheric conditions (see 5.1.1), the smoke response value of the specimen shall be measured as described in 5.1.5.

The greater of the smoke response value measured in this test and that measured for the same specimen in the reproducibility test shall be designated y_{max} or m_{max}, and the lesser shall be designated y_{min} or m_{min}.

Then the heat response value of the specimen shall be tested as specified in 5.1.6 at a rate of rise of air temperature of 20 K/min.

The greater of the heat response value measured in this test and that measured for the same specimen in the reproducibility test shall be designated T_{max}, and the lesser shall be designated T_{min}.

5.6.2.1.3 Requirements

a) No alarm or fault signal shall be given during the transition to the conditioning temperature or during the period at the conditioning temperature.

b) The ratio of the smoke response values y_{max}: y_{min} or m_{max}: m_{min} shall be not greater than 1,6.

c) The ratio of the heat response values T_{max} : T_{min} shall be no greater than 1,3.

d) The lower smoke response value y_{min} shall be not less than 0,2 or m_{min} shall be not less than 0,05 dB m^{-1}.

5.6.2.2 Damp heat, steady-state (endurance)

5.6.2.2.1 Object

To demonstrate the ability of the detector to withstand the long term effects of humidity (e.g. changes in electrical properties of materials, chemical reactions involving moisture, galvanic corrosion, etc.) in the service environment.

5.6.2.2.2 Test procedure

5.6.2.2.2.1 Reference

The test apparatus and procedure shall be as described in EN 60068-2-78:2013, Test Cab, and as described below.

5.6.2.2.2.2 State of the specimen during conditioning

The specimen shall be mounted as described in 5.1.3 but shall not be supplied with power during the conditioning.

5.6.2.2.2.3 Conditioning

The following conditioning shall be applied:

— Temperature: (40 ± 2) °C

— Relative Humidity: (93 ± 3) %

— Duration: 21 days

5.6.2.2.2.4 Final measurements

After a recovery period of between 1 h and 2 h at standard atmospheric conditions (see 5.1.1), the smoke response value of the specimen shall be measured as described in 5.1.5.

The greater of the smoke response value measured in this test and that measured for the same specimen in the reproducibility test shall be designated y_{max} or m_{max}, and the lesser shall be designated y_{min} or m_{min}.

Then the heat response value of the specimen shall be tested as specified in 5.1.6 at a rate of rise of air temperature of 20 K/min.

The greater of the heat response value measured in this test and that measured for the same specimen in the reproducibility test shall be designated T_{max}, and the lesser shall be designated T_{min}.

5.6.2.2.3 Requirements

a) No alarm or fault signal, attributable to the endurance conditioning, shall be given on reconnection of the specimen.

b) The ratio of the smoke response values y_{max}: y_{min} or m_{max}: m_{min} shall be not greater than 1,6.

c) The ratio of the heat response values T_{max} : T_{min} shall be no greater than 1,3.

d) The lower smoke response value y_{min} shall be not less than 0,2 or m_{min} shall be not less than 0,05 dB m^{-1}.

5.6.3 Shock and vibration resistance

5.6.3.1 Shock (operational)

5.6.3.1.1 Object

To demonstrate the immunity of the detector to mechanical shocks which are likely to occur, albeit infrequently, in the anticipated service environment.

5.6.3.1.2 Test procedure

5.6.3.1.2.1 Reference

The test apparatus and procedure shall be as described in EN 60068-2-27:2009, Test Ea, for a half sine wave pulse, but with the peak acceleration related to specimen mass as indicated below.

5.6.3.1.2.2 State of the specimen during conditioning

The specimen shall be mounted as described in 5.1.3 to a rigid fixture, and shall be connected to its supply and monitoring equipment as described in 5.1.2.

5.6.3.1.2.3 Conditioning

For specimens with a mass ≤ 4,75 kg the following conditioning shall be applied:

— Shock pulse type: Half sine
— Pulse duration: 6 ms
— Peak acceleration: 10 · (100 - 20M) ms^{-2} (Where *M* is the specimen's mass in kg)
— Number of directions: 6

— Pulses per direction: 3

NOTE No test is applied to specimens with a mass > 4,75 kg.

5.6.3.1.2.4 Measurements during conditioning

The specimen shall be monitored during the conditioning period and for a further 2 min to detect any alarm or fault signals.

5.6.3.1.2.5 Final measurements

After the conditioning the smoke response value of the specimen shall be measured as described in 5.1.5.

The greater of the smoke response value measured in this test and that measured for the same specimen in the reproducibility test shall be designated y_{max} or m_{max}, and the lesser shall be designated y_{min} or m_{min}.

Then the heat response value of the specimen shall be tested as specified in 5.1.6 at a rate of rise of air temperature of 20 K/min.

The greater of the heat response value measured in this test and that measured for the same specimen in the reproducibility test shall be designated T_{max}, and the lesser shall be designated T_{min}.

5.6.3.1.3 Requirements

a) No alarm or fault signal shall be given during the conditioning period or the additional 2 min.

b) The ratio of the smoke response values y_{max}: y_{min} or m_{max}: m_{min} shall be not greater than 1,6.

c) The ratio of the heat response values T_{max} : T_{min} shall be no not greater than 1,3.

d) The lower smoke response value y_{min} shall be not less than 0,2 or m_{min} shall be not less than 0,05 dB m^{-1}.

5.6.3.2 Impact (operational)

5.6.3.2.1 Object

To demonstrate the immunity of the detector to mechanical impacts upon its surface, which it may sustain in the normal service environment, and which it can reasonably be expected to withstand.

5.6.3.2.2 Test procedure

5.6.3.2.2.1 Apparatus

The test apparatus shall consist of a swinging hammer incorporating a rectangular-section aluminium alloy head (Aluminium alloy Al Cu_4 Si Mg complying with ISO 209:2007, solution treated and precipitation treated condition) with the plane impact face chamfered to an angle of 60° to the horizontal, when in the striking position (i.e. when the hammer shaft is vertical). The hammer head shall be (50 ± 2,5) mm high, (76 ± 3,8) mm wide and (80 ± 4) mm long at mid height as shown in Figure F.1. A suitable apparatus is described in Annex F.

5.6.3.2.2.2 State of the specimen during conditioning

The specimen shall be rigidly mounted to the apparatus by its normal mounting means and shall be positioned so that it is struck by the upper half of the impact face when the hammer is in the vertical position (i.e. when the hammerhead is moving horizontally). The azimuthal direction and position of impact, relative to the specimen shall be chosen as that most likely to impair the normal functioning of the specimen.

The specimen shall be connected to its supply and monitoring equipment as described in 5.1.2.

5.6.3.2.2.3 Conditioning

The following conditioning shall be applied:

— Impact energy: (1,9 ± 0,1) J

— Hammer velocity: (1,5 ± 0,13) m s^{-1}

— Number of impacts: 1

5.6.3.2.2.4 Measurements during conditioning

The specimen shall be monitored during the conditioning period and for a further 2 min to detect any alarm or fault signals.

5.6.3.2.2.5 Final measurements

After the conditioning the smoke response value of the specimen shall be measured as described in 5.1.5.

The greater of the smoke response value measured in this test and that measured for the same specimen in the reproducibility test shall be designated y_{max} or m_{max}, and the lesser shall be designated y_{min} or m_{min}.

Then the heat response value of the specimen shall be tested as specified in 5.1.6 at a rate of rise of air temperature of 20 K/min.

The greater of the heat response value measured in this test and that measured for the same specimen in the reproducibility test shall be designated T_{max}, and the lesser shall be designated T_{min}.

5.6.3.2.3 Requirements

a) No alarm or fault signal shall be given during the conditioning period or the additional 2 min.

b) The ratio of the smoke response values y_{max}: y_{min} or m_{max}: m_{min} shall be not greater than 1,6.

c) The ratio of the heat response values T_{max} : T_{min} shall be no greater than 1,3.

d) The lower smoke response value y_{min} shall be not less than 0,2 or m_{min} shall be not less than 0,05 dB m^{-1}.

5.6.3.3 Vibration, sinusoidal (operational)

5.6.3.3.1 Object

To demonstrate the immunity of the detector to vibration at levels considered appropriate to the normal service environment.

5.6.3.3.2 Test procedure

5.6.3.3.2.1 Reference

The test apparatus and procedure shall be as described in EN 60068-2-6:2008, Test Fc, and as described below.

5.6.3.3.2.2 State of the specimen during conditioning

The specimen shall be mounted on a rigid fixture as described in 5.1.3 and shall be connected to its supply and monitoring equipment as described in 5.1.2. The vibration shall be applied in each of three mutually perpendicular axes, in turn. The specimen shall be mounted so that one of the three axes is perpendicular to its normal mounting plane.

5.6.3.3.2.3 Conditioning

The following conditioning shall be applied:

— Frequency range:	(10 to 150) Hz
— Acceleration amplitude:	5 m s^{-2} (approximately 0,5 g_n)
— Number of axes:	3
— Sweep rate:	1 octave min^{-1}
— Number of sweep cycles:	1 per axis

NOTE The vibration operational and endurance tests may be combined such that the specimen is subjected to the operational test conditioning followed by the endurance test conditioning in one axis before changing to the next axis. Only one final measurement needs be made.

5.6.3.3.2.4 Measurements during conditioning

The specimen shall be monitored during the conditioning period to detect any alarm or fault signals.

5.6.3.3.2.5 Final measurements

The final measurements, as specified in 5.6.3.4.2.4, are normally made after the vibration endurance test and shall only be made here if the operational test is conducted in isolation.

5.6.3.3.3 Requirements

a) No alarm or fault signal shall be given during the conditioning; and

b) The ratio of the smoke response values y_{max}: y_{min} or m_{max}: m_{min} shall be not greater than 1,6.

c) The ratio of the heat response values T_{max} : T_{min} shall be no greater than 1,3.

d) The lower smoke response value y_{min} shall be not less than 0,2 or m_{min} shall be not less than 0,05 dB m^{-1}.

5.6.3.4 Vibration, sinusoidal (endurance)

5.6.3.4.1 Object

To demonstrate the ability of the detector to withstand the long term effects of vibration at levels appropriate to the service environment.

5.6.3.4.2 Test procedure

5.6.3.4.2.1 Reference

The test apparatus and procedure shall be as described in EN 60068-2-6:2008 Test Fc, and as described below.

5.6.3.4.2.2 State of the specimen during conditioning

The specimen shall be mounted on a rigid fixture as described in 5.1.3, but shall not be supplied with power during conditioning. The vibration shall be applied in each of three mutually perpendicular axes, in turn. The specimen shall be mounted so that one of the three axes is perpendicular to its normal mounting axis.

5.6.3.4.2.3 Conditioning

The following conditioning shall be applied:

—	Frequency range:	(10 to 150) Hz
—	Acceleration amplitude:	10 m s^{-2} (≈1,0 g_n)
—	Number of axes:	3
—	Sweep rate:	1 octave min^{-1}
—	Number of sweep cycles:	20 per axis

NOTE The vibration operational and endurance tests may be combined such that the specimen is subjected to the operational test conditioning followed by the endurance test conditioning in one axis before changing to the next axis. Only one final measurement needs be made.

5.6.3.4.2.4 Final measurements

After the conditioning the smoke response value of the specimen shall be measured as described in 5.1.5.

The greater of the smoke response value measured in this test and that measured for the same specimen in the reproducibility test shall be designated y_{max} or m_{max}, and the lesser shall be designated y_{min} or m_{min}.

Then the heat response value of the specimen shall be tested as specified in 5.1.6 at a rate of rise of air temperature of 20 K/min.

The greater of the heat response value measured in this test and that measured for the same specimen in the reproducibility test shall be designated T_{max}, and the lesser shall be designated T_{min}.

5.6.3.4.3 Requirements

a) No alarm or fault signal, attributable to the endurance conditioning, shall be given on reconnection of the specimen.

b) The ratio of the smoke response values y_{max}: y_{min} or m_{max}: m_{min} shall be not greater than 1,6.

c) The ratio of the heat response values T_{max} : T_{min} shall be no greater than 1,3.

d) The lower smoke response value y_{min} shall be not less than 0,2 or m_{min} shall be not less than 0,05 dB m^{-1}.

5.6.4 Electrical stability

5.6.4.1 Electromagnetic Compatibility (EMC), Immunity tests (operational)

5.6.4.1.1 Object

To demonstrate the immunity against electromagnetic disturbances.

5.6.4.1.2 Test procedure

5.6.4.1.2.1 References

The EMC immunity tests shall be carried out, as described in EN 50130-4:2011.

5.6.4.1.2.2 State of the specimen during conditioning

The specimen shall be mounted as described in 5.1.3. and shall be connected to its supply and monitoring equipment as described in 5.1.2.

5.6.4.1.2.3 Conditioning

The following EMC immunity tests shall be carried out:

a) Electrostatic discharge;

b) Radiated electromagnetic fields;

c) Conducted disturbances induced by electromagnetic fields;

d) Fast transient bursts;

e) Slow high energy voltage surges.

5.6.4.1.2.4 Final measurement

After the conditioning the smoke response value of the specimen shall be measured as described in 5.1.5.

The greater of the smoke response value measured in this test and that measured for the same specimen in the reproducibility test shall be designated y_{max} or m_{max}, and the lesser shall be designated y_{min} or m_{min}.

Then the heat response value of the specimen shall be tested as specified in 5.1.6 at a rate of rise of air temperature of 20 K/min.

The greater of the heat response value measured in this test and that measured for the same specimen in the reproducibility test shall be designated T_{max}, and the lesser shall be designated T_{min}.

5.6.4.1.3 Requirements

For these tests the criteria for compliance specified in EN 50130-4:2011 and the following shall apply:

a) The ratio of the smoke response values y_{max}: y_{min} or m_{max}: m_{min} shall be not greater than 1,6.

b) The ratio of the heat response values T_{max} : T_{min} shall be no greater than 1,3.

c) The lower smoke response value y_{min} shall be not less than 0,2 or m_{min} shall be not less than 0,05 dB m^{-1}.

5.6.5 Resistance to chemical agents

5.6.5.1 Sulphur dioxide SO_2 corrosion (endurance)

5.6.5.1.1 Object

To demonstrate the ability of the detector to withstand the corrosive effects of sulphur dioxide as an atmospheric pollutant.

5.6.5.1.2 Test procedure

5.6.5.1.2.1 Reference

The test apparatus and procedure shall be as described in EN 60068-2-42:2003, Test Kc, except that the conditioning shall be as described below.

5.6.5.1.2.2 State of the specimen during conditioning

The specimen shall be mounted as described in 5.1.3. It shall not be supplied with power during the conditioning, but it shall have untinned copper wires, of the appropriate diameter, connected to sufficient terminals, to allow the final measurement to be made, without making further connections to the specimen.

5.6.5.1.2.3 Conditioning

The following conditioning shall be applied:

— Temperature: (25 ± 2) °C

— Relative humidity: (93 ± 3) %

— SO_2 concentration: (25 ± 5) µl/l

— Duration: 21 days

5.6.5.1.2.4 Final measurements

Immediately after the conditioning, the specimen shall be subjected to a drying period of 16 h at (40 ± 2) °C, ≤ 50 % RH, followed by a recovery period of at least 1 h at the standard laboratory conditions. After this, the smoke response value of the specimen shall be measured as described in 5.1.5.

The greater of the smoke response value measured in this test and that measured for the same specimen in the reproducibility test shall be designated y_{max} or m_{max}, and the lesser shall be designated y_{min} or m_{min}.

Then the heat response value of the specimen shall be tested as specified in 5.1.6 at a rate of rise of air temperature of 20 K/min.

The greater of the heat response value measured in this test and that measured for the same specimen in the reproducibility test shall be designated T_{max}, and the lesser shall be designated T_{min}.

5.6.5.1.3 Requirements

a) No alarm or fault signal, attributable to the endurance conditioning, shall be given on reconnection of the specimen.

b) The ratio of the smoke response values y_{max}: y_{min} or m_{max}: m_{min} shall be not greater than 1,6.

c) The ratio of the heat response values T_{max} : T_{min} shall be no greater than 1,3.

d) The lower smoke response value y_{min} shall be not less than 0,2 or m_{min} shall be not less than 0,05 dB m^{-1}.

6 Assessment and verification of constancy of performance (AVCP)

6.1 General

The compliance of the point detectors using a combination of smoke and heat sensors with the requirements of this Standard and with the performances declared by the manufacturer in the DoP shall be demonstrated by:

— determination of product type,

— factory production control by the manufacturer, including product assessment.

The manufacturer shall always retain the overall control and shall have the necessary means to take responsibility for the conformity with its declared performance(s).

6.2 Type testing

6.2.1 General

All performances related to characteristics included in this standard shall be determined when the manufacturer intends to declare the respective performances unless the standard gives provisions for declaring them without performing tests. (e.g. use of previously existing data, CWFT and conventionally accepted performance).

Assessment previously performed in accordance with the provisions of this standard, may be taken into account provided that they were made to the same or a more rigorous test method, under the same AVCP system on the same product or products of similar design, construction and functionality, such that the results are applicable to the product in question.

NOTE 1 Same AVCP system means testing by an independent third party under the responsibility of a notified product certification body.

For the purpose of assessment manufacturer's products may be grouped into families where it is considered that the results for one or more characteristics from any one product within the family are representative for that same characteristics for all products within that same family.

NOTE 2 Products may be grouped in different families for different characteristics.

Reference to the assessment method standards should be made to allow the selection of a suitable representative sample.

In addition, the determination of the product type shall be performed for all characteristics included in the standard for which the manufacturer declares the performance:

— at the beginning of the production of a new or modified point detectors using a combination of smoke and heat sensors (unless a member of the same product range), or

— at the beginning of a new or modified method of production (where this may affect the stated properties); or

they shall be repeated for the appropriate characteristic(s), whenever a change occurs in the design of the point detector using a combination of smoke and heat sensors, in the raw material or in the supplier of the components, or in the method of production (subject to the definition of a family), which would affect significantly one or more of the characteristics.

Where components are used whose characteristics have already been determined, by the component manufacturer, on the basis of assessment methods of other product standards, these characteristics need not be re-assessed. The specifications of these components shall be documented.

Products bearing regulatory marking in accordance with appropriate harmonized European specifications may be presumed to have the performances declared in the DoP, although this does not replace the responsibility on the manufacturer to ensure that the point detector using a combination of smoke and heat sensors as a whole is correctly manufactured and its component products have the declared performance values.

6.2.2 Test samples, testing and compliance criteria

The number of samples of point detectors using a combination of smoke and heat sensors to be tested/assessed shall be in accordance with Table 3.

Table 3 – Number of samples to be tested and compliance criteria

Characteristic	**Requirement**	**Assessment method**	**No. of samples**	**Compliance criteria**
Nominal activation conditions/sensitivity	*4.2*	*5.2*	*18*	*4.2*
Operational reliability	*4.3*	*5.3*	*1*	*4.3*
Tolerance to supply parameters	*4.4*	*5.4*	*3*	*4.4*
Performance parameters under fire conditions	*4.5*	*5.5*	*6*	*4.5*
Durability of nominal activation conditions/sensitivity	*4.6*	*5.6*	*9*	*4.6*

6.2.3 Test reports

The results of the determination of the product type shall be documented in test reports. All test reports shall be retained by the manufacturer for at least 10 years after the last date of production of the point detectors using a combination of smoke and heat to which they relate.

6.3 Factory production control (FPC)

6.3.1 General

The manufacturer shall establish, document and maintain an FPC system to ensure that the products placed on the market comply with the declared performance of the essential characteristics.

The FPC system shall consist of:

— procedures,

— regular inspections and tests or assessments or both

— the use of the results to control:

  — raw and other incoming materials or components,

  — equipment,

  — the production process and the product.

All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures. This factory production control system documentation shall:

— ensure a common understanding of the evaluation of the constancy of performance,

— enable the achievement of the required product performances,

— enable the effective operation of the production control system to be checked.

Factory production control, therefore, brings together operational techniques and all measures allowing maintenance and control of the compliance of the product with the declared performance(s) of the essential characteristics.

6.3.2 Requirements

6.3.2.1 General

The manufacturer is responsible for organizing the effective implementation of the FPC system in line with the content of this product standard. Tasks and responsibilities in the production control organization shall be documented and this documentation shall be kept up-to-date.

The responsibility, authority and the relationship between personnel that manages, performs or verifies work affecting product constancy shall be defined. This applies in particular to personnel that need to initiate actions preventing product non-constancies from occurring, actions in case of non-constancies and to identify and register product constancy problems.

Personnel performing work affecting the constancy of performance of the product shall be competent on the basis of appropriate education, training, skills and experience for which records shall be maintained.

In each factory the manufacturer may delegate the action to a person having the necessary authority to:

— identify procedures to demonstrate constancy of performance of the product at appropriate stages;

— identify and record any instance of non-constancy;

— identify procedures to correct instances of non-constancy.

The manufacturer shall draw up and keep up-to-date documents defining the FPC. The manufacturer's documentation and procedures should be appropriate to the product and manufacturing process and the FPC system should achieve an appropriate level of confidence in the constancy of performance of the product. This involves:

a) the preparation of documented procedures and instructions relating to factory production control operations, in accordance with the requirements of the technical specification to which reference is made;

b) the effective implementation of these procedures and instructions;

c) the recording of these operations and their results;

d) the use of these results to correct any deviations, repair the effects of such deviations, treat any resulting instances of non-conformity and, if necessary, revise the FPC to rectify the cause of non-constancy of performance.

Where subcontracting takes place, the manufacturer shall retain the overall control of the product and ensure that he receives all the information that is necessary to fulfil his responsibilities according to this European Standard.

If the manufacturer has part of the product designed, manufactured, assembled, packed, processed and/or labelled by subcontracting, the FPC of the subcontractor may be taken into account, where appropriate for the product in question.

The manufacturer who subcontracts all of his activities may in no circumstances pass these responsibilities on to a subcontractor.

NOTE Manufacturers having an FPC system, which complies with EN ISO 9001 standard and which addresses the provisions of the present European standard are considered as satisfying the FPC requirements of the Regulation (EU) No 305/2011.

6.3.2.2 Equipment

6.3.2.2.1 Testing

All weighing, measuring and testing equipment shall be calibrated or verified or both and regularly inspected according to documented procedures, frequencies and criteria to ensure consistency with the monitoring and measuring requirements. All calibrated or verified equipment shall have identification in order to determine their status.

6.3.2.2.2 Manufacturing

All equipment used in the manufacturing process shall be regularly inspected and maintained to ensure use, wear or failure does not cause inconsistency in the manufacturing process. Inspections and maintenance shall be carried out and recorded in accordance with the manufacturer’s written procedures and the records retained for the period defined in the manufacturer's FPC procedures.

6.3.2.3 Raw materials and components

The specifications of all incoming raw materials and components shall be documented, as shall the inspection scheme for ensuring their compliance. In case supplied kit components are used, the constancy of performance system of the component shall be that given in the appropriate harmonized technical specification for that component.

6.3.2.4 Traceability and marking

Individual products shall be identifiable and traceable with regard to their production origin. The manufacturer shall have written procedures ensuring that processes related to affixing traceability codes and/or markings are inspected regularly.

6.3.2.5 Controls during manufacturing process

The manufacturer shall plan and carry out production under controlled conditions.

6.3.2.6 Product testing and evaluation

The manufacturer shall establish procedures to ensure that the declared performance of the characteristics is maintained. The characteristics, and the means of control, are indicated in Clause 4 and Clause 5.

6.3.2.7 Non-complying products

The manufacturer shall have written procedures which specify how non complying products shall be dealt with. Any such events shall be recorded as they occur and these records shall be kept for the period defined in the manufacturer’s written procedures.

Where the product fails to satisfy the acceptance criteria, the provisions for non-complying products shall apply, the necessary corrective action(s) shall immediately be taken and the products or batches not complying shall be isolated and properly identified.

Once the fault has been corrected, the test or verification in question shall be repeated.

The results of controls and tests shall be recorded. The product description, date of manufacture, test method adopted, test results and acceptance criteria shall be entered in the records under the signature of the person responsible for the control/test.

With regard to any control result not meeting the requirements of this European standard, the corrective measures taken to rectify the situation (e.g. a further test carried out, modification of manufacturing process, throwing away or putting right of product) shall be indicated in the records.

6.3.2.8 Corrective action

The manufacturer shall have documented procedures that instigate action to eliminate the cause of non-conformities in order to prevent recurrence.

6.3.2.9 Handling, storage and packaging

The manufacturer shall have procedures providing methods of product handling and shall provide suitable storage areas preventing damage or deterioration.

6.3.3 Product specific requirements

The FPC system shall:

— address this European Standard, and

— ensure that the products placed on the market comply with the declaration of performance.

The FPC system shall include a product specific test plan, which identifies procedures to demonstrate compliance of the product at appropriate stages, i.e.

a) the controls and tests to be carried out prior to and/or during manufacture according to a frequency laid down in the test plan, and/or

b) the verifications and tests to be carried out on finished products according to a frequency laid down in the test plan.

If the manufacturer uses only finished products, the operations under b) shall lead to an equivalent level of conformity of the product as if FPC had been carried out during the production.

If the manufacturer carries out parts of the production himself, the operations under b) may be reduced and partly replaced by operations under a). Generally, the more parts of the production that are carried out by the manufacturer, the more operations under b) may be replaced by operations under a).

In any case the operation shall lead to an equivalent level of compliance of the product as if FPC had been carried out during the production.

NOTE Depending on the specific case, it can be necessary to carry out the operations referred to under a) and b), only the operations under a) or only those under b).

The operations under a) centre as much on the intermediate states of the product as on manufacturing machines and their adjustment, and measuring equipment etc. These controls and tests and their frequency shall be chosen based on product type and composition, the manufacturing process and its complexity, the sensitivity of product features to variations in manufacturing parameters etc.

The manufacturer shall establish and maintain records that provide evidence that the production has been sampled and tested. These records shall show clearly whether the production has satisfied the defined acceptance criteria and shall be available for at least three years.

6.3.4 Initial inspection of factory and FPC

Initial inspection of factory and of FPC shall be carried out when the production process has been finalized and in operation. The factory and FPC documentation shall be assessed to verify that the requirements of 6.3.2 and 6.3.3 are fulfilled.

During the inspection it shall be verified:

a) that all resources necessary for the achievement of the product characteristics included in this European Standard are in place and correctly implemented,

and

b) that the FPC-procedures in accordance with the FPC documentation are followed in practice

and

c) that the product complies with the product type samples, for which compliance of the product performance to the DoP has been verified.

All locations where final assembly or at least final testing of the relevant product is performed shall be assessed to verify that the above conditions a) to c) are in place and implemented.

If the FPC system covers more than one product, production line or production process, and it is verified that the general requirements are fulfilled when assessing one product, production line or production process, then the assessment of the general requirements does not need to be repeated when assessing the FPC for another product, production line or production process.

All assessments and their results shall be documented in the initial inspection report.

6.3.5 Continuous surveillance of FPC

Surveillance of the FPC shall be undertaken once a year.

The surveillance of the FPC shall include a review of the FPC test plan(s) and production processes(s) for each product to determine if any changes have been made since the last assessment or surveillance. The significance of any changes shall be assessed.

Checks shall be made to ensure that the test plans are still correctly implemented and that the production equipment is still correctly maintained and calibrated at appropriate time intervals.

The records of tests and measurement made during the production process and to finished products shall be reviewed to ensure that the values obtained still correspond with those values for the samples submitted to the determination of the product type and that the correct actions have been taken for non-compliant products.

6.3.6 Procedure for modifications

If modifications are made to the product, production process or FPC system that could affect any of the product characteristics declared according to this standard, then all characteristics for which the manufacturer declares performance, which may be affected by the modification, shall be subject to the determination of the product type as described in 6.2.1.

Where relevant, a re-assessment of the factory and of the FPC system shall be performed for those aspects, which may be affected by the modification.

All assessments and their results shall be documented in a report.

6.3.7 One-off products, pre-production products, (e.g. prototypes) and products produced in very low quantities

The point detectors using a combination of smoke and heat sensors produced as a one-off, prototypes assessed before full production is established and products produced in very low quantities (less than 50 per year) are assessed as follows:

For type assessment, the provisions of 6.2.1, 3rd paragraph apply, together with the following additional provisions:

— in the case of prototypes, the test samples shall be representative of the intended future production and shall be selected by the manufacturer;

— on request of the manufacturer, the results of the assessment of prototype samples may be included in a certificate or in test reports issued by the involved third party.

The FPC system of one-off products and products produced in very low quantities shall ensure that raw materials and/or components are sufficient for production of the product. The provisions on raw materials and/or components shall apply only where appropriate. The manufacturer shall maintain records allowing traceability of the product.

For prototypes, where the intention is to move to series production, the initial inspection of the factory and FPC shall be carried out before the production is already running and/or before the FPC is already in practice. The FPC-documentation and the factory shall be assessed.

In the initial assessment of the factory and FPC it shall be verified:

a) that all resources necessary for the achievement of the product characteristics included in this European Standard will be available, and

b) that the FPC procedures in accordance with the FPC documentation will be implemented and followed in practice, and

c) that procedures are in place to demonstrate that the factory production processes can produce a component complying with the requirements of this European Standard and that the component will be the same the samples used for the determination of the product type, for which compliance with this European standard has been verified.

Once series production is fully established, the provisions of 6.3 shall apply.

7 Classification and designation

No classification of point detectors using a combination of smoke and heat sensors is specified in this European Standard.

8 Marking, Labelling and Packaging

Point detectors using a combination of smoke and heat sensors shall be marked with the following information:

a) the number and date of this European Standard, EN 54-29:2015;

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

c) the model designation (type or number);

d) 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;

e) the wiring terminal designations.

For detachable detectors, the detector head shall be marked with a), b), c) and d), and the base shall be marked with, at least c) (i.e. its own model designation) 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 point detector using a combination of smoke and heat sensors and shall be accessible during maintenance. The marking shall not be placed on screws or other easily removable parts.

Where regulatory marking provisions require information on some or all items listed in this clause, the requirements of this clause concerning those common items are deemed to be met.

The point detectors using a combination of smoke and heat sensors shall either be supplied with sufficient data to enable their correct operation or, if all of these data are not supplied with each point detector using a combination of smoke and heat sensors, reference to the appropriate data sheet(s) or technical manual shall be given on, or with each point detector using a combination of smoke and heat sensors.

Annex A
(normative)

Smoke tunnel for smoke response values

The following specifies those properties of the smoke tunnel which are of primary importance for making repeatable and reproducible measurements of smoke response values of detectors. However, since it is not practical to specify and measure all parameters which can influence the measurements, the background information in Annex N should be carefully considered and taken into account when a smoke tunnel is designed and used to make measurements in accordance with this standard.

The smoke tunnel shall have a horizontal working section containing a working volume. The working volume is a defined part of the working section where the air temperature and air flow are within the required test conditions. Conformance with this requirement shall be regularly verified under static conditions, by measurements at an adequate number of points distributed within and on the imaginary boundaries of the working volume. The working volume shall be large enough to fully enclose the detector to be tested and the sensing parts of the measuring equipment. The working section shall be designed to allow the dazzling apparatus described in Annex E to be inserted. The detector to be tested shall be mounted in its normal operating position on the underside of a flat board aligned with the airflow in the working volume. The board shall be of such dimensions that the edge(s) of the board are at least 20 mm from any part of the detector. The detector mounting arrangement shall not unduly obstruct the air flow between the board and the tunnel ceiling.

Means shall be provided for creating an essentially laminar air flow at the required velocities (i.e. (0,2 ± 0,04) m s^{-1} or (1,0 ± 0,2) m s^{-1}) through the working volume. It shall be possible to control the temperature at the required values and to increase the temperature at a rate not exceeding 1 K min^{-1} to 55°C.

Both aerosol density measurements, *m* and *y*, shall be made in the working volume in the proximity of the detector.

Means shall be provided for the introduction of the test aerosol such that a homogeneous aerosol density is obtained in the working volume.

Only one detector shall be mounted in the tunnel, unless it has been demonstrated that measurements made simultaneously on more than one detector are in close agreement with measurements made by testing detectors individually. In the event of a dispute the value obtained by individual testing shall be accepted.

Annex B
(normative)

Test aerosol for smoke response value measurements

A polydisperse aerosol shall be used as the test aerosol. The maximum of the aerosol mass distribution shall correspond to particle diameters between 0,5 µm and 1 µm with the refractive index of the aerosol particles of approximately 1,4.

The test aerosol shall be reproducible and stable with regard to the following parameters:

— Particle mass distribution;

— Optical constants of the particles;

— Particle shape;

— Particle structure.

NOTE One possible method to ensure that the aerosol is stable is to measure and monitor the stability of the ratio *m* : *y*.

An aerosol generator producing a paraffin oil mist should be used (e.g. using pharmaceutical grade paraffin oil).

Annex C
(normative)

Smoke measuring instruments

C.1 Obscuration meter

The smoke response value of detectors using scattered light or transmitted light is characterized by the absorbance index (extinction module) of the test aerosol, measured in the proximity of the detector, at the moment that it activates an alarm signal.

The absorbance index is designated *m* and given the units of decibels per metre (dB m^{-1}). The absorbance index *m* is given by the following equation:

$$m = \frac{10}{d} \log \left(\frac{P_0}{P}\right) \quad \text{dB m}^{-1}$$

where

d is the distance, in metres, travelled by the light in the test aerosol or smoke, from the light source to the light receiver;

P_0 is the radiated power received without test aerosol or smoke;

P is the radiated power received with test aerosol or smoke.

For all aerosol or smoke concentrations up to 2 dB m^{-1}, the measuring error of the obscuration meter shall not exceed 0,02 dB m^{-1} + 5 % of the measured aerosol or smoke concentration.

The optical system shall be arranged so that any light scattered by more than 3° by the test aerosol or smoke is disregarded by the light detector.

The effective radiated power of the light beam shall be as follows:

a) at least 50 % shall be within a wavelength range from 800 nm to 950 nm;

b) not more than 1 % shall be in the wavelength range below 800 nm; and

c) not more than 10 % shall be in the wavelength range above 1 050 nm.

NOTE The effective radiated power in each wavelength range is the product of the power emitted by the light source, the transmission level of the optical measuring path in clean air and the sensitivity of the receiver, within this wavelength range.

C.2 Measuring ionization chamber (MIC)

C.2.1 General

The smoke response value of detectors using ionization is characterized by a non dimensional quantity *y* which is derived from the relative change of the current flowing in a measuring ionization chamber, and which is related to the particle concentration of the test aerosol, measured in the proximity of the detector, at the moment that it activates an alarm signal.

C.2.2 Operating method and basic construction

The mechanical construction of the measuring ionization chamber is shown in Annex Q.

The measuring device consists of a measuring chamber, an electronic amplifier and a method of continuously sucking in a sample of the aerosol or smoke to be measured.

The principle of operation of the measuring ionization chamber is shown in Figure C.1. The measuring chamber contains a measuring volume and a suitable means by which the sampled air is sucked in and passes the measuring volume in such a way that the aerosol/smoke particles diffuse into this volume. This diffusion is such that the flow of ions within the measuring volume is not disturbed by air movements.

The air within the measuring volume is ionized by alpha radiation from an americium radioactive source, such that there is a bipolar flow of ions when an electrical voltage is applied between the electrodes. This flow of ions is affected by the aerosol or smoke particles in a known manner. The relative variation in the current of ions is used as a measurement of the aerosol or smoke concentration.

The measuring chamber is so dimensioned and operated that the following relationships apply:

$$Z \times \overline{d} = \eta \times y \quad \text{and} \quad y = \left(\frac{I_0}{I}\right) - \left(\frac{I}{I_0}\right)$$

where

I_0 is the chamber current in air without test aerosol or smoke;

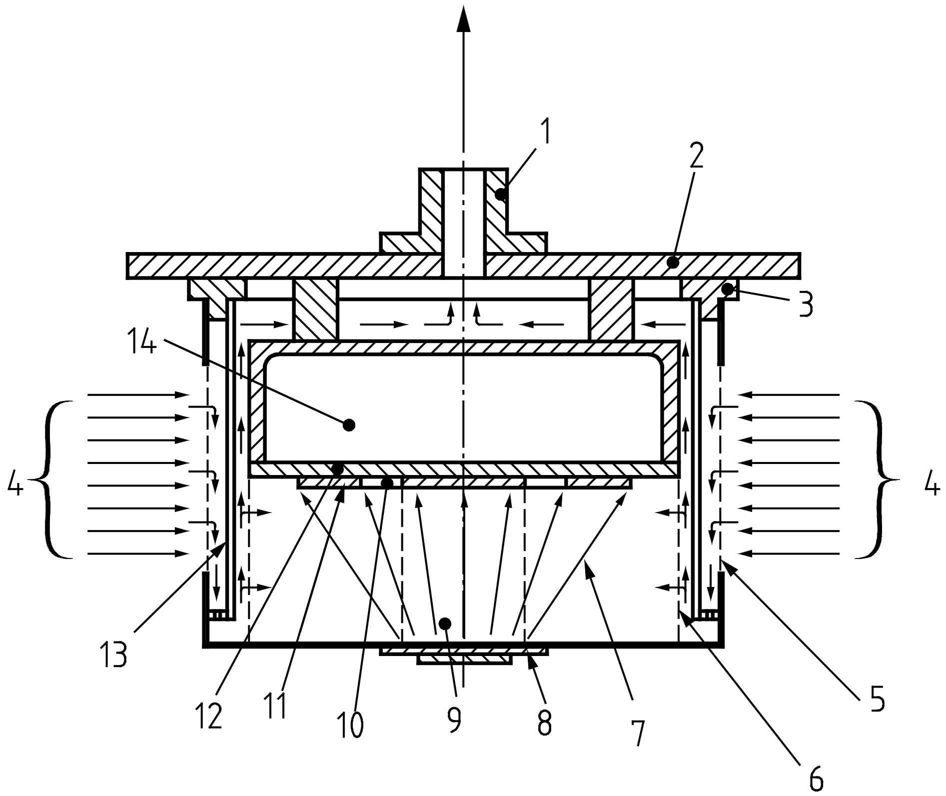
I is the chamber current in air with test aerosol or smoke;

η is the chamber constant;

Z is the particle concentration in particles per m^3;

$\overline{d}$ is the average particle diameter in metres.

The non-dimensional quantity y, which is approximately proportional to the particle concentration for a particular type of aerosol or smoke, is used as a measure of response value for smoke detectors using ionization.



Key

1	suction nozzle	6	inner grid	11	guard ring
2	assembly plate	7	α rays	12	insulating material
3	insulating ring	8	α source	13	windshield
4	air/smoke entry	9	measuring volume	14	electronics
5	outer grid	10	measuring electrode		

Figure C.1 — Measuring ionization chamber - method of operation

C.2.3 Technical data

a) Radiation source:

Isotope:	Americium Am^{241};
Activity:	130 kBq (3,5 µCi) ± 5 %;
Average α energy:	4,5 MeV ± 5 %;
Mechanical construction:	Americium oxide embedded in gold between two layers of gold. Covered with a hard gold alloy. The source is in the form of a circular disc with a diameter of 27 mm, which is mounted in a holder such that no cut edges are accessible.

b) Ionization chamber:

The chamber impedance (i.e. the reciprocal of the slope of the current vs voltage characteristic of the chamber in its linear region (chamber current ≤ 100 pA)) shall be $1,9 \times 10^{11}\ \Omega \pm 5\ \%$, when measured in aerosol- and smoke-free air at:

Pressure: (101,3 ± 1) kPa;

Temperature:	(25 ± 2) °C;
Relative humidity:	(55 ± 20) %;

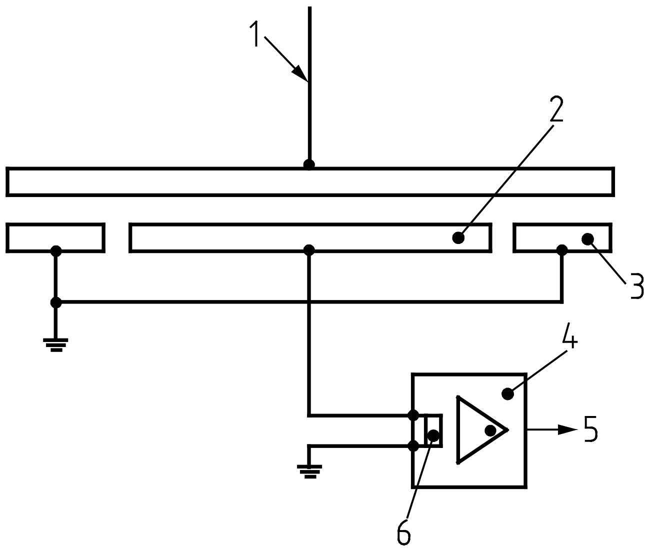
with the potential of the guard ring within ± 0,1 V of the voltage of the measuring electrode.

c) Current measuring amplifier:

The chamber is operated in the circuit shown in Figure C.2, with the supply voltage such that the chamber current between the measuring electrodes is 100 pA in aerosol- or smoke-free air. The input impedance of the current measuring device shall be < 10^9 Ω.

d) Suction system:

The suction system shall draw air through the device at a continuous steady flow of 30 l min^{-1} ± 10 % at atmospheric pressure.



Key

1	supply voltage	4	current measuring amplifier
2	measuring electrode	5	output voltage proportional to chamber current
3	guard ring	6	input impedance, Z_{in} < 10^9 Ω

Figure C.2 — Measuring ionization chamber - operating circuit

Annex D
(normative)

Heat tunnel for heat response value

This annex specifies those properties of the heat tunnel that are of primary importance for making repeatable and reproducible measurements of heat response values (see 5.1.6). The information in Annex O should be carefully considered and taken into account when designing the heat tunnel and using it to make measurements in accordance with this standard.

The heat tunnel shall meet the following requirements for each class of heat detector it is used to test:

a) The heat tunnel (see Figure O.1) shall have a horizontal working section containing a working volume. The working volume is a defined part of the working section, where the air temperature and air flow conditions are within ± 2 K and ± 0,1 m/s, respectively, of the nominal test conditions. Conformance with this requirement shall be regularly verified under both static and rate-of-rise conditions by measurements at an adequate number of points distributed within and on the imaginary boundaries of the working volume. The working volume shall be large enough to fully enclose the detector(s) to be tested, the required amount of mounting board and the temperature measuring sensor.

b) The detector to be tested shall be mounted in its normal operating position on the underside of a flat board aligned with the air flow in the working volume. The board shall be (5 ± 1) mm thick and of such dimensions that the edge(s) of the board are at least 20 mm from any part of the detector. The edge(s) of the board shall have a semi-circular form and the air flow between the board and the tunnel ceiling shall not be unduly obstructed. The material from which the board is made shall have a thermal conductivity not greater than 0,52 W/(m K).

c) If more than one detector is to be mounted in the working volume and tested simultaneously (Figure O.2), then previous tests shall have been conducted, which confirm that response time measurements made simultaneously on more than one detector are in close agreement with measurements made by testing detectors individually. In the event of a dispute, the value obtained by individual testing shall be accepted.

d) Means shall be provided for creating a stream of air through the working volume at the constant temperatures and rates of rise of air temperature specified for the classes of detector to be tested. This air stream shall be essentially laminar and maintained at a constant mass flow, equivalent to (0,8 ± 0,1) m/s at 25 °C.

e) The temperature sensor shall be positioned at least 50 mm upstream of the detector and at least 25 mm below the lower surface of the mounting board. The air temperature shall be controlled to within ± 2 K of the nominal temperature required at any time during the test.

f) The air-temperature measuring system shall have an overall time constant of not greater than 2 s, when measured in air with a mass flow equivalent to (0,8 ± 0,1) m/s at 25 °C.

g) Means shall be provided for measuring the response time of the detector under test to an accuracy of ± 1 s.

Annex E
(normative)

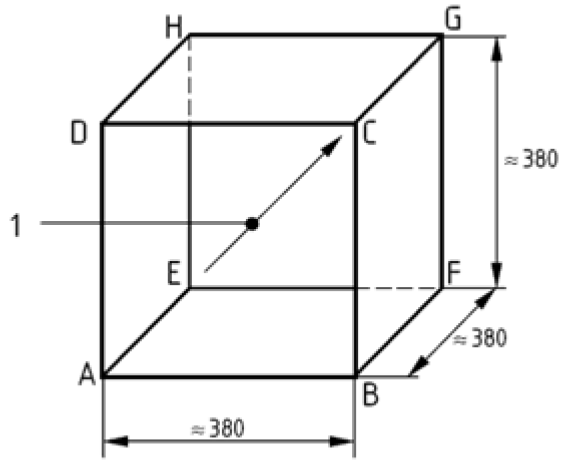
Apparatus for dazzling test

The apparatus (see Figure E.1) shall be constructed so that it can be inserted in the working section of the smoke tunnel. Four of the cube faces shall be closed and lined on the inside with high gloss aluminium foil; two opposing cube faces shall be open so that the test aerosol can flow through the device. Circular fluorescent lamps (32 W) with a diameter of approximately 30 cm shall be fitted to the closed surfaces of the cube.

The detector to be tested shall be installed within the cube (see Figure E.1) so that light can play on it from above, below and from two sides.

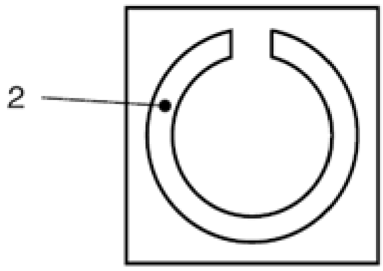
Care should be taken with the electrical connections to the fluorescent lamps to avoid technical interference with the detection system.

Dimensions in millimetres



NOTE It is essential that sides ABCD and EFGH be open to allow the flow of aerosol.

Sides ABFE, AEHD, BFGC and DCGH shall have lamps mounted as shown below:



Key

1 stream of aerosol

2 fluoroscent lamp

Figure E.1 — Dazzling apparatus

Annex F
(informative)

Apparatus for impact test

The apparatus (see Figure F.1) consists essentially of a swinging hammer comprising a rectangular section head (striker), with a chamfered impact face, mounted on a tubular steel shaft. The hammer is fixed into a steel boss, which runs on ball bearings on a fixed steel shaft mounted in a rigid steel frame, so that the hammer can rotate freely about the axis of the fixed shaft. The design of the rigid frame is such as to allow complete rotation of the hammer assembly when the specimen is not present.

The striker is of dimensions 76 mm wide, 50 mm high and 94 mm long (overall dimensions) and is manufactured from aluminium alloy (Al Cu_4 Si Mg to ISO 209:2007), solution treated and precipitation treated condition. It has a plane impact face chamfered at (60 ± 1)° to the long axis of the head. The tubular steel shaft has an outside diameter of (25 ± 0,1) mm with walls (1,6 ± 0,1) mm thick.

The striker is mounted on the shaft so that its long axis is at a radial distance of 305 mm from the axis of rotation of the assembly, the two axes being mutually perpendicular. The central boss is 102 mm in outside diameter and 200 mm long and is mounted coaxially on the fixed steel pivot shaft, which is approximately 25 mm in diameter, however the precise diameter of the shaft will depend on the bearings used.

Diametrically opposite the hammer shaft are two steel counter balance arms, each 20 mm in outside diameter and 185 mm long. These arms are screwed into the boss so that the length of 150 mm protrudes. A steel counter balance weight is mounted on the arms so that its position can be adjusted to balance the weight of the striker and arms, as in Figure F.1. On the end of the central boss is mounted a 12 mm wide x 150 mm diameter aluminium alloy pulley and round this an inextensible cable is wound, one end being fixed to the pulley. The other end of the cable supports the operating weight.

The rigid frame also supports the mounting board on which the specimen is mounted by its normal fixings. The mounting board is adjustable vertically so that the upper half of the impact face of the hammer will strike the specimen when the hammer is moving horizontally, as shown in Figure F.1.

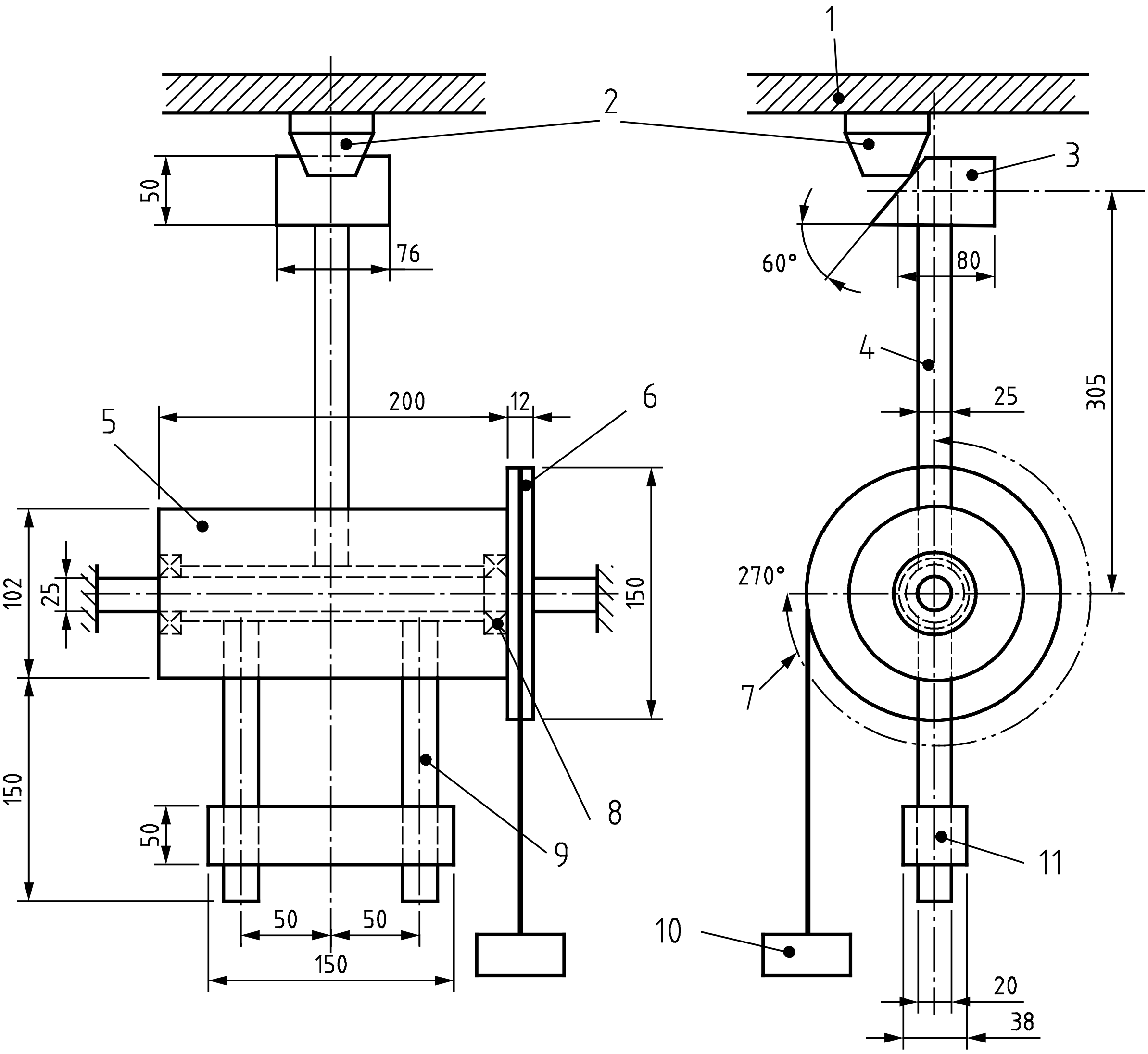
To operate the apparatus the position of the specimen and the mounting board is first adjusted as shown in Figure F.1 and the mounting board is then secured rigidly to the frame. The hammer assembly is then balanced carefully by adjustment of the counter balance weight with the operating weight removed. The hammer arm is then drawn back to the horizontal position ready for release and the operating weight is reinstated. On release of the assembly the operating weight will spin the hammer and arm through an angle of 3π/2 radians to strike the specimen. The mass of the operating weight to produce the required impact energy of 1,9 J equals:

$$\frac{0{,}388}{3\,\pi\,r} \quad \text{kg}$$

where *r* is the effective radius of the pulley in metres. This equals approximately 0,55 kg for a pulley radius of 75 mm.

As the standard calls for a hammer velocity at impact of (1,5 ± 0,13) m s^{-1} the mass of the hammer head will need to be reduced by drilling the back face sufficiently to obtain this velocity. It is estimated that a head of mass of about 0,79 kg will be required to obtain the specified velocity, but this will have to be determined by trial and error.

Dimensions in millimetres



Key

1	mounting board	7	270° angle of movement
2	detector	8	ball bearings
3	striker	9	counter balance arms
4	striker shaft	10	operating weight
5	boss	11	counter balance weight
6	pulley		

NOTE The dimensions shown are for guidance, apart from those relating to the hammer head.

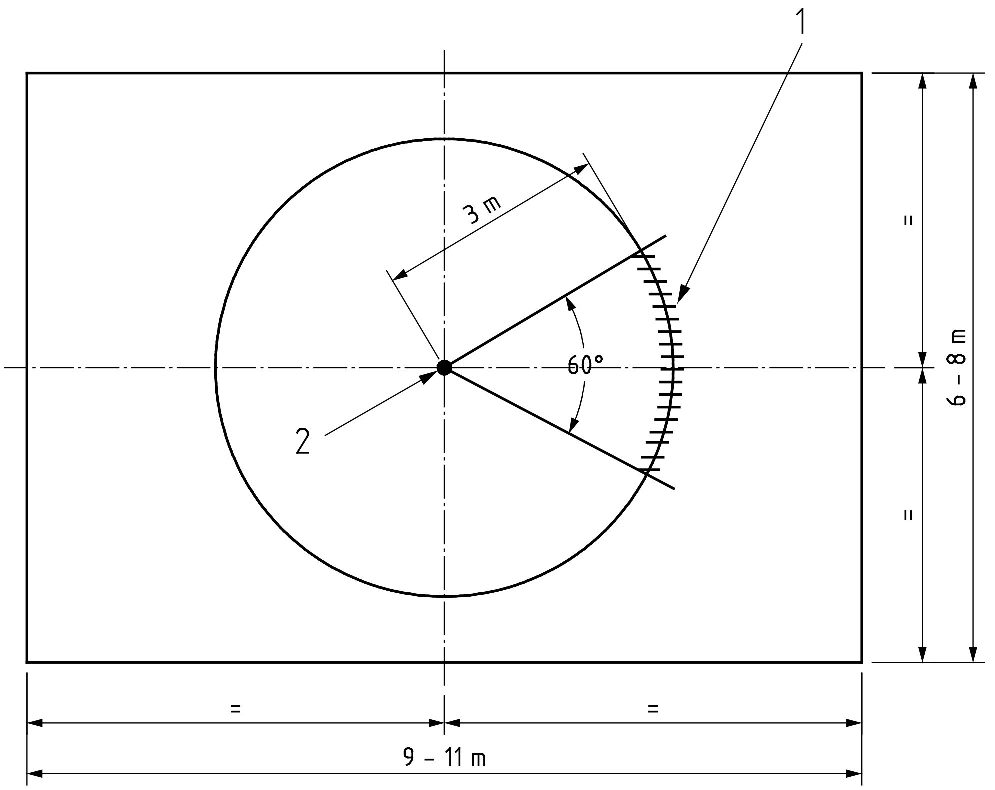
Figure F.1 — Impact apparatus

Annex G
(normative)

Fire test room

The specimens to be tested, the MIC, the temperature probe and the measuring part of the obscuration meter, shall all be located within the volume shown in Figure G.1 and Figure G.2.

The specimens, the MIC and the mechanical parts of the obscuration meter shall be at least 100 mm apart, measured to the nearest edges. The centre line of the beam of the obscuration meter shall be at least 35 mm below the ceiling.

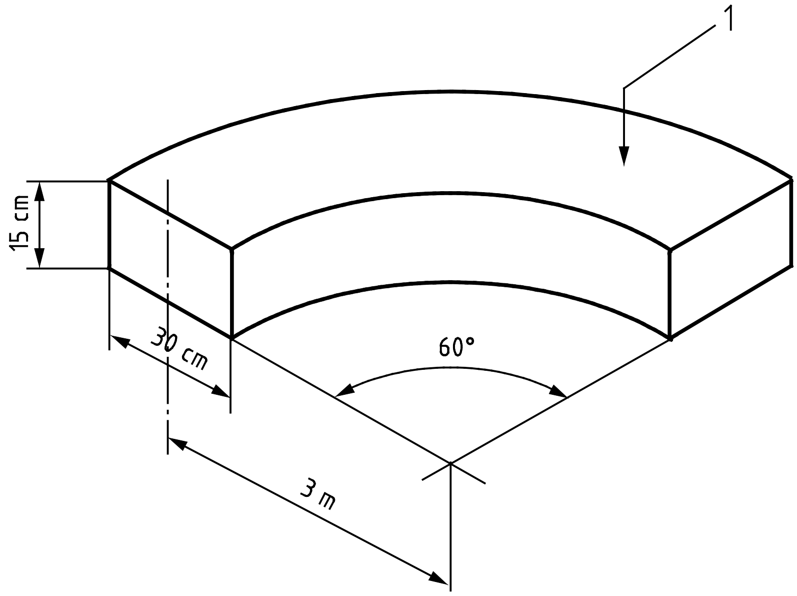


Key

1 specimens and measuring instruments (see Figure G.2)

2 position of test fire

Figure G.1 — Plan view of the fire test room



Key

1 ceiling

Figure G.2 — Mounting position for specimens and measuring instruments

Annex H
(normative)

Open wood fire (TF1)

H.1 Fuel

Approximately 70 dried beech wood sticks, each stick having dimensions of 10 mm × 20 mm by 250 mm.

A moisture content of about 5 % is recommended to obtain a valid test fire. This can be achieved by drying wood for 2 to 3 days in a climatic chamber at 50°C. If necessary, the sticks should be transported from the oven in a closed plastic bag and opened just prior to laying out the sticks in the test arrangement.

H.2 Arrangement

Seven layers are to be superimposed on a base surface measuring approximately 50 cm wide x 50 cm long x 8 cm high (see Figure H.1). A bowl 5 cm in diameter shall be located in the centre of base surface. It shall contain between 0,5 cm^3 and 1 cm^3 of methylated spirits.

NOTE The variation of content of methylated spirits is needed to achieve a valid test fire in different fire test rooms.

H.3 Method of ignition

Ignition shall be by flame or spark in the methylated spirits.

H.4 Variables

Between five and eight layers shall be superimposed on a base surface measuring approximately 50 cm wide x 50 cm long x 8 cm high (see Figure H.1).

NOTE The number of sticks may be varied in order for the test fire to remain within the profile curve limits.

H.5 End-of-test condition

The end of test condition shall be when either

— y_E = 6,

— t_E is greater than 370 s or

— all the specimens have set off an alarm signal.

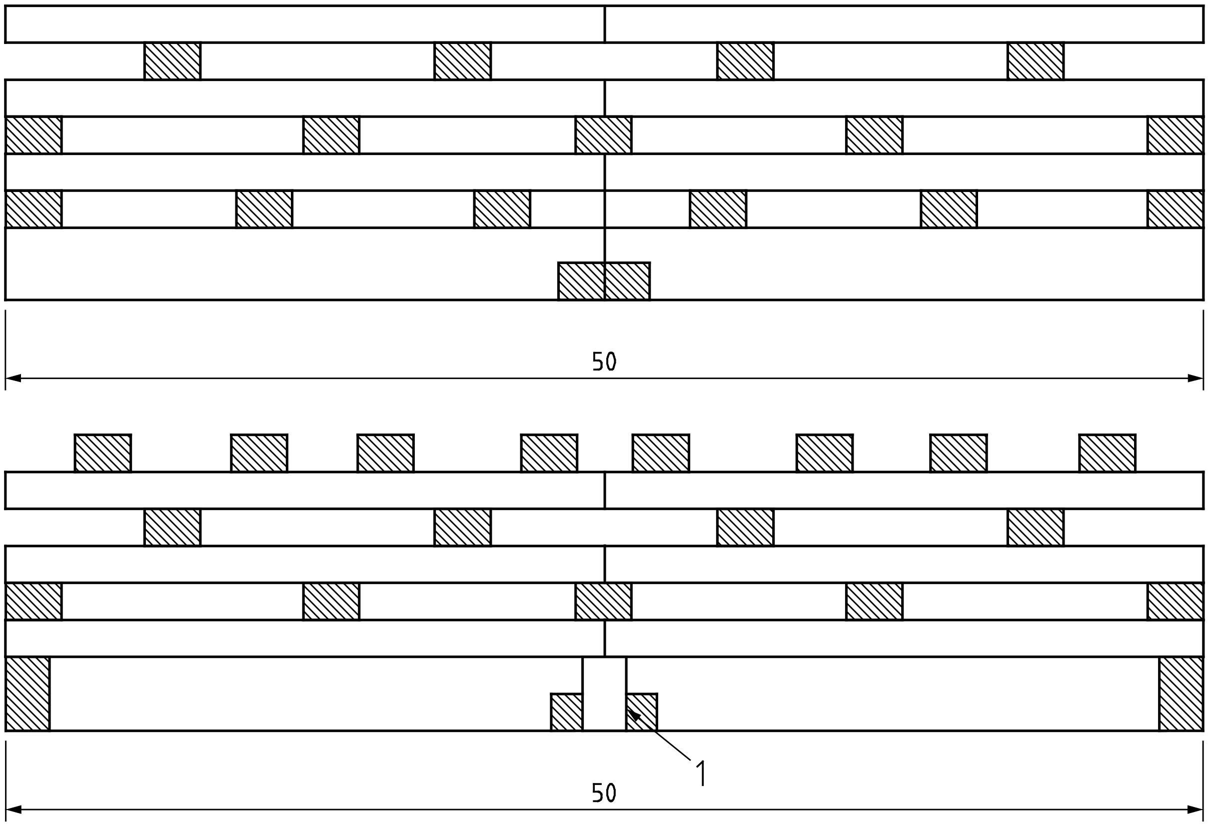
H.6 Test validity criteria

The development of the fire shall be such that the curves of *m* against *y*, and m against time, *t*, fall within the boundary areas shown in Figure H.2 and Figure H.3 respectively. That is, 0,45 dB m^{-1} < *m* < 0,75 dB m^{-1} and 270 s < *t* < 370 s at the end-of-test condition y_E = 6,0.

It shall be allowed to shift the starting point of the measurement in time in order to make the result fit into the boundary curves.

If the end of test condition, y_E = 6 is reached before all the specimens have responded, then the test is only considered valid if a temperature rise of 20 K has been achieved.

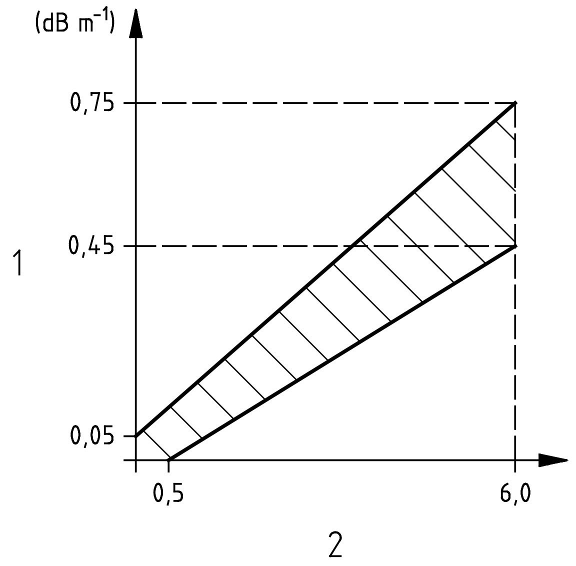
Dimensions in cm



Key

1 container for methylated spirits

Figure H.1 —Wood arrangement for test fire TF-1

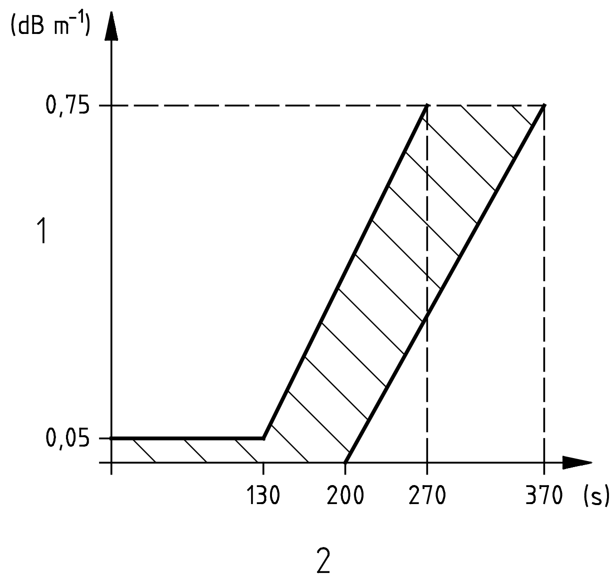


key

1 *m*-value

2 *y*-value

Figure H.2 — Limits for *m* against *y*, Fire TF1



Key

1 *m*-value

2 time, *t*

Figure H.3 — Limits for *m* against time, *t*, Fire TF1

Annex I
(normative)

Smouldering (pyrolysis) wood fire (TF2)

I.1 Fuel

Approximately 10 dried beechwood sticks (moisture content approximately 5 %), each stick having dimensions of 75 mm × 25 mm × 20 mm.

I.2 Hotplate

The hot plate shall have a 220 mm diameter grooved surface with eight concentric grooves, each 2 mm deep and 5 mm wide, with the outer groove 4 mm from the edge and a distance of 3 mm between grooves. The hot plate shall have a rating of approximately 2 kW.

The temperature of the hot plate shall be measured by a temperature probe attached to the fifth groove, counted from the edge of the hot plate, and secured to provide a good thermal contact.

I.3 Arrangement

The sticks shall be arranged radially on the grooved hotplate surface, with the 20-mm side in contact with the surface such that the temperature probe lies between the sticks and is not covered, as shown in Figure I.1.

I.4 Heating rate

The hotplate shall be powered such that its temperature rises from ambient to 600 °C in approximately 11 min.

I.5 End-of-test condition

The end-of-test condition shall be when:

— m_E = 2 dB/m, or

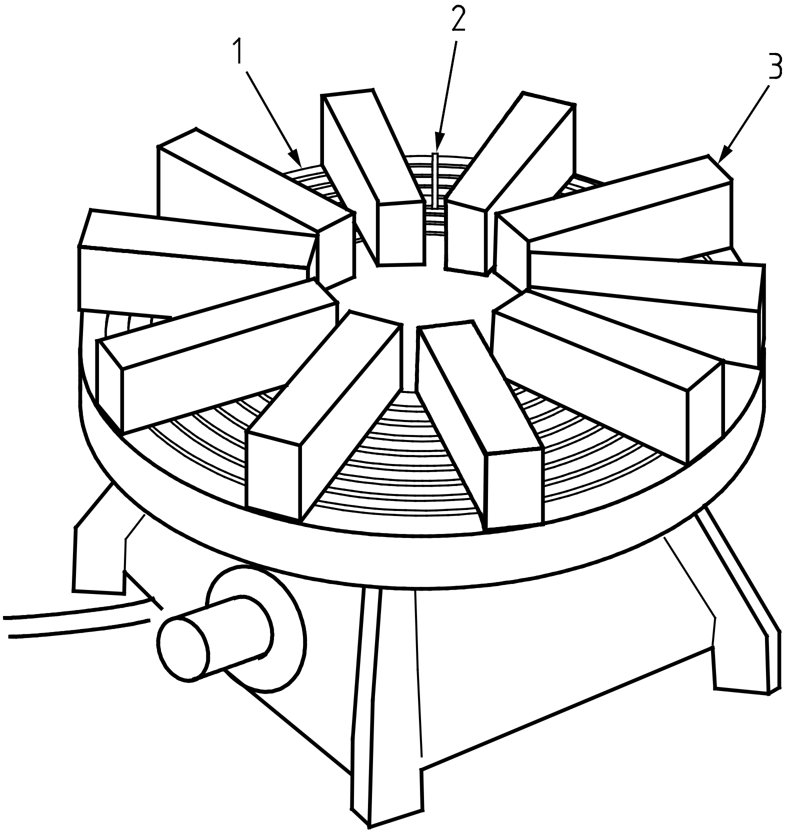
— t > 840 s,

— all of the specimens have generated an alarm signal, whichever is the earlier.

I.6 Test validity criteria

No flaming shall occur before the end-of-test condition has been reached. The development of the fire shall be such that the curves of m against y, and m against time, t, fall within the limits shown in Figure I.2 and Figure I.3, respectively. That is, $1,23 < y < 2,05$ and $570\ s < t < 840\ s$ at the end-of-test condition m_E = 2 dB/m.

If the end of test condition, m_E = 2 dB/m is reached before all the specimens of detectors using ionization have responded, then the test is only considered valid if a y-value of 1,6 has been reached.



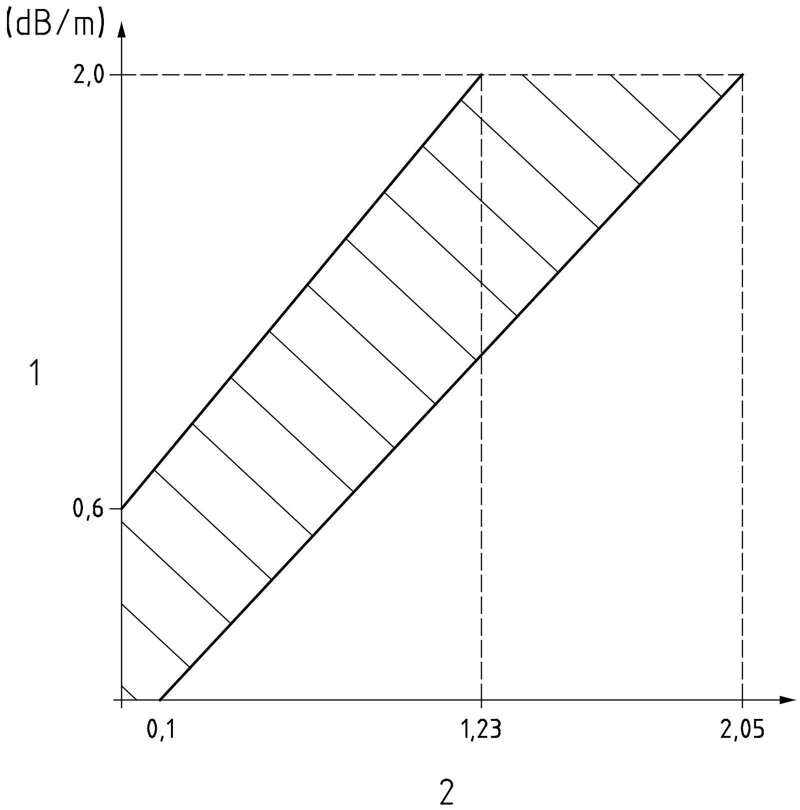
Key

1 grooved hotplate

2 temperature sensor

3 wooden sticks

Figure I.1 — Arrangement of sticks on hotplate

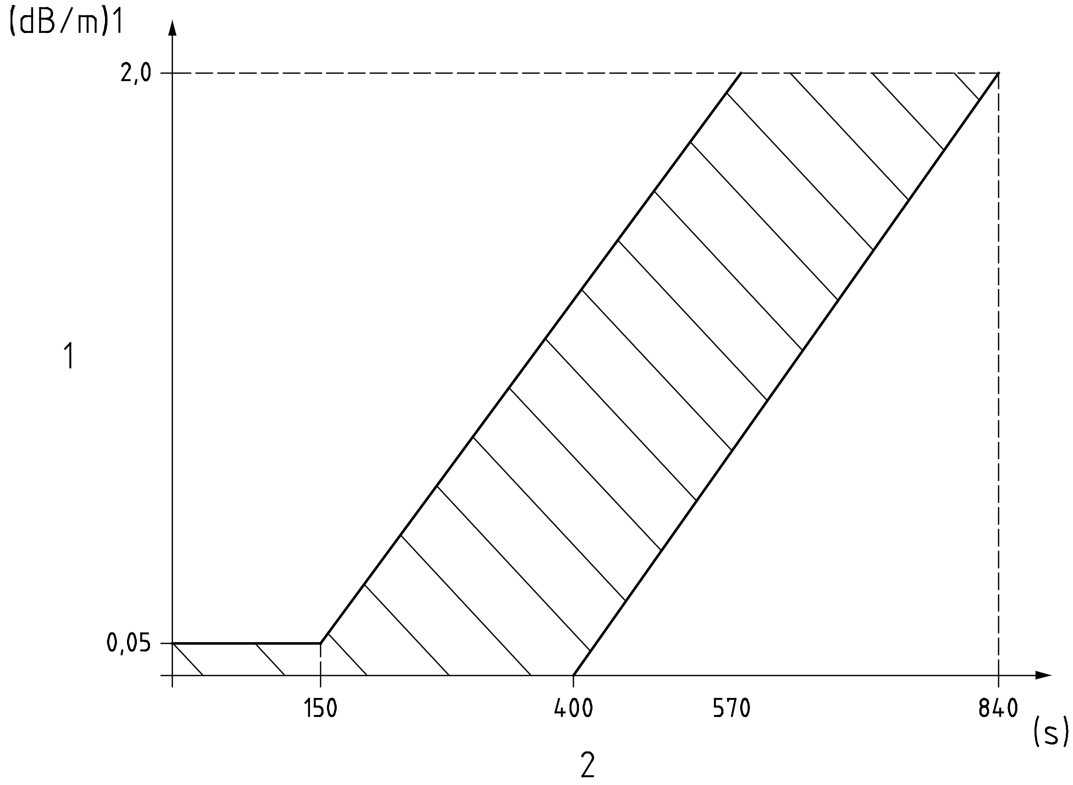


Key

1 *m*-value

2 *y*-value

Figure I.2 — Limits for *m* against *y*, Fire TF2



Key

1 *m*-value

2 time, *t*

Figure I.3 — Limits for *m* against time, *t*, Fire TF2

Annex J
(normative)

Glowing smouldering cotton fire (TF3)

J.1 Fuel

Approximately 90 pieces of braided cotton wick, each approximately 80 cm long and weighing approximately 3 g. The wicks shall be free from any protective coating and shall be washed and dried if necessary.

J.2 Arrangement

The wicks shall be fastened to a ring approximately 10 cm in diameter and suspended approximately 1 m above a non-combustible plate as shown in Figure J.1.

Dimensions in metres

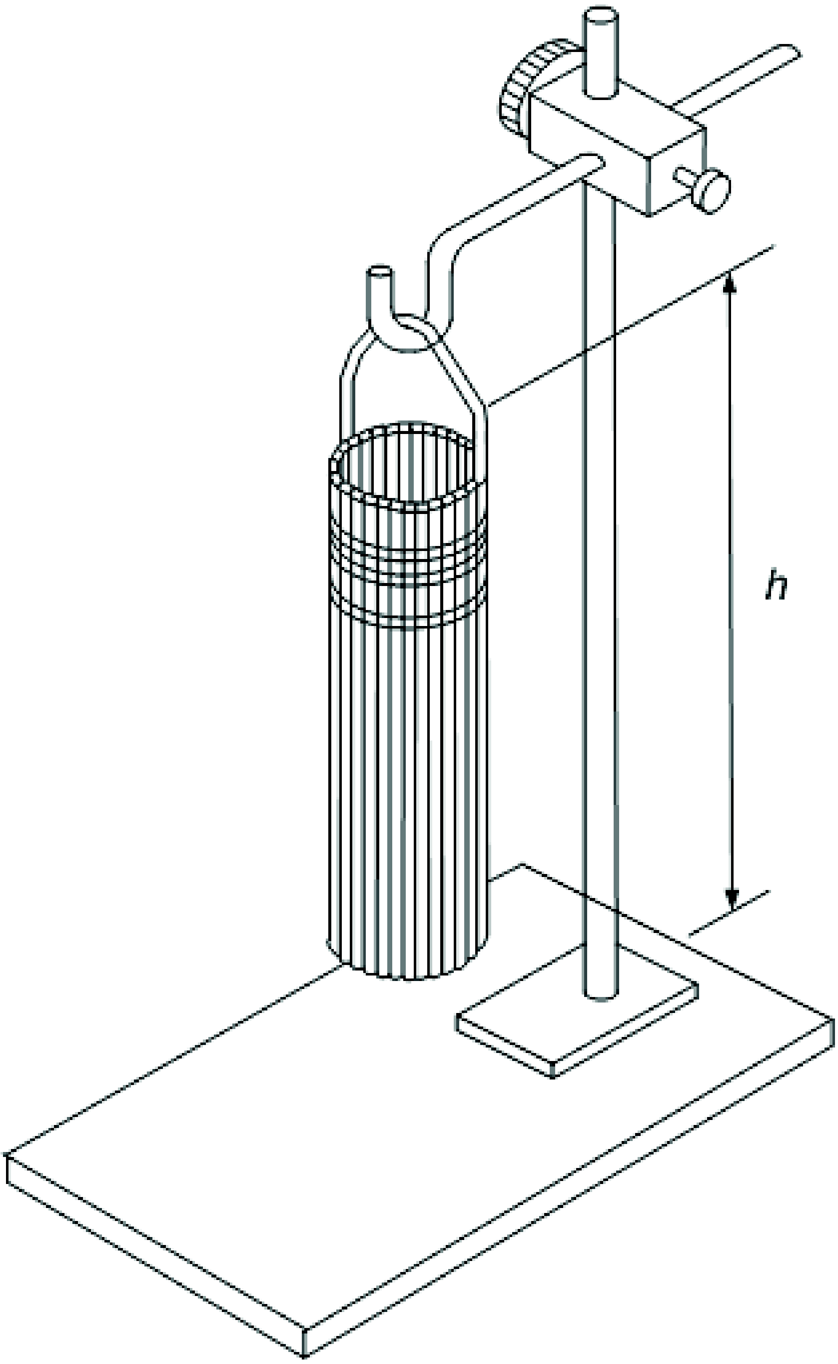


Figure J.1 — Arrangement of cotton wicks

J.3 Ignition

The lower end of each wick shall be ignited so that the wicks continue to glow. Any flaming shall be blown out immediately. The test time shall start when all wicks are glowing.

J.4 End-of-test condition

The end-of-test condition shall be when:

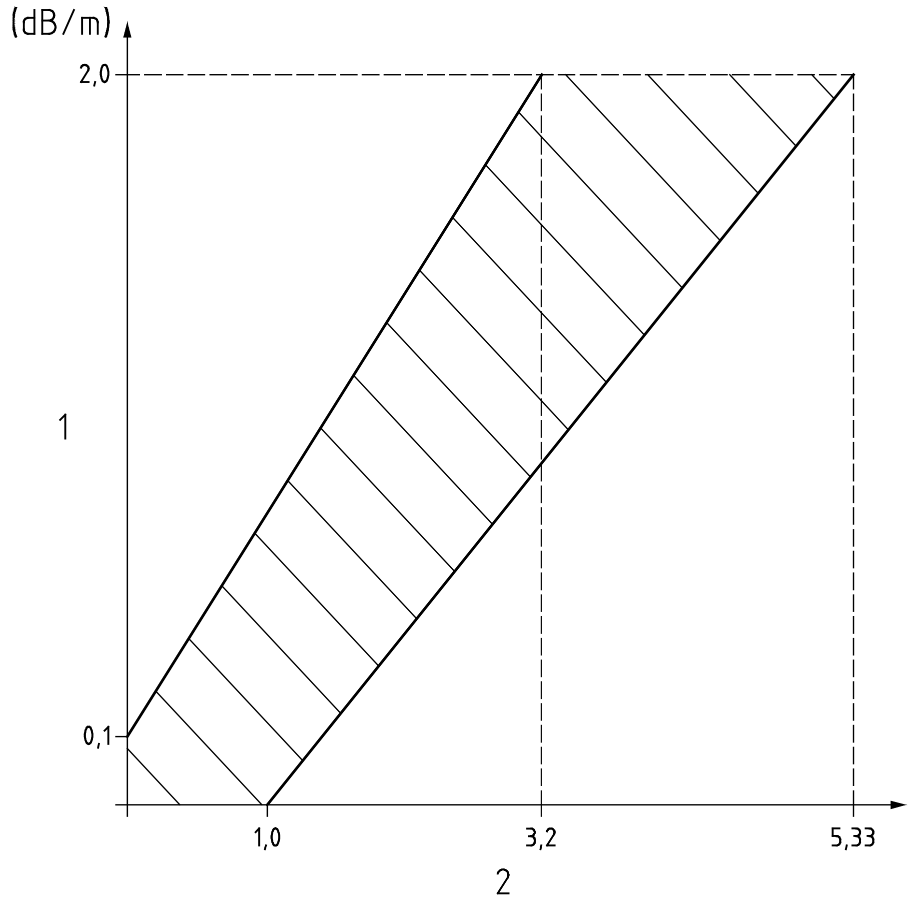
— m_E = 2 dB/m, or

— t > 750 s, or

— all of the specimens have generated an alarm signal, whichever is the earlier.

J.5 Test validity criteria

The development of the fire shall be such that the curves of m against y and m against time, t, fall within limits shown in Figures J.2 and J.3, respectively. That is 3,2 < y < 5,33 and 280 s < t < 750 s at the end-of-test condition m_E = 2 dB/m.

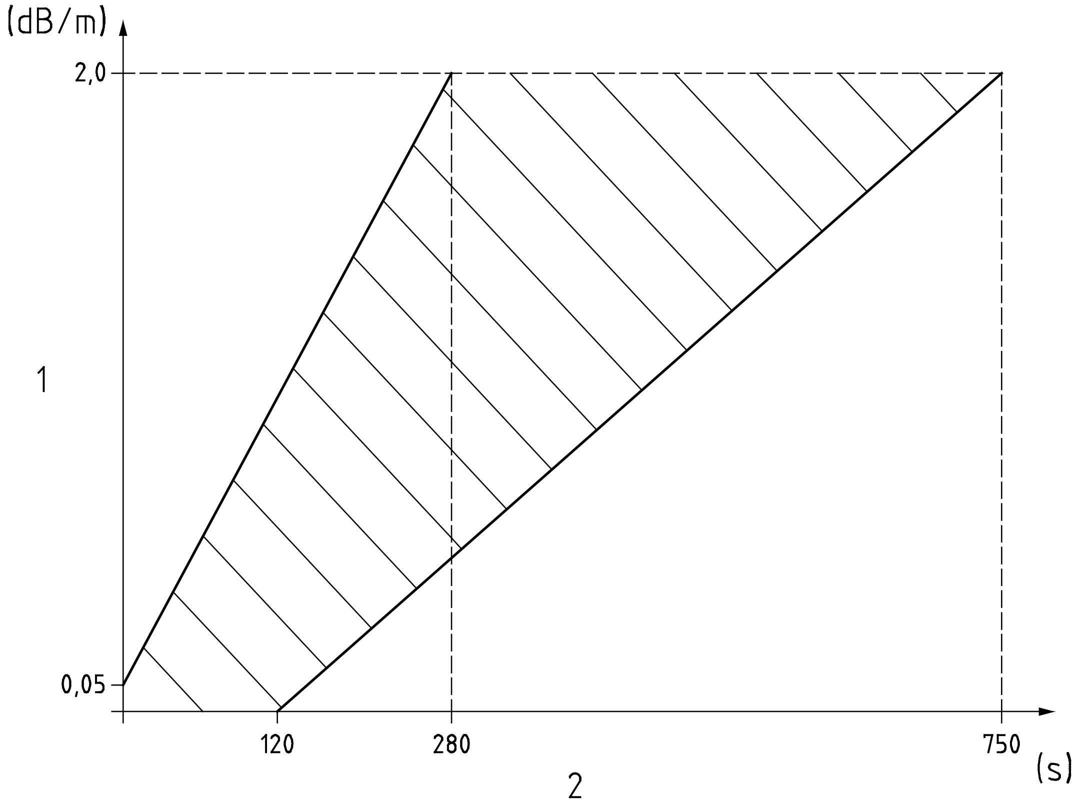


Key

1 m-value

2 y-value

Figure J.2 — Limits for m against y, Fire TF3



Key

1 *m*-value

2 time, *t*

Figure J.3 — Limits for *m* against time, *t*, Fire TF3

Annex K
(normative)

Open plastics (polyurethane) fire (TF4)

K.1 Fuel

Three mats, approximately 50 cm × 50 cm × 2 cm, of soft polyurethane foam, without flame-retardant additives and having a density of approximately 20 kg/m^3, are usually found sufficient. However, the exact quantity of fuel may be adjusted to obtain valid tests.

K.2 Conditioning

The mats shall be maintained in a humidity not exceeding 50 % at least 48 h prior to test.

K.3 Arrangement

The mats shall be placed one on top of another on a base formed from aluminium foil with the edges folded up to provide a tray.

K.4 Ignition

The mats shall normally be ignited at a corner of the lower mat; however the exact position of ignition may be adjusted to obtain a valid test. A small quantity of a clean burning material (e.g. 5 cm^3 of methylated spirit) may be used to assist the ignition.

K.5 Method of ignition

Ignition shall be by flame, spark or equivalent method.

K.6 End-of-test condition

The end-of-test condition shall be when:

— y_E = 6, or

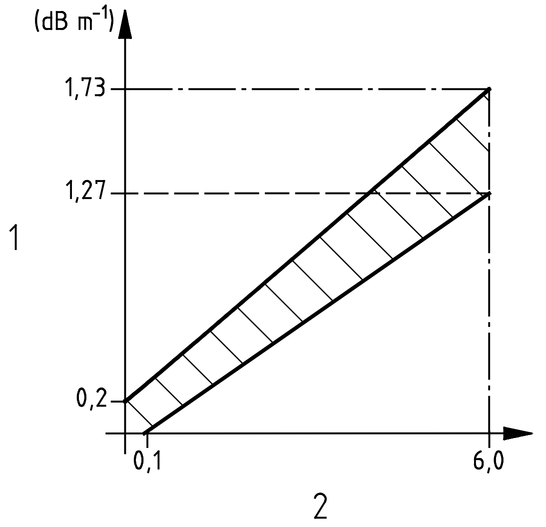
— t > 180 s, or

— all of the specimens have generated an alarm signal, whichever is the earlier.

K.7 Test validity criteria

The development of the fire shall be such that the curves of m against y and m against time, t, fall within limits shown in Figure K.1 and Figure K.2, respectively. That is 1,27 dB/m < m < 1,73 dB/m and 140 s < t < 180 s at the end-of-test condition y_E = 6.

If the end of test condition, $y_E = 6$ is reached before all the specimens have responded, then the test is only considered valid if an *m*-value of > 1,5 dB/m and a temperature rise of 8 K has been achieved.

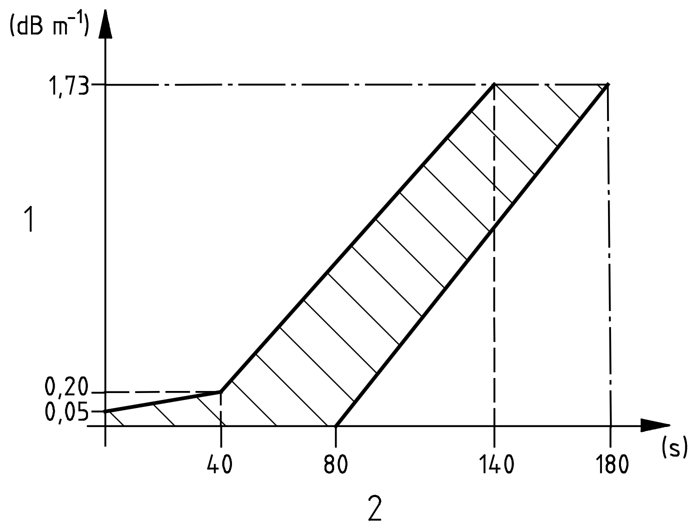


Key

1 *m*-value

2 *y*-value

Figure K.1 — Limits for *m* against, *y*, Fire TF4



Key

1 *m*-value

2 time, *t*

Figure K.2 — Limits for *m* against time, *t*, Fire TF4

Annex L
(normative)

Liquid (heptane) fire (TF5)

L.1 Fuel

Approximately 650 g of a mixture of *n*-heptane (purity ≥ 99 %) with approximately 3 % of toluene (purity ≥ 99 %), by volume. The precise quantities may be varied to obtain valid tests.

L.2 Arrangement

The heptane/toluene mixture shall be burnt in a square steel tray with dimensions of approximately 33 cm × 33 cm × 5 cm.

L.3 Ignition

Ignition shall be by flame or spark.

L.4 End-of-test condition

The end-of-test condition shall be when

— $y_E = 6$, or

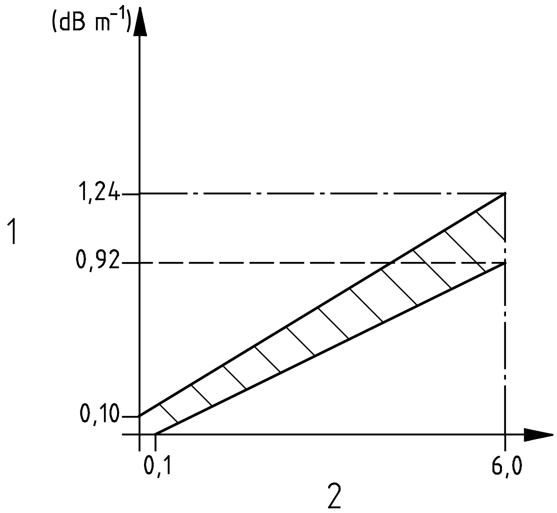
— $t > 240$ s, or

— all of the specimens have generated an alarm signal, whichever is the earlier.

L.5 Test validity criteria

The development of the fire shall be such that the curves of m against y, m against time, t, and S against time, t, fall within the limits shown in Figure L.1 and Figure L.2, respectively. That is 0,92 dB/m < m < 1,24 dB/m and 120 s < t < 240 s at the end-of-test condition $y_E = 6$.

If the end of test condition, $y_E = 6$ is reached before all the specimens have responded, then the test is only considered valid if an *m*-value of > 1,1 dB/m and a temperature rise of 35 K has been reached.

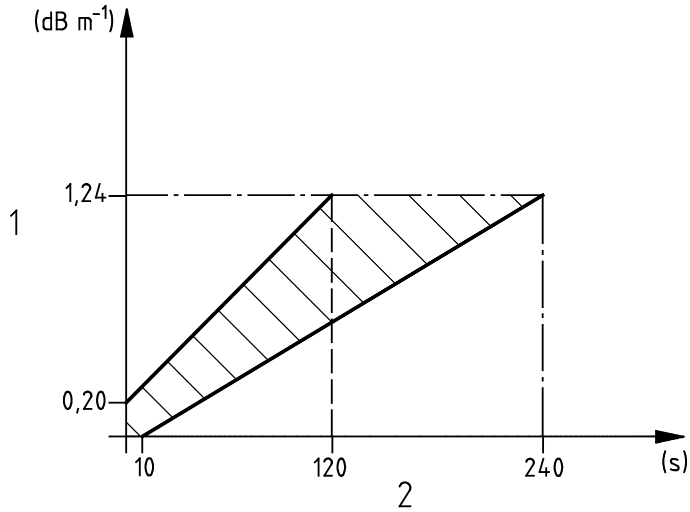


Key

1 *m*-value

2 *y*-value

Figure L.1 — Limits for *m* against *y*, Fire TF5



Key

1 *m*-value

2 time, *t*

Figure L.2 — Limits for *m* against time, *t*, Fire TF5

Annex M
(normative)

Low temperature black smoke (decalene) liquid fire (TF8)

M.1 Fuel

Approximately 170 g of decalene (decahydronaphtalene for synthesis; a mixture of cis and trans isomers - $C_{10}H_{18}$ – M = 138,25 g/mol – with a density of 0,88 kg/l).

M.2 Arrangement

The decalene shall be burned in a square steel tray with dimensions approximately 12 cm x 12 cm and 2 cm depth.

M.3 Ignition

Ignition shall be by flame or spark etc. A small quantity of a clean burning material (5 g of ethanol C_2H_5OH) shall be used to assist ignition.

M.4 End-of-test condition

The end-of-test condition shall be when

— m_E = 1,7 dB/m, or

— t = 1000 s, or

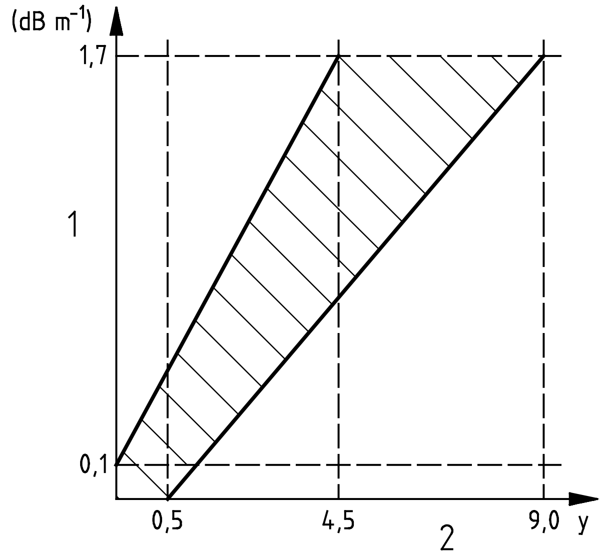
— all of the specimens have generated an alarm signal, whichever is the earlier.

M.5 Test validity criteria

The development of the fire shall be such that the curves of m against y and m against time, t, fall within the limits shown in Figure M.1 and Figure M.2, respectively. That is 4,5 < y < 9 and 550 s < t < 1 000 s at the end-of-test condition m_E = 1,7 dB/m.

The maximum temperature rise until the end-of-test shall be $\Delta T_E \leq$ 10K.

If the end of test condition, m_E = 1,7 dB/m is reached before all the specimens of detectors using ionization have responded, then the test is only considered valid if a *y*-value of 6 has been reached.

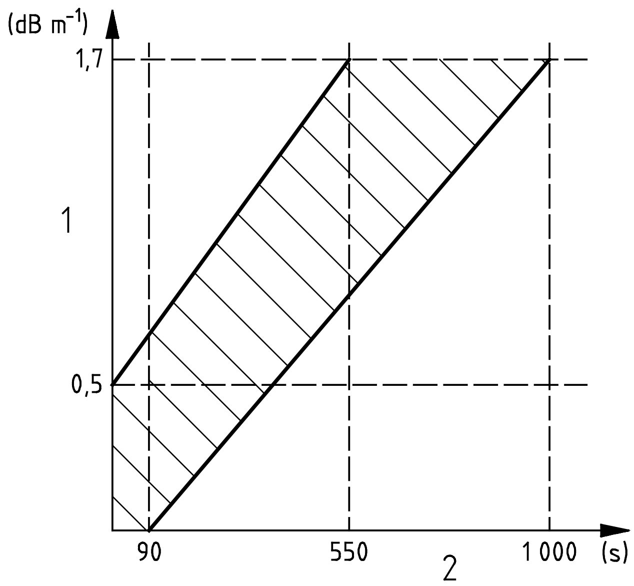


Key

1 *m*-value

2 *y*-value

Figure M.1 —Limits for *m* against *y*, Fire TF8



Key

1 *m*-value

2 time, *t*

Figure M.2 - Limits for *m* against time, *t*, Fire TF8

Annex N
(informative)

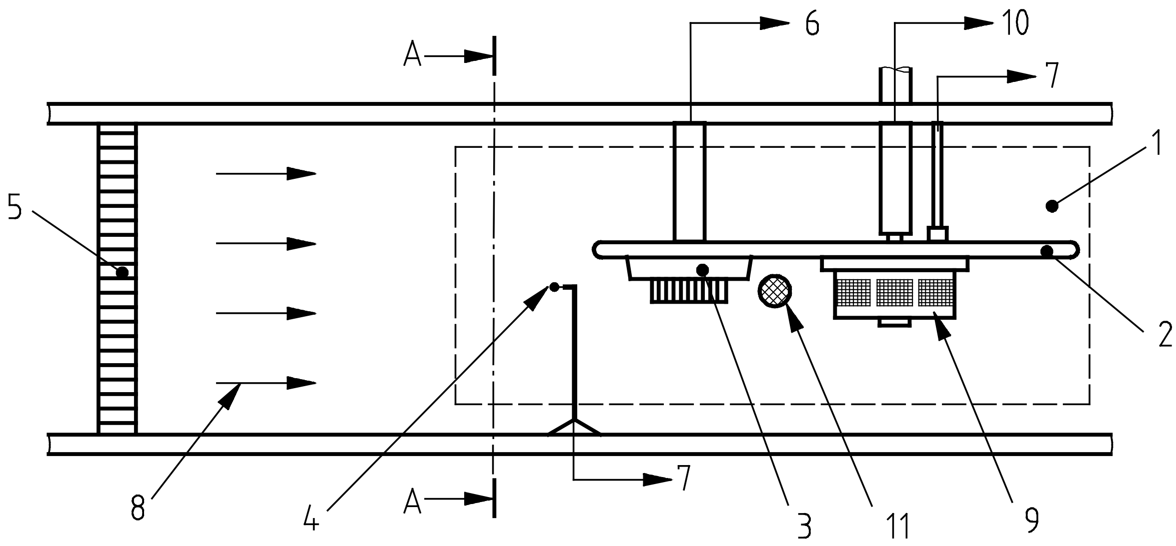
Information concerning the construction of the smoke tunnel

Smoke detectors respond when the signal(s) from one or more smoke sensors fulfil certain criteria. The smoke concentration at the sensor(s) is related to the smoke concentration surrounding the detector but the relation is usually complex and dependent on several factors, such as orientation, mounting, air velocity, turbulence, rate of rise of smoke density etc. The relative change of the response value measured in the smoke tunnel is the main parameter considered when the stability of smoke detectors is evaluated by testing in accordance with this standard.

Many different smoke tunnel designs are suitable for the tests specified in this standard but the following points should be considered when designing and characterizing a smoke tunnel.

The smoke response value measurements require increasing aerosol density until the detector responds. This can be facilitated in a closed circuit smoke tunnel. A purging system is required to purge the smoke tunnel after each aerosol exposure.

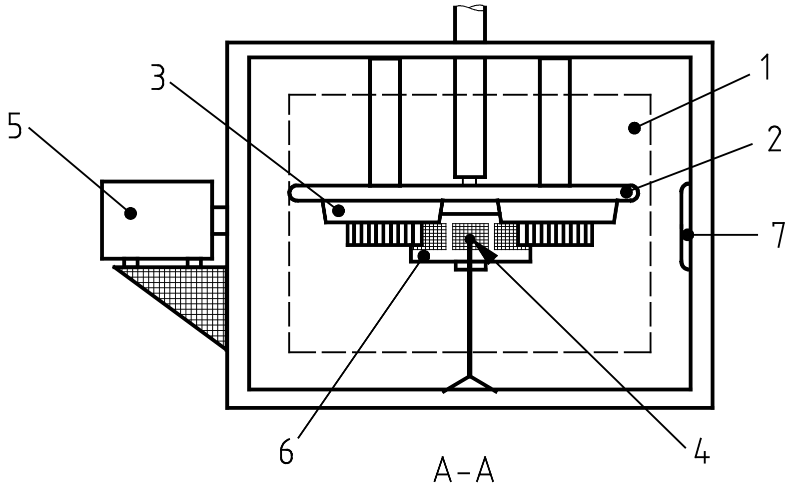
The air flow created by a fan in the tunnel will be turbulent, and needs to pass through an air straightener to create a nearly laminar and uniform air flow in the working volume (see Figure N.1 and Figure N.2). This can be facilitated by using a filter, honeycomb or both, in line with, and upstream of the working section of the tunnel. If a filter is used it should be coarse enough to let the aerosol pass. Care should be taken to ensure that the airflow is well mixed to give a uniform temperature and aerosol density before entering the flow straightener. Efficient mixing can be obtained by feeding the aerosol to the tunnel upstream of the fan.



Key

1	working volume	5	flow straightener	9	MIC, measuring ionization chamber
2	mounting board	6	supply and monitoring equipment	10	MIC suction
3	detector(s) under test	7	control and measuring equipment	11	obscuration meter
4	temperature sensor	8	air flow		

Figure N.1 — Smoke tunnel, working section, side view



Key

1 working volume
2 mounting board
3 detector(s) under test
4 temperature sensor
5 obscuration meter
6 MIC, measuring ionization chamber
7 reflector for obscuration meter

Figure N.2 — Smoke tunnel, working section, cross section A-A

Means for heating the air before it enters the working section are required. The tunnel should have a system capable of controlling the heating as to achieve the specified temperatures and temperature profiles in the working volume. The heating should be achieved by means of low temperature heaters to avoid the production of extraneous aerosols or alteration of the test aerosol.

Special attention should be given to the arrangement of the elements in the working volume in order to avoid disturbance of the test conditions e.g. due to turbulence. The suction through the MIC creates a mean air velocity of approximately 0,04 m s^{-1} in the plane of the entrance openings in the chamber housing. However, the effect of the suction will be negligible if the MIC is placed 10 cm to 15 cm downstream of the detector position.

The smoke tunnel may be designed for aerosol-free wind exposures with 5 m s^{-1} and 10 m s^{-1}, provided this does not interfere with the operation when the tunnel is used for response value measurements.

Annex O
(informative)

Construction of the heat tunnel

Heat detectors respond when the signal(s) from one or more sensors fulfil(s) certain criteria. The temperature of the sensor(s) is related to the air temperature surrounding the detector, but the relation is usually complex and dependent on several factors, such as orientation, mounting, air velocity, turbulence, rate of rise of air temperature, etc. Response times and response temperature and their stability are the main parameters considered when the fire-detection performance of heat detectors is evaluated by testing in accordance with this standard.

Many different heat-tunnel designs are suitable for the tests specified in this standard but the points which follow should be considered when designing and characterizing a heat tunnel against the requirements given in Annex D.

There are two basic types of heat tunnels; recirculating and non-recirculating. All else being equal, a non-recirculating tunnel requires a higher-powered heater than a recirculating tunnel, particularly for the higher rates of rise of air temperature. More care is generally needed to ensure that the high-powered heater and control system of a non-recirculating tunnel are sufficiently responsive to the changes in heat demand necessary to attain the required temperature-versus-time conditions in the working section. On the other hand, maintaining a constant mass flow with increasing temperature is generally more difficult in a recirculating tunnel.

The temperature control system should be able to maintain the temperature within ± 2 K of the “ideal ramp” for all of the specified rates of rise of air temperature. Such performance can be achieved in different ways e.g.

— by proportional heating control, where more heating elements are used when generating higher rates of rise. Improved temperature control may be achieved by powering some of the heating elements continuously, while controlling others. With this control system the distance between the tunnel heater and the detector under test should not be so large that the intrinsic delay in the temperature-control feedback loop becomes excessive at an air flow of 0,8 ± 0,1) m/s;

— by rate-controlled feed-forward heating control, assisted by proportional/integral (PI) feedback. This control system will permit greater distance between the tunnel heater and the detector under test.

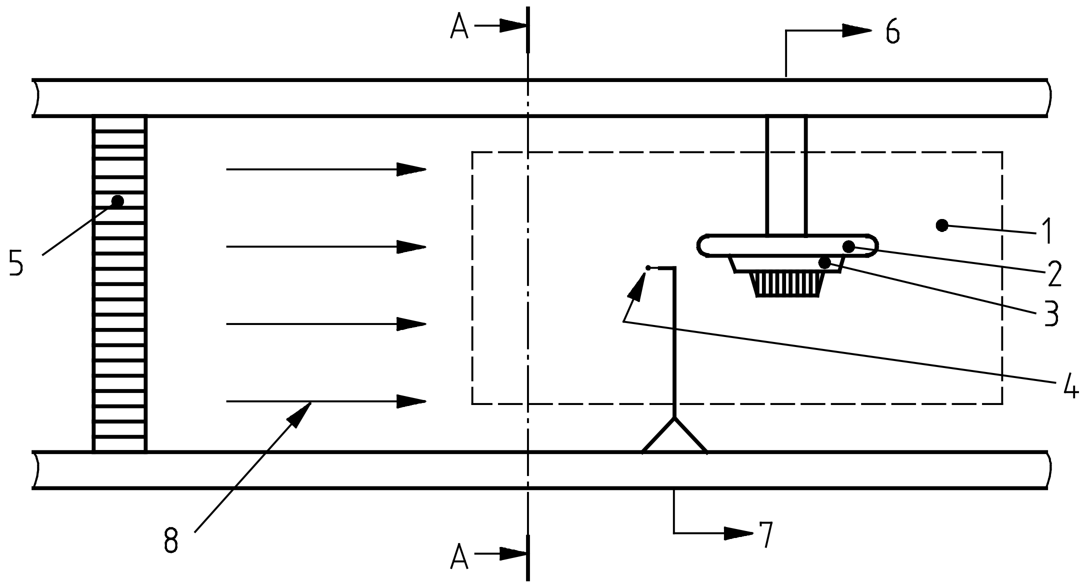
The important point is that the specified temperature profiles are obtained with the required accuracy within the working section.

For a non-recirculating tunnel, the anemometer used for air flow control and monitoring may be placed in a section of the tunnel upstream of the heater, where it will be subject to a substantially constant temperature, thereby eliminating any need to temperature compensate its output. A constant velocity, indicated by an anemometer so positioned, should correlate with a constant mass flow through the working volume. However, to maintain a constant mass flow at normal atmospheric pressure in a recirculating tunnel, it is necessary to increase the air velocity as the air temperature is increased. Careful consideration should therefore be given to ensuring that there is an appropriate correction for the temperature coefficient of the anemometer monitoring the airflow. It should not be assumed that an automatically temperature-compensated anemometer would compensate sufficiently quickly at high rates of rise of air temperature.

The air flow created by a fan in the tunnel will be turbulent, and will need to pass through a turbulence-reducer to create a nearly laminar and uniform air flow in the working volume (see Figure O.1). This may be facilitated by using a filter, honeycomb or both, in line with, and upstream of, the working section of the tunnel. Care should be taken to ensure that the airflow from the heater is mixed to a uniform temperature before entering the turbulence reducer.

It is not possible to design a tunnel where uniform temperature and flow conditions prevail in all parts of the working section. Deviations will exist, especially close to the walls of the tunnel where a boundary layer of slower and cooler air will normally be observed. The thickness of this boundary layer and the temperature gradient across it can be reduced by constructing or lining the walls of the tunnel with a low-thermal conductivity material.

Special attention should be given to the temperature-measuring system in the tunnel. The required overall time constant of not greater than 2 s in air means that the temperature sensor should have a very small thermal mass. In practice, only the fastest thermocouples and similar small sensors will be adequate for the measuring system. The effect of heat loss from the sensor via its leads can normally be minimized by exposing several centimetres of the lead to the airflow.



Key

1 working volume

2 mounting board

3 detector(s) under test

4 temperature sensor

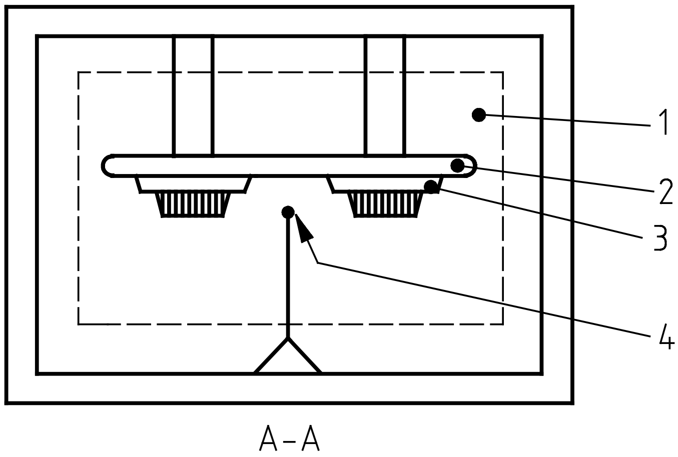
5 turbulence reducer

6 output to supply and monitoring equipment

7 output control and measuring equipment

8 air flow

Figure O.1 — Example of working section of heat tunnel



Key

1 working volume

2 mounting boards

3 detectors under tests

4 temperature sensor

Figure O.2 — Arrangement of heat tunnel - Section A-A

Annex P
(informative)

Information concerning test procedures and requirements for the response to slowly developing fires

A simple detector operates by comparing the signal from the sensor with a certain fixed value (alarm value). When the sensor signal reaches the value, the detector activates an alarm signal. The smoke density at which this occurs is the response value for the detector. In this simple detector the alarm value is fixed and does not depend on the rate of change of sensor signal with time.

It is known that the sensor signal in clean air can change over the life of the detector. Such changes can be caused, for example, by contamination of the sensing chamber with dust or by other long-term effects such as component ageing. This drift can, in time, lead to increased sensitivity and eventually to false alarms.

It may be considered beneficial therefore to provide compensation for such drift in order to maintain a more constant level of smoke response value with time. For the purposes of this discussion it is assumed that the compensation is achieved by increasing the smoke response value to offset some or all of the upward drift in the sensor output.

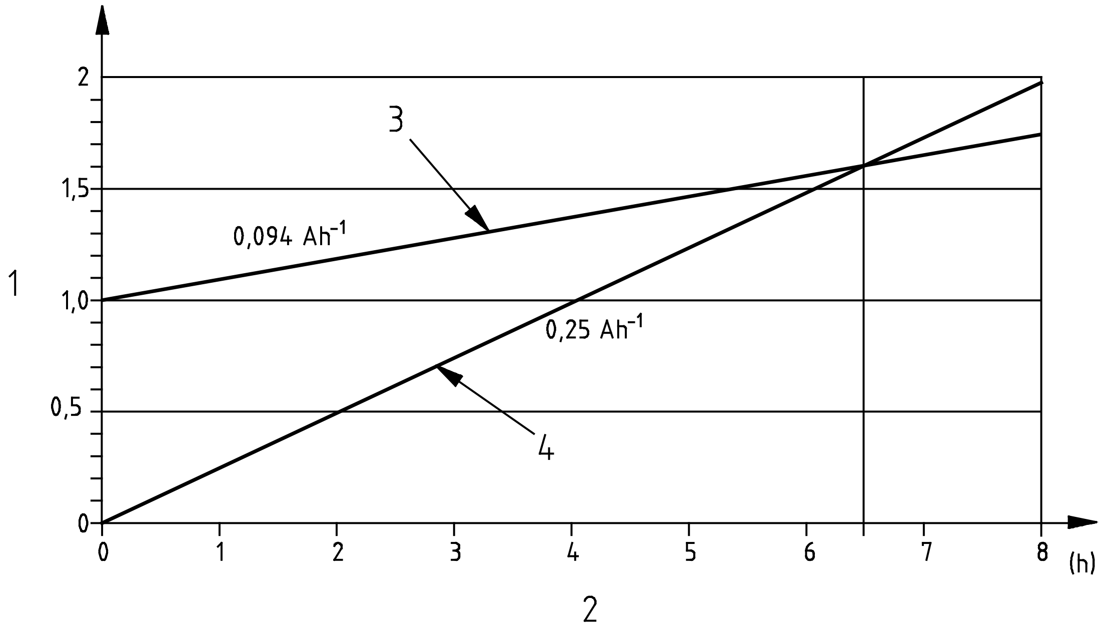
Any compensation for drift will reduce the sensitivity of the detector to slow changes in the smoke response value even if these changes are caused by a real, but gradual, increase in smoke level. The object of requirement 5.2.2 a) is to ensure that the compensation does not reduce the sensitivity to a slowly developing fire to an unacceptable degree.

For the purposes of this standard it is assumed that the development of any fire which presents a serious danger to life or property will be such that the sensor output will change at a rate of at least $A/4$ per hour where A is the nominal smoke response value of the detector. The response to rates of change less than $A/4$ per hour is not specified in this standard, and there is therefore no requirement for the detector to respond to these lower rates of change.

In order not to restrict the way in which compensation is achieved, 5.2.2 requires only that the time to reach the smoke response value, for all rates of change greater than $A/4$ per hour, does not exceed 1,6 × the time to reach the smoke response value, if the compensation were not present.

If the smoke response value increases in a linear fashion with time in response to a rise in the sensor signal, and if the extent of the compensation is not limited, then the maximum rate of compensation allowed can be seen from Figure P.1 to be $0{,}6A/6{,}4 = 0{,}094A$ per hour, since at this compensation rate the sensor output will reach the compensated response value in exactly 6,4 h.

Although it has been assumed above that the smoke response value is compensated linearly and continuously, the process need not be linear nor continuous. For example, the stepwise adjustment shown in Figure P.2 is reached in 6 h, which is less than the limiting value of 6,4 h.



Key

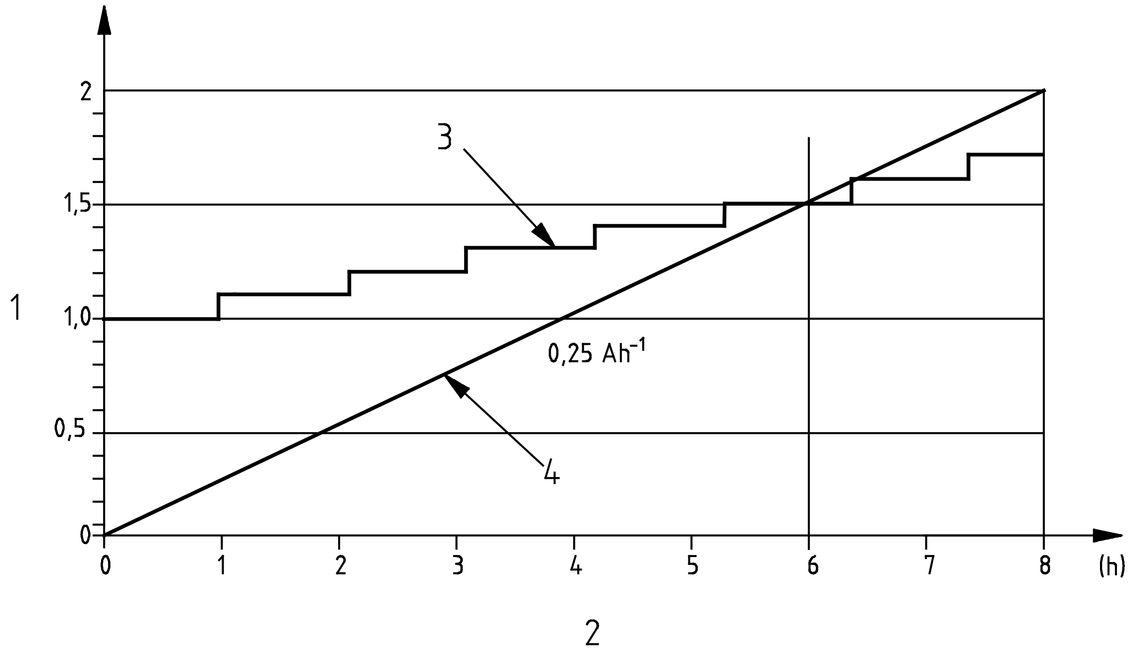
1 relative response value (relative to *A*)

2 time

3 compensated response value

4 sensor output

Figure P.1 — Linear compensation - limiting case



Key

1 relative response value (relative to *A*)

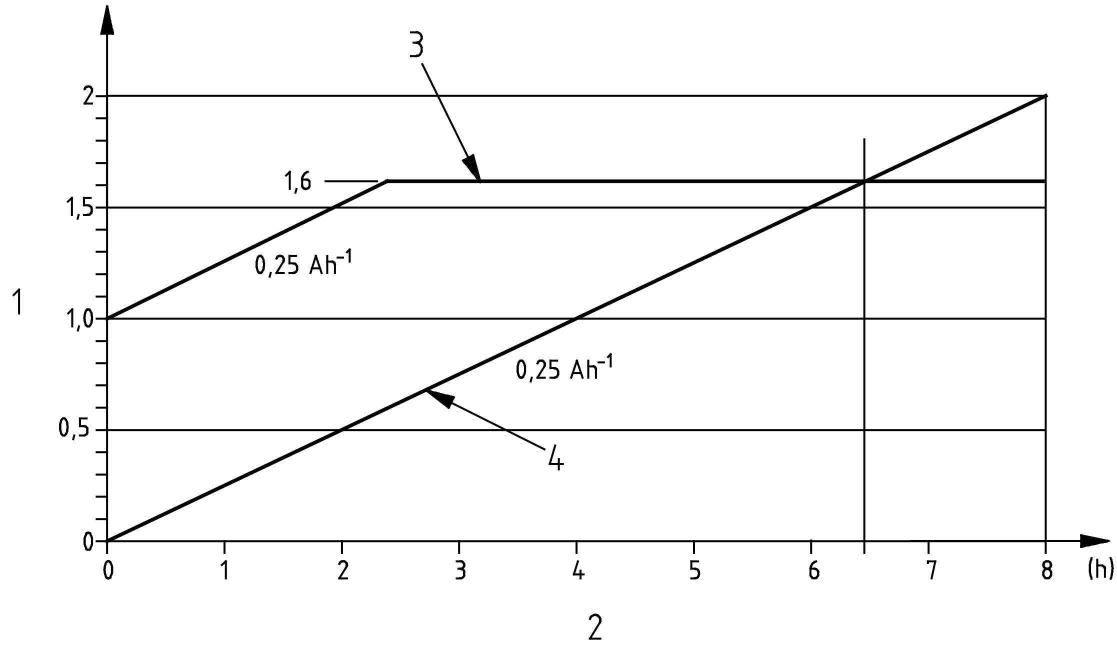
2 time

3 compensated response value

4 sensor output

Figure P.2 — Stepwise compensation - limiting case

Furthermore, the rate of compensation need not be limited to 0,094*A* per hour if the extent of the compensation is restricted to 0,6*A*. The relatively rapid rate of compensation shown in Figure P.3 also meets the requirement in reaching an alarm condition in 6,4 h. In this case the maximum rate of compensation will be limited only by the requirements of the test fires.



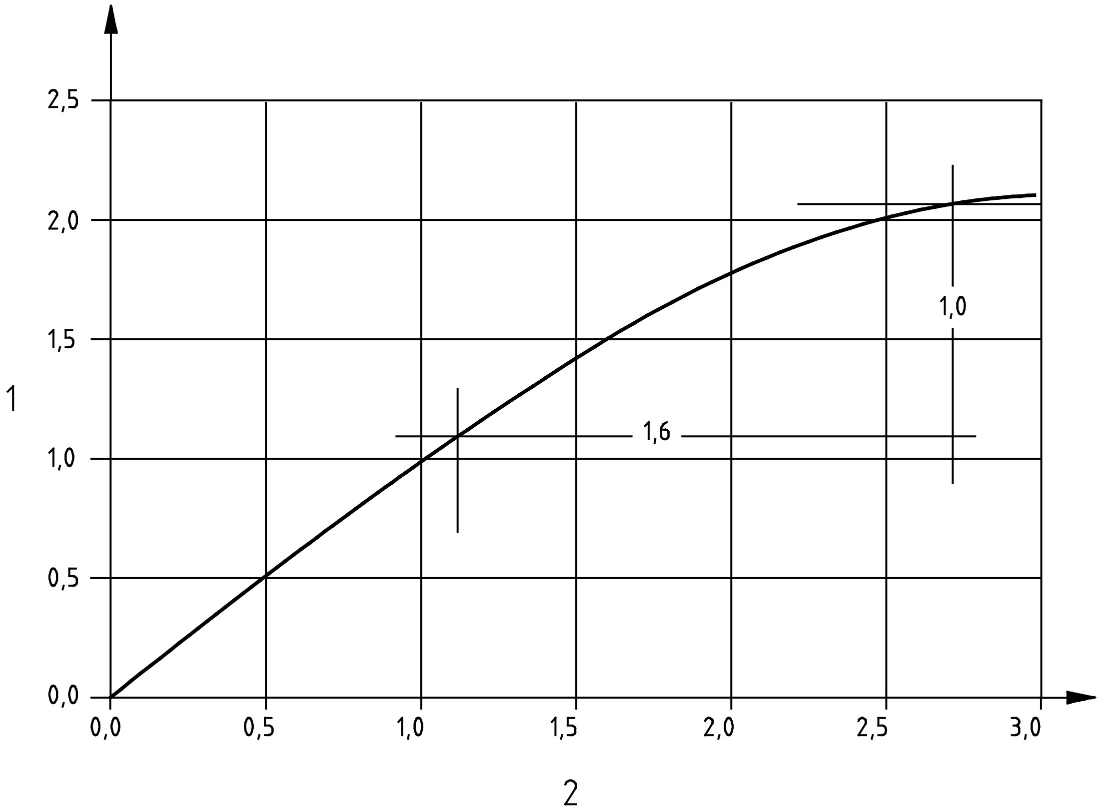
Key

1	relative response value (relative to *A*)	3	compensated response value
2	time	4	sensor output

Figure P.3 — High-rate, limited-extent compensation

The requirements of 5.2.2 a) allow considerable freedom in the way in which compensation for slow changes is achieved. However, it is recognized that in any practical detector the range over which the output of the sensor is linearly related to smoke (or other stimulus which is equivalent to smoke) is finite. If the range of compensation takes the smoke response value into this nonlinear region then the sensitivity of the detector could become degraded to an unacceptable degree.

As an example, consider a detector having the transfer characteristic shown in Figure P.4, in which both axes are expressed in terms of smoke response value *A*. The nonlinearity of the characteristic causes the effective sensitivity to reduce at higher values of stimulus. In this instance, it is necessary to limit the compensation to less than 1,1 × *A*, since in order to produce a change in output of *A*, the stimulus has to increase from 1,1 × *A* to 2,7 × *A*. This reduction in sensitivity by a factor of 1,6 represents the maximum allowed by 5.2.2 b).



Key

1 output

2 stimulus

Figure P.4 — Example of nonlinear transfer characteristic

Annex Q
(informative)

Information concerning the construction of the measuring ionization chamber

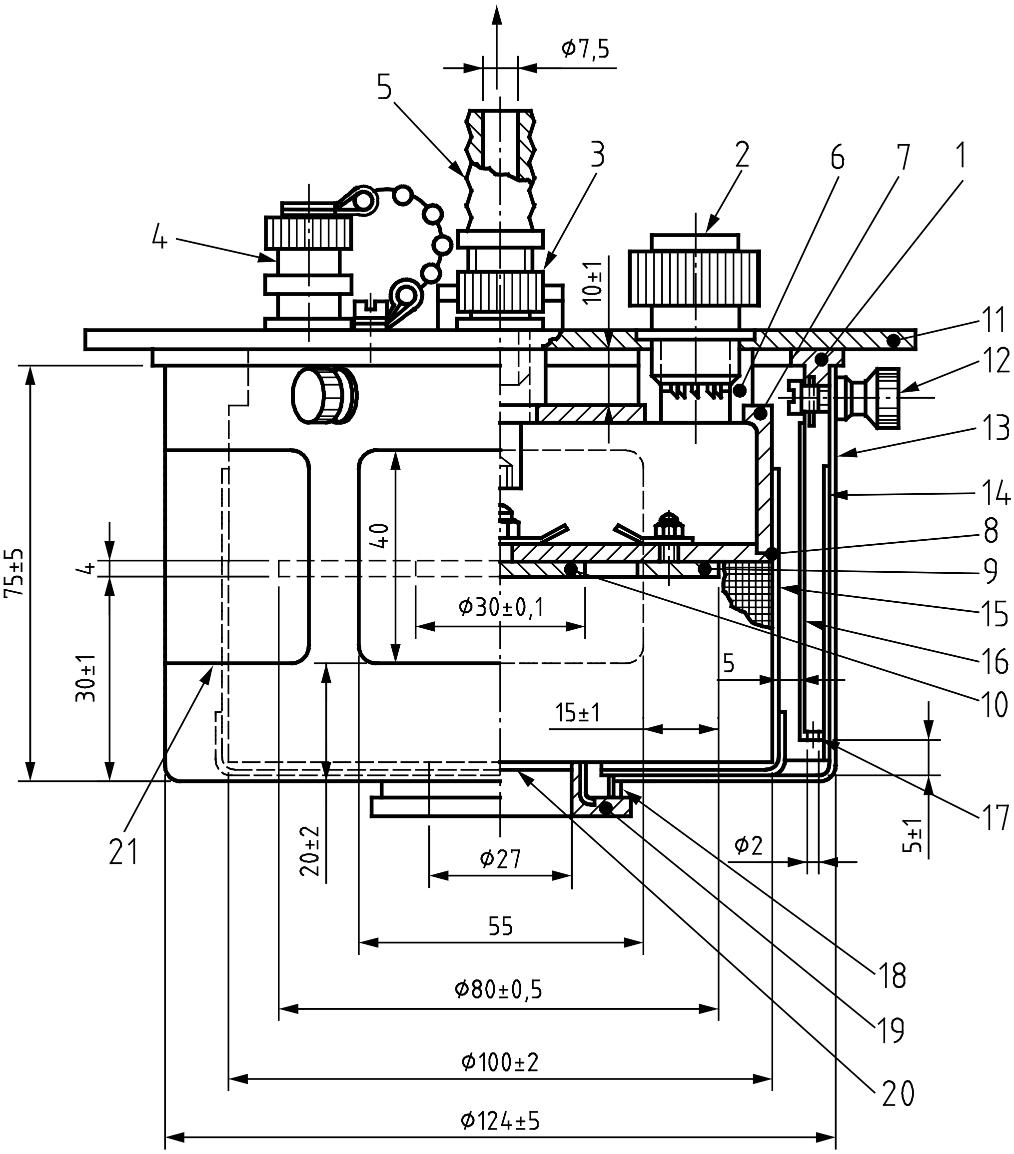
The mechanical construction of the measuring ionization chamber is shown in Figure Q.1. The functionally important dimensions are marked with their tolerances. Further details of the various parts of the device are given in Table Q.1.

NOTE The measuring ionization chamber is fully described in “Investigation of ionization chamber for reference measurements of smoke density” by M. Avlund, published by DELTA Electronics, Venlighedsvej 4 DK-2970 Hørsholm, Denmark.

Table Q.1 — List of parts of the measuring ionization chamber

Reference No.	Item	Number provided	Dimensions, Special features	Material
1	Insulating ring	1		Polyamide
2	Multipole socket	1	10-pole	
3	Measuring electrode terminal	1	To chamber supply	
4	Measuring electrode terminal	1	To amplifier or current measuring device	
5	Suction Nozzle	1		
6	Guide socket	4		Polyamide
7	Housing	1		Aluminium
8	Insulating plate	1		Polycarbonate
9	Guard ring	1		Stainless steel
10	Measuring electrode	1		Stainless steel
11	Assembly plate	1		Aluminium
12	Fixing screw with milled nut	3	M3	Nickel plated brass
13	Cover	1	Six openings	Stainless steel
14	Outer grid	1	Wire 0,2 mm diameter 0,8 mm internal mesh width	Stainless steel
15	Inner grid	1	Wire 0,4 mm diameter 1,6 mm internal mesh width	Stainless steel
16	Windshield	1		Stainless steel
17	Intermediate ring	1	With 72 equispaced holes each 2 mm diameter	
18	Threaded ring	1		Nickel plated brass
19	Source holder	1		Nickel plated brass
20	Source	1	27 mm diameter	See C.2.3
21	Openings on the periphery	6		

Dimensions in millimetres



NOTE 1 See Table Q.1 for the list of parts.

NOTE 2 Dimensions without a tolerance marked are recommended dimensions.

Figure Q.1 — Mechanical construction of the measuring ionization chamber

Annex ZA
(informative)

Clauses of this European Standard addressing the provisions of the EU Construction Products Regulation

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under the mandate M/109 for fire alarm/detection, fixed firefighting, fire and smoke control and explosion suppression products given to CEN by the European Commission and the European Free Trade Association.

If this European standard is cited in the Official Journal of the European Union (OJEU), the clauses of this standard, shown in this annex, are considered to meet the provisions of the relevant mandate, under the Regulation (EU) No. 305/2011.

This annex deals with the CE marking of the point detectors using a combination of smoke and heat sensors intended for the uses indicated in Table ZA.1 and shows the relevant clauses applicable.

This annex has the same scope as in Clause 1 of this standard related to the aspects covered by the mandate and is defined by Table ZA.1.

Table ZA.1 — Relevant clauses

Product: Point detectors using a combination of smoke and heat sensors **Intended use:** Fire detection and fire alarm systems installed in buildings.			
Essential characteristics	**Clauses in this and other European Standard(s) related to essential characteristics**	**Regulatory classes**	**Notes**
Nominal activation conditions/sensitivity: Individual alarm indication Response to slowly developing fires Repeatability of smoke response Directional dependence of smoke response Directional dependence of heat response Lower limit of heat response Reproducibility of smoke response Reproducibility of heat response	4.2.1 4.2.2 4.2.3 4.2.4 4.2.5 4.2.6 4.2.7 4.2.8 4.2.9 4.2.10		Intensity (lux) Time (s) + description Ratio and value (dB/m) + description Ratio (dB) and value (dB/m) + description Ratio (K) + description Temperature (°C) and time (s) + description Ratio (dB) and value (dB/m) + description Ratio (K) + description Description Ratio (dB)+ description

Air movement Dazzling			
Operational reliability: Connection of ancillary devices Monitoring of detachable detectors Manufacturer's adjustments On-site adjustment of behaviour Protection against the ingress of foreign bodies Requirements for software controlled devices	4.3.1 4.3.2 4.3.3 4.3.4 4.3.5 4.3.6		Description Description Description Description Size (mm) + desription Description
Tolerance to supply parameters: Variations in supply parameters	4.4.1	None	Ratio and value (dB/m) + description
Performance parameters under fire conditions: Fire sensitivity	4.5.1		Description
Durability of nominal activation conditions/sensitivity: Temperature resistance: Dry heat (operational) Cold (operational) Humidity resistance: Damp heat, cyclic (operational) Damp heat, steady-state (endurance) Shock and vibration resistance: Shock (operational) Impact (operational) Vibration, sinusoidal (operational) Vibration, sinusoidal (endurance) Electrical stability EMC, immunity (operational) Resistance to chemical agents SO_2 corrosion (endurance)	4.6.1.1 4.6.1.2 4.6.2.1 4.6.2.2 4.6.3.1 4.6.3.2 4.6.3.3 4.6.3.4 4.6.4.1 4.6.5.1		Ratio and value (dB/m) + description Ratio and value (dB/m) + description Ratio and value (dB/m) + description Ratio and value (dB/m) + description Ratio and value (dB/m) + description Ratio and value (dB/m) + description Ratio and value (dB/m) + description Ratio and value (dB/m) + description Ratio and value (dB/m) + description Ratio and value (dB/m) + description

The declaration of the product performance related to certain essential characteristics is not required in those Member States (MS) where there are no regulatory requirements on these essential characteristics for the intended use of the product.

In this case, manufacturers placing their products on the market of these MS are not obliged to determine nor declare the performance of their products with regard to these essential characteristics and the option “No performance determined” (NPD) in the information accompanying the CE marking and in the declaration of performance (see ZA.3) may be used for those essential characteristics.

ZA.2 Procedure for assessment and verification of constancy of performance (AVCP) of point detectors using a combination of smoke and heat sensors

ZA.2.1 System of AVCP

The AVCP system(s) of point detectors using a combination of smoke and heat sensors indicated in Table ZA.1, established by EC Decision 1996/577/EC (OJEU L254 of 1996-10-08), as amended by EC Decision 2002/592/EC (OJEU L192 of 2002-07-20) is shown in Table ZA.2 for the indicated intended use(s) and relevant level(s) or class(es) of performance.

Table ZA.2 — System of AVPC

Product	Intended use	Level(s) or class(es) of performance	AVCP system
Fire detection/fire alarm: Alarm devices	Fire safety	-	1
System 1: See Regulation (EU) No. 305/2011 (CPR) Annex V, 1.2			

The AVCP of the point detectors using a combination of smoke and heat sensors in Table ZA.1 shall be according to the AVCP procedures indicated in Table ZA.3 resulting from application of the clauses of this or other European Standard indicated therein. The content of tasks of the notified body shall be limited to those essential characteristics as provided for, if any, in Annex III of the relevant mandate and to those that the manufacturer intends to declare.

Table ZA.3 — Assignment of evaluation of conformity tasks for Fire alarm devices - Point detectors using a combination of smoke and heat sensors under system 1

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use which are declared	6.3
	Further testing of samples taken at factory according to the prescribed test plan	Essential characteristics of Table ZA.1 relevant for the intended use which are declared	6.3.5
Tasks for the product certification body	Determination of the product type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	Essential characteristic of Table ZA.1 relevant for the intended use	6.3
	Initial inspection of the manufacturing plant and of FPC	Parameters related to essential characteristics of Table ZA.1, relevant for the intended use, which are declared, Documentation of FPC	6.3
	Continuous surveillance, assessment and evaluation of FPC	Parameters related to essential characteristics of Table ZA.1, relevant for the intended use, which are declared,. Documentation of FPC	6.3

ZA.2.2 Declaration of performance (DoP)

ZA.2.2.1 General

The manufacturer shall draw up the DoP and affixes the CE marking on the basis of AVCP system set out in Annex V of the Regulation (EU) No 305/2011:

— the factory production control and further testing of samples taken at the factory according to the prescribed test plan, carried out by the manufacturer; and

— the certificate of constancy of performance issued by the notified product certification body on the basis of determination of the product type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product; initial inspection of the manufacturing plant and of factory production control and continuous surveillance, assessment and evaluation of factory production control.

ZA.2.2.2 Content

The model of the DoP is provided in Annex III of the Regulation (EU) No 305/2011. According to this Regulation, the DoP shall contain, in particular, the following information:

— the reference of the product-type for which the declaration of performance has been drawn up;

— the AVCP system or systems of the construction product, as set out in Annex V of the CPR;

— the reference number and date of issue of the harmonized standard which has been used for the assessment of each essential characteristic;

— where applicable, the reference number of the Specific Technical Documentation used and the requirements with which the manufacturer claims the product complies.

The DoP shall in addition contain:

a) the intended use or uses for the construction product, in accordance with the applicable harmonized technical specification;

b) the list of essential characteristics, as determined in the harmonized technical specification for the declared intended use or uses;

c) the performance of at least one of the essential characteristics of the construction product, relevant for the declared intended use or uses;

d) where applicable, the performance of the construction product, by levels or classes, or in a description, if necessary based on a calculation in relation to its essential characteristics determined in accordance with the Commission determination regarding those essential characteristics for which the manufacturer shall declare the performance of the product when it is placed on the market or the Commission determination regarding threshold levels for the performance in relation to the essential characteristics to be declared;

e) the performance of those essential characteristics of the construction product which are related to the intended use or uses, taking into consideration the provisions in relation to the intended use or uses where the manufacturer intends the product to be made available on the market;

f) for the listed essential characteristics for which no performance is declared, the letters “NPD” (No Performance Determined).

Regarding the supply of the DoP, article 7 of the Regulation (EU) No 305/2011 applies.

The information referred to in Article 31 or, as the case may be, in Article 33 of Regulation (EC) No 1907/2006, (REACH) shall be provided together with the DoP.

ZA.2.2.3 Example of DoP

The following gives an example of a filled-in DoP for point detectors using a combination of smoke and heat sensors:

DECLARATION OF PERFORMANCE

[insert here the number of the DoP, e.g. 001CPR2013-07-14]

1. Unique identification code of the product-type:

[insert here the unique identification code of the product to which the DoP applies, (e.g OT point detector, Model OT110-AK*)]*

2. Type, batch or serial number or any other element allowing identification of the construction product as required under Article 11(4):

[insert here the code given by the manufacturer in accordance with the provisions included in its FPC, (e.g OT point detector, Model OT110-AK 22359961*)]*

3. Intended use or uses of the construction product, in accordance with the applicable harmonized technical specification, as foreseen by the manufacturer:

Fire detection and fire alarm systems in buildings

4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required under Article 11(5), e.g.:

AnyCo Ltd,

PO Box 210

EC1-0XX - United Kingdom

Tel. +44207123456

Fax: +44207123457

Email: sales@anyco.co.uk

5. Where applicable, name and contact address of the authorized representative whose mandate covers the tasks specified in Article 12(2), e.g.:

Anyone SA

PO Box 01

B-1050 Brussels, Belgium

Tel. +32987654321

Fax: +32123456789

E-mail: anyone@provider.be

6. System or systems of assessment and verification of constancy of performance of the construction product as set out in CPR, Annex V:

System 1

7. In case of the declaration of performance concerning a construction product covered by a harmonized standard:

The product certification body No1234 performed the determination of the product type under system 1 on the basis of the type testing, the initial inspection of the manufacturing plant and of factory production control and the continuous surveillance, assessment and evaluation of factory production control, and issued the certificate of constancy of performance.

8. Declared performance;

Essential characteristic	Performance	Harmonized technical specification
Nominal activation conditions/sensitivity: Individual alarm indication Response to slowly developing fires Repeatability of smoke response Directional dependence of smoke response Directional dependence of heat response Lower limit of heat response Reproducibility of smoke response Reproducibility of heat response Air movement Dazzling	Light intensity ≥ 500 lx t_{Alarm} ≤ 1,6 x A/R + 100 s and limitation (y_{max}/y_{min} ≤ 1,6 and y_{min} ≥ 0,2) or (m_{max}/m_{min} ≤ 1,6 and m_{min} ≥ 0,05 dB m^{-1}) (y_{max}/y_{min} ≤ 1,6 and y_{min} ≥ 0,2) or (m_{max}/m_{min} ≤ 1,6 and m_{min} ≥ 0,05 dB m^{-1}) T_{max}/T_{min} ≤ 1,6 No false operation ($y_{max}/\hat{y}$ ≤ 1,33 and $\hat{y}/y_{min}$ ≤ 1,5 and y_{min} ≥ 0,2) or ($m_{max}/\overline{m}$ ≤ 1,33 and $\overline{m}/m_{min}$ ≤ 1,5 and m_{min} ≥ 0,05 dB m^{-1}) T_{max}/T_{min} ≤ 1,3 $0,625 < \frac{\left[y_{(0,2)\max} + y_{(0,2)\min}\right]}{\left[y_{(1,0)\max} + y_{(1,0)\min}\right]} < 1,6$. or $0,625 < \frac{\left[m_{(0,2)\max} + m_{(0,2)\min}\right]}{\left[m_{(1,0)\max} + m_{(1,0)\min}\right]} < 1,6$; m_{max}/m_{min} ≤ 1,6	EN 54–29:2015
Operational reliability: Connection of ancillary devices Monitoring of detachable detectors Manufacturer's adjustments On-site adjustment of behaviour Protection against the ingress of foreign bodies Requirements for software controlled devices	Open- and short circuit fail prove Removal detectable Special means required Special means required, settings clearly marked Sphere (1,3 ± 0,05) mm cannot enter Documentation available, modular structure, invalid data not permitted, program deadlock avoided, site specific data in non-volatile memory with two-week retention.	
Tolerance to supply parameters: Variations in supply parameters	(y_{max}/y_{min} ≤ 1,6 and y_{min} ≥ 0,2) or (m_{max}/m_{min} ≤ 1,6 and m_{min} ≥ 0,05 dB m^{-1});	

	$T_{max}/T_{min} \leq 1,3$	
Performance parameters under fire conditions: Fire sensitivity	Alarm in each test fire before end of test condition	
Durability of nominal activation conditions/sensitivity: Temperature resistance: Dry heat (operational)	($y_{max}/y_{min} \leq 1,6$ and $y_{min} \geq 0,2$) or ($m_{max}/m_{min} \leq 1,6$ and $m_{min} \geq 0,05$ dB m^{-1}), no false operation	
Cold (operational)	($y_{max}/y_{min} \leq 1,6$ and $y_{min} \geq 0,2$) or ($m_{max}/m_{min} \leq 1,6$ and $m_{min} \geq 0,05$ dB m^{-1}); $T_{max}/T_{min} \leq 1,3$, no false operation	
Humidity resistance: Damp heat, cyclic (operational)	($y_{max}/y_{min} \leq 1,6$ and $y_{min} \geq 0,2$) or ($m_{max}/m_{min} \leq 1,6$ and $m_{min} \geq 0,05$ dB m^{-1}); $T_{max}/T_{min} \leq 1,3$, no false operation	
Damp heat, steady-state (endurance)	($y_{max}/y_{min} \leq 1,6$ and $y_{min} \geq 0,2$) or ($m_{max}/m_{min} \leq 1,6$ and $m_{min} \geq 0,05$ dB m^{-1}); $T_{max}/T_{min} \leq 1,3$, no false operation	
Shock and vibration resistance: Shock (operational)	($y_{max}/y_{min} \leq 1,6$ and $y_{min} \geq 0,2$) or ($m_{max}/m_{min} \leq 1,6$ and $m_{min} \geq 0,05$ dB m^{-1}); $T_{max}/T_{min} \leq 1,3$, no false operation	
Impact (operational)	($y_{max}/y_{min} \leq 1,6$ and $y_{min} \geq 0,2$) or ($m_{max}/m_{min} \leq 1,6$ and $m_{min} \geq 0,05$ dB m^{-1}); $T_{max}/T_{min} \leq 1,3$, no false operation	
Vibration, sinusoidal (operational)	($y_{max}/y_{min} \leq 1,6$ and $y_{min} \geq 0,2$) or ($m_{max}/m_{min} \leq 1,6$ and $m_{min} \geq 0,05$ dB m^{-1}); $T_{max}/T_{min} \leq 1,3$, no false operation	
Vibration, sinusoidal (endurance)	($y_{max}/y_{min} \leq 1,6$ and $y_{min} \geq 0,2$) or ($m_{max}/m_{min} \leq 1,6$ and $m_{min} \geq 0,05$ dB m^{-1}); $T_{max}/T_{min} \leq 1,3$, no false operation	
Electrical stability EMC, immunity (operational)	($y_{max}/y_{min} \leq 1,6$ and $y_{min} \geq 0,2$) or ($m_{max}/m_{min} \leq 1,6$ and $m_{min} \geq 0,05$ dB m^{-1}); $T_{max}/T_{min} \leq 1,3$	
Resistance to chemical agents SO_2 corrosion (endurance)	($y_{max}/y_{min} \leq 1,6$ and $y_{min} \geq 0,2$) or ($m_{max}/m_{min} \leq 1,6$ and $m_{min} \geq 0,05$ dB m^{-1}); $T_{max}/T_{min} \leq 1,3$	

9 The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 8. This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.

Signed for and on behalf of the manufacturer by:

……

(name and function)

…………………………………………………………… ……………………………………………………………..

(place, date of issue) (signature)

ZA.3 CE marking and labelling

The CE marking symbol shall be in accordance with the general principles set out in Article 30 of Regulation (EC) No 765/2008 and shall be affixed visibly, legibly and indelibly together with the identification number of the certification body and the number of the DoP to the point detector using a combination of smoke and heat sensors.

The CE marking symbol shall also be placed also on the packaging or in the documents accompanying the point detector using a combination of smoke and heat and it shall be followed by:

a) the last two digits of the year in which it was first affixed;

b) the name and the registered address of the manufacturer, or the identifying mark allowing identification of the name and address of the manufacturer easily and without any ambiguity;

c) the unique identification code of the product- type;

d) the reference number of the declaration of performance;

e) the level or class of the performance declared;

f) the dated reference to the harmonized technical specification applied, EN 54-29:2015;

g) the identification number of the notified body;

h) the intended use as laid down in the harmonized technical specification applied.

The CE marking shall be affixed before the construction product is placed on the market. It may be followed by a pictogram or any other mark notably indicating a special risk or use.

Figure ZA.1 gives an example of the information to be placed on the point detector using a combination of smoke and heat sensors subject to AVPC under system 1.

Figure ZA.2 gives an example of the information related to be placed in the commercial documents accompanying the *[insert here the name of the construction products as given in the title of the standard].*

CE 1234	*CE marking, consisting of the "CE"-symbol given in Directive 93/68/EEC.* *Identification number of the product certification body*
[001CPR2013–07–14]	*Reference number of the DoP*

Figure ZA.1 — Example of CE marking information to be affixed on the point detector using a combination of smoke and heat sensors

1234	*CE marking, consisting of the “CE”-symbol given in Directive 93/68/EEC.* *Identification number of the product certification body*
AnyCo Ltd, PO Box 210, EC1–0XX - UK	*Name or identifying mark and registered address of the producer or identifying mark*
15	*Last two digits of the year in which the marking was first affixed*
[001CPR2013–07–14]	*Reference number of the DoP*
EN 54–29:2015	*No. of European Standard as referenced in the OJEU*
[e.g. OT point detector, Model OT110-AK]	Unique identification code of the product-type as given by the manufacturer
Intended for use in fire detection and fire alarm systems in buildings	*Intended use as laid down in the European standard applied*
Individual alarm indication: Light intensity ≥ 500 lx Response to slowly developing fires: $t_{Alarm} \leq 1{,}6 \times A/R + 100$ s and limitation Repeatability of smoke response: $y_{max}/y_{min} \leq 1{,}6$ and $y_{min} \geq 0{,}2$ Directional dependence of smoke response: $y_{max}/y_{min} \leq 1{,}6$ and $y_{min} \geq 0{,}2$ Directional dependence of heat response: $T_{max}/T_{min} \leq 1{,}6$ Lower limit of heat response: No false operation Reproducibility of smoke response: $y_{max}/\hat{y} \leq 1{,}33$ and $\hat{y}/y_{min} \leq 1{,}5$ and $y_{min} \geq 0{,}2$ Reproducibility of heat response: $T_{max}/T_{min} \leq 1{,}3$ Air movement: $0{,}625 < \frac{\left[y_{(0,2)max} + y_{(0,2)min}\right]}{\left[y_{(1,0)max} + y_{(1,0)min}\right]} < 1{,}6$. Dazzling: $m_{max}/m_{min} \leq 1{,}6$ Connection of ancillary devices: Open- and short circuit fail prove Monitoring of detachable detectors: Removal detectable Manufacturer's adjustments: Special means required On-site adjustment of behaviour: Special means required, settings clearly marked Protection against the ingress of foreign bodies: Sphere (1,3 ± 0,05) mm cannot enter Requirements for software controlled devices: Documentation available, modular structure, invalid data not permitted, program deadlock avoided, site specific data in non-volatile memory with two-week retention. Variations in supply parameters: $y_{max}/y_{min} \leq 1{,}6$ and $y_{min} \geq 0{,}2$; $T_{max}/T_{min} \leq 1{,}3$ Fire sensitivity: Alarm in each test fire before end of test condition **Durability of nominal activation conditions/sensitivity:** Temperature resistance: Dry heat (operational): $y_{max}/y_{min} \leq 1{,}6$ and $y_{min} \geq 0{,}2$, no false operation Cold (operational):	*Level or class of the performance declared*

$y_{max}/y_{min} \leq 1,6$ and $y_{min} \geq 0,2$, $T_{max}/T_{min} \leq 1,3$; no false operation

Humidity resistance:
Damp heat, cyclic (operational):

$y_{max}/y_{min} \leq 1,6$ and $y_{min} \geq 0,2$, $T_{max}/T_{min} \leq 1,3$; no false operation
Damp heat, steady-state (endurance):

$y_{max}/y_{min} \leq 1,6$ and $y_{min} \geq 0,2$, $T_{max}/T_{min} \leq 1,3$; no false operation

Shock and vibration resistance:
Shock (operational):

$y_{max}/y_{min} \leq 1,6$ and $y_{min} \geq 0,2$, $T_{max}/T_{min} \leq 1,3$; no false operation

Impact (operational):

$y_{max}/y_{min} \leq 1,6$ and $y_{min} \geq 0,2$, $T_{max}/T_{min} \leq 1,3$; no false operation

Vibration, sinusoidal (operational):

$y_{max}/y_{min} \leq 1,6$ and $y_{min} \geq 0,2$, $T_{max}/T_{min} \leq 1,3$; no false operation

Vibration, sinusoidal (endurance):

$y_{max}/y_{min} \leq 1,6$ and $y_{min} \geq 0,2$, $T_{max}/T_{min} \leq 1,3$; no false operation

Electrical stability
EMC, immunity (operational):

$y_{max}/y_{min} \leq 1,6$ and $y_{min} \geq 0,2$, $T_{max}/T_{min} \leq 1,3$

Resistance to chemical agents
SO_2 corrosion (endurance):

$y_{max}/y_{min} \leq 1,6$ and $y_{min} \geq 0,2$, $T_{max}/T_{min} \leq 1,3$

Figure ZA.2 — Example of CE marking information in the documentation accompanying the point detector using a combination of smoke and heat sensors

Bibliography

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 54-7:2000, *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 60068-2-2:2007, *Environmental testing - Part 2-2: Tests - Test B: Dry heat (IEC 60068-2-2:2007)*

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

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