BS EN 54-22:2015

BSI Standards Publication

Fire detection and fire alarm systems

Part 22: Resettable line-type heat detectors

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National foreword

This British Standard is the UK implementation of EN 54-22:2015.

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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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 54-22:2015) 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of an identical text or by endorsement, at the latest by November 2015, and conflicting national standards shall be withdrawn at the latest by May 2019.

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

EN 54 "Fire detection and fire alarm systems" consists of the following parts:

Part 1: Introduction

Part 2: Control and indicating equipment

Part 3: Fire alarm devices – Sounders

Part 4: Power supply equipment

Part 5: Heat detectors – Point detectors

Part 7: Smoke detectors – Point detectors using scattered light, transmitted light or ionization

Part 10: Flame detectors – Point detectors

Part 11: Manual call points

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

Part 13: Compatibility assessment of system components

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

Part 15: Point detectors using a combination of detected phenomena

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 routine 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: Carbon monoxide detectors – Point detectors (in preparation)

Part 27: Duct smoke detectors (in preparation)

Part 28: Non-resettable line-type heat detectors (in preparation)

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

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

Part 31: Multi-sensor detector – 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 www.cen.eu.

According to the CEN/CENELEC Internal Regulations, the national standards organizations 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

Resettable line-type heat detectors (RLTHD) have been incorporated into fire alarm systems for a considerable number of years. These detectors are typically used in areas where point type heat detectors are presented with challenging environmental characteristics and also where access to the detectors may significantly influence the fire alarm system design.

This standard defines the minimum system functionality for RLTHD products. RLTHD are based upon many unique operating principles. It is the intention of this standard to define common operating characteristics for each type of RLTHD in conjunction with existing EN 54 detector standards, so that resettable line-type heat detectors have a response behaviour comparable to that of point type heat detectors.

Due to the various applications for RLTHD, it is necessary to devise separate environmental classification tests for the sensing element and the sensor control units of these systems. It is not the purpose of this standard to define applications or how RLTHD should be used in applications. However, the standard indicates two general fields of application, room protection and secondly local protection. The standard defines separate response test classifications for these two fields.

Generally there are two functional principles employed by RLTHD: non-integrating and integrating systems. Therefore separated subclasses have been created for non integrating systems and for integrating systems.

1 Scope

This European Standard applies to resettable line-type heat detectors consisting of a sensing element using an optical fibre, a pneumatic tube or an electrical sensor cable connected to a sensor control unit, either directly or through an interface module, intended for use in fire detection and fire alarm systems installed in and around buildings and other civil engineering works (see EN 54-1:2011).

This European Standard specifies the requirements and performance criteria, the corresponding test methods and provides for the Assessment and Verification of Constancy of Performance (AVCP) of resettable line-type heat detectors to this EN.

This European Standard also covers resettable line-type heat detectors intended for use in the local protection of plant and equipment.

Resettable line-type heat detectors with special characteristics and developed for specific risks are not covered by this EN.

This European Standard does not cover line-type heat detectors that are based on non-resettable, fixed temperature electrical cables (so called “digital” systems).

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

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 + Corrigendum 1988 +A1:1992)*

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

EN 60068-2-2:2007, *Environmental testing — Part 2-2: Tests — Test B: Dry heat (IEC 60068-2-2:2007)*

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

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

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

3 Terms, definitions and abbreviations

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

3.1 Terms and definitions

3.1.1
functional unit
part of a line-type heat detector in addition to the sensor control unit and the sensing element which is essential for the function of the line-type heat detector

EXAMPLE Terminating device, filter, switch.

3.1.2
integrating line-type heat detector
detectors for which the response to temperature is summed in some way, (not necessarily linearly), along a length of the sensing element. For such detectors, the output to the sensor control unit is therefore a function of the temperature distribution along the length of the sensing element

EXAMPLE Pneumatic systems.

3.1.3
linear line-type heat detector
detectors which respond to heat applied to any point along the length of the sensing element

3.1.4
line-type heat detector
LTHD
detector which responds to heat sensed in the vicinity of a continuous line

Note 1 to entry: A line-type heat detector may consist of a sensor control unit, a sensing element and functional units.

3.1.5
local protection application
application in which the sensing element is installed in relatively close proximity to the potential fire risk

EXAMPLE pipelines, conveyor belts, combustion engines/turbines, rolling stock, transformers, process dryers, cable trays, escalators, chemical process equipment, electrical equipment cabinets, ventilation systems (dust collector, hood extractor, etc.), switch gear (e.g. printing press), etc.

3.1.6
multipoint line-type heat detector
detectors that contain multiple discrete temperature sensors, which are separated by a distance of no more than 10 m, embedded within the sensing element (see 3.1.11)

3.1.7
non-resettable line-type heat detectors
NLTHD
LTHD which can only respond once

3.1.8
non-integrating line-type heat detector
detectors for which the output signal is depending on local temperature effects but not on the integration of the whole temperature distribution along the sensing element

EXAMPLE Fibre optics systems.

3.1.9
resettable line-type heat detectors
RLTHD
LTHD which is able to return to its quiescent condition after a response

3.1.10
room protection application
application in which the sensing element is installed at a distance from the potential fire hazard close to the ceiling or roof of the area to be protected

EXAMPLE car parks (open or closed), road/rail/metro tunnels, floor/ceiling voids, elevator shafts, cold stores, warehouses, heritage buildings, aircrafts hangars, spray shops, chemical storehouses, ammunition depots, refineries, silos, etc.

3.1.11
sensing element
heat sensing part of the line-type heat detector which can be a fibre optic cable, a pneumatic tube or an electrical cable

Note 1 to entry: A sensing element may consist of different segments separated e.g. by functional units or splices.

3.1.12
sensor control unit
unit that supervises the sensing element and communicates to the control and indicating equipment

Note 1 to entry: The unit can be remote or an integral part of the control and indicating equipment as defined by EN 54-2.

3.2 Abbreviations

For the purposes of this document the following abbreviation apply:

RLTHD resettable line-type heat detector

4 Product characteristics

4.1 General

4.1.1 Compliance

In order to comply with this standard, resettable line-type heat detectors shall meet the provisions of Clause 4, which shall be verified by visual inspection or engineering assessment as described in Clause 5 and shall meet the requirements of the tests.

4.1.2 Heat response classes

4.1.2.1 Heat response for room protection application

For room protection application the heat response of RLTHD is classified as indicated in Table 1.

NOTE Test fires TF6S, TF6 and TF6F are specified in Annex B.

Table 1 —Heat response, room protection for integrating and non-integrating RLTHD

Heat response class		**Typical application temperature** °C	**Maximum application temperature** °C	**Minimum static response temperature** °C	**Maximum static response temperature** °C	**TF6S**		**TF6**		**TF6F**	
						response time		**response time**		**response time**	
non-integrating RLTHD	Integrating RLTHD					**Lower value** s	**Upper value** s	**Lower value** s	**Upper value** s	**Lower value** s	**Upper value** s
A1N	A1I	25	50	54	65	50	400	30	210	20	130
A2N	A2I	25	50	54	70	120	600	60	300	40	180

4.1.2.2 Heat response for local protection application

For local protection application the heat response of the RLTHD is classified as indicated in Table 2.

Table 2 —Heat response local protection for integrating and non-integrating RLTHD

Heat response class		**Typical application temperature** °C	**Maximum application temperature** °C	**Minimum static response temperature** °C	**Maximum static response temperature** °C
non-integrating RLTHD	Integrating RLTHD				
BN	BI	40	65	69	85
CN	CI	55	80	84	100
DN	DI	70	95	99	115
EN	EI	85	110	114	130
FN	FI	100	125	129	145
GN	GI	115	140	144	160

4.1.3 Environmental groups

Different environmental groups are necessary to reflect the different service environment of the components of a line-type heat detector:

The sensing element is in either environmental group II or III.

The sensor control unit and the functional unit are in either environmental group I, II or III.

NOTE Environmental group I covers equipment likely to be installed indoors in commercial/industrial premises but for which the avoidance of extreme environmental conditions can be taken into account in the selection of the mounting site. Environmental group II covers equipment likely to be installed indoors in commercial/industrial premises in all general areas. Environmental group III covers equipment which is intended to be installed out of doors.

4.2 Nominal activation conditions/sensitivity

4.2.1 Individual alarm indication

Each sensor control unit shall be provided with an integral red visual indicator, by which the general alarm condition can be identified, until the alarm condition is reset. Where other conditions of the sensor control unit can be visually indicated, they shall be clearly distinguishable from the alarm indication, except when the sensor control unit is switched into a service mode. The visual indicator shall be visible from a distance of 6 m in the direct line of sight perpendicular to the surface, in an ambient light intensity up to 500 lux.

If more than one sensing element is connected to the sensor control unit, there shall be a separate alarm indication for each sensing element.

To confirm this, the detector shall be assessed in accordance with 5.2.1.

4.2.2 Signalling

The line-type heat detector shall signal the alarm and fault status to the control and indicating equipment.

If more than one sensing element is connected to a sensor control unit, there shall be separate alarm and fault signals for each sensing element.

To confirm this, the detector shall be assessed in accordance with 5.2.2.

4.2.3 Repeatability

The ratio of response times of the RLTHD shall be within the limits, even after a number of alarm conditions, as specified in 5.2.3.

4.2.4 Reproducibility

The ratio of response times of several specimens of the RLTHD shall be within the limits as specified in 5.2.4.

4.3 Operational reliability

4.3.1 Connection of ancillary devices

Where the RLTHD provides for connections to ancillary devices (e.g. remote indicators, RS 485 interface), open or short-circuit failures of these connections shall not prevent the correct operation of the RLTHD.

Where such connections are present the detector shall be assessed in accordance with 5.3.1.

4.3.2 Manufacturer's adjustments

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

To confirm this, the detector shall be assessed in accordance with 5.3.2.

4.3.3 Requirements for software controlled detectors

4.3.3.1 General

For RLTHD, which rely on software control in order to fulfil the requirements of this standard, the requirements of 4.3.3.2, 4.3.3.3 and 4.3.3.4 shall be met.

4.3.3.2 Software documentation

4.3.3.2.1 The manufacturer shall submit documentation, which gives an overview of the software design. This documentation shall provide sufficient detail for the design to be inspected for compliance with this standard and shall include the following as a minimum:

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,

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.

4.3.3.2.2 The manufacturer shall have available detailed design documentation, which only needs to be provided if required by the testing laboratory. 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).

4.3.3.3 Software design

In order to ensure the reliability of the RLTHD, 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.

4.3.3.4 The storage of programs and data

The program necessary to comply with this standard and any preset data, such as manufacturer's settings, shall be held in non-volatile memory. Writing to areas of memory containing this program and data shall only be possible by the use of some special tool or code and shall not be possible during normal operation of the RLTHD.

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.

To confirm this, the detector shall be assessed in accordance with 5.3.3.

4.3.4 Sensing element fault

The RLTHD shall generate fault conditions as specified in 5.3.4.

4.3.5 On-site adjustment of response behaviour

The effective response behaviour of a RLTHD is dependent upon both the sensitivity settings of the sensor control unit and the heat sensing element. Many types of RLTHD therefore have facilities to adjust the sensitivity of the RLTHD to suit the application.

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;

b) any setting(s), at which the manufacturer does not claim compliance with this standard, shall only be accessible by the use of a code or special tool, and it shall be clearly marked on the detector or in the associated data, that if these setting(s) are used, the detector does not comply with the standard.

NOTE These adjustments can be carried out at the sensor control unit or at the control and indicating equipment.

To confirm this, the detector shall be assessed in accordance with 5.3.5

4.3.6 Maximum ambient temperature test (sensing element)

The RLTHD shall function correctly even if the sensing element is exposed to high ambient temperatures as specified in 5.3.6.

4.4 Tolerance to supply voltage

4.4.1 Variation in supply parameters

The RLTHD shall function correctly within the specified range(s) of the supply parameters as specified in 5.4.1

4.4.2 Low voltage fault

The RLTHD shall signal a fault condition when its input power supply falls below the minimum voltage specified by the manufacturer as specified in 5.4.2

4.5 Performance parameters under fire conditions

4.5.1 Fire sensitivity for room protection application

Heat response Class A1N, A1I, A2N and A2I RLTHD (for room protection application) shall have an adequate sensitivity to the heat release of a real test fire as required for general application in fire detection systems as specified in 4.1.2.1.and tested as specified in 5.5.1

4.5.2 Static response temperature test

The RLTHD shall have, depending on its classification, an adequate sensitivity to a slow rate of rise of temperature as specified in 4.1.2.2.and tested as specified in 5.5.2.

The RLTHD shall also be capable of alarming when temperature rise is very slow and generate the alarm within a temperature range specified for its class.

4.6 Durability of nominal activation conditions/sensitivity

4.6.1 Temperature resistance

4.6.1.1 Dry heat (operational) sensor control unit

The sensor control unit of the RLTHD shall function correctly, at high ambient temperatures as specified in 5.6.1.1.

4.6.1.2 Dry heat (endurance) for sensing element

The sensing element of the RLTHD shall be capable of withstanding long term exposure to high temperature as specified in 5.6.1.2.

4.6.1.3 Cold (operational) for sensing element

The RLTHD shall function correctly even if the sensing element is exposed to low ambient temperatures as specified in 5.6.1.3.

4.6.1.4 Cold (operational) for sensor control unit

The sensor control unit of the RLTHD shall function correctly at low ambient temperatures as specified in 5.6.1.4.

4.6.2 Humidity resistance

4.6.2.1 Damp heat, steady state (endurance) for sensor control unit and sensing element

The RLTHD shall be capable of withstanding long term exposure to a high level of continuous humidity as specified in 5.6.2.1.

4.6.2.2 Damp heat, cyclic (operational) for sensing element

The RLTHD shall function correctly even if the sensing element is exposed to a high level of humidity as specified in 5.6.2.2.

4.6.2.3 Damp heat, cyclic (operational) for sensor control

The sensor control unit of the RLTHD shall function correctly at a high level of humidity as specified in 5.6.2.3.

4.6.2.4 Damp heat, steady state (operational) for sensor control unit

The sensor control unit of the RLTHD shall function correctly at a high level of humidity as specified in 5.6.2.4.

4.6.2.5 Damp heat, cyclic (endurance) for sensor control unit and sensing element

The RLTHD shall be capable withstanding the effect of cyclic humidity levels as specified in 5.6.2.5.

4.6.3 Shock and vibration resistance

4.6.3.1 Shock (operational) for sensor control unit

The sensor control unit of the RLTHD shall operate correctly when submitted to mechanical shocks as specified in 5.6.3.1.

4.6.3.2 Impact (operational) for sensor control unit

The sensor control unit of the RLTHD shall operate correctly when submitted to mechanical impacts as specified in 5.6.3.2.

4.6.3.3 Impact (operational) for sensing element

The RLTHD shall function correctly even if the sensing element is submitted to mechanical impacts as specified in 5.6.3.3.

4.6.3.4 Vibration, sinusoidal (operational) for sensor control unit

The sensor control unit of the RLTHD shall operate correctly when submitted to sinusoidal vibration as specified in 5.6.3.4.

4.6.3.5 Vibration, sinusoidal (operational) for sensing element

The RLTHD shall function correctly even if the sensing element is submitted to sinusoidal vibration as specified in 5.6.3.5.

4.6.3.6 Vibration, sinusoidal (endurance) for sensor control unit

The sensor control unit of the RLTHD shall be capable of withstanding the effect of sinusoidal vibration as specified in 5.6.3.6.

4.6.3.7 Vibration, sinusoidal (endurance) for sensing element

The sensing element of the RLTHD shall be capable of withstanding the effect of sinusoidal vibration as specified in 5.6.3.7.

4.6.4 Corrosion resistance

4.6.4.1 Sulphur dioxide (SO_2) corrosion (endurance) for sensing element

The sensing element of the RLTHD shall be capable of withstanding exposure to an SO_2 corrosive atmosphere as specified in 5.6.4.1.

4.6.4.2 Sulphur dioxide (SO_2) corrosion (endurance) for sensor control unit

The sensor control unit of the RLTHD shall be capable of withstanding exposure to an SO_2 corrosive atmosphere as specified in 5.6.4.2.

4.6.5 Electrical stability

4.6.5.1 Electromagnetic immunity

The RLTHD shall operate correctly when submitted to electromagnetic interference as specified in 5.6.5.1.

5 Testing, assessments 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 specified in EN 60068-1:1994 as follows:

a) temperature: (15 to 35) °C;

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

c) 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 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 constant throughout the tests. The value chosen for each parameter shall normally be the nominal value, or the mean of the specified range. If a test procedure requires a specimen to be monitored to detect any alarm or fault signals, then connections shall be made to any necessary ancillary devices (e.g. through wiring to an end-of-line device for conventional detectors to allow a fault signal to be recognized).

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

5.1.3 Mounting arrangements

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

5.1.4 Tolerances

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

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

5.1.5 Procedure for measurement of response time

5.1.5.1 General

The purpose of this procedure is to establish any deviation in system response time following the environmental tests.

The specimen shall be connected to a suitable supply and monitoring equipment in accordance with 5.1.2

The response time of the RLTHD shall be measured using the heat tunnel described in Annex F.

The orientation of the sensing element in the heat tunnel shall be chosen arbitrarily and shall be the same for each measurement.

Before the measurement, stabilize the temperature of the air stream and the section of sensing element to be heated at a typical application temperature according to 4.1.2 unless otherwise specified. The measurement is then made by increasing the air temperature in the tunnel, linearly with respect to time and at the rate of rise specified in the applicable test procedure, until the supply and monitoring equipment indicates an alarm.

During the measurement, the airflow in the tunnel shall be maintained at a constant mass flow, equivalent to (0,8 ± 0,1) m/s at 25 °C. The air temperature shall be controlled to within ± 2 K of the nominal temperature required at any time during the test.

The response time, *t*, shall be measured from the moment the temperature starts increasing to the indication of an alarm from the supply and monitoring equipment.

NOTE 1 Linear extrapolation of the stabilized and the increasing temperature against time lines can be used to establish the effective start time of the temperature increase.

NOTE 2 It is advised to take care not to subject detectors to a damaging thermal shock when transferring them to and from a stabilized or alarm temperature.

5.1.5.2 Linear heat detectors

For measurement of the response time of linear heat detectors, the length of sensing element, L_1 which shall be connected to the sensor control unit shall be chosen to be the worst case for the technology employed. This shall be agreed between the manufacturer and the testing laboratory.

NOTE 1 It is advised to determine the worst case taking into account the effect on the temperature measurement of noise and losses in the sensing element.

A section of (10 ± 0,1) m (L_{test}) of sensing element shall be wrapped around a test frame as described in Annex C and Annex D and heated in the heat tunnel. This section shall be kept the same for all relevant tests to allow the comparison of the response time before, during and after the environmental tests.

The remaining section of the sensing element (L_1 – L_{test}) not exposed to the induced test temperature shall remain at ambient temperature (23 ± 5) °C during the measurement unless otherwise stated in the individual tests.

NOTE 2 To facilitate the test procedure, it may be necessary to introduce easily detachable connections between different sections of the sensing element. It is advised to take into account the losses introduced by these connections when determining L_1.

NOTE 3 The manufacturer can specify a minimum length of sensing element that needs to be connected before and/or after the section of the sensing element being heated (L_{test}).

NOTE 4 To reduce validation time for integrating line-type heat detectors the system setting used in the test 5.1.5 can be more sensitive than the system settings used in the performance tests (see 5.5 and 5.3.6).

5.1.5.3 Multipoint heat detectors

For measurement of the response time of multipoint heat detectors, the length of sensing element, L_1 which shall be connected to the sensor control unit shall be chosen to be the worst case for the technology employed. This shall be agreed between the manufacturer and the testing laboratory.

When testing the response time of multipoint detectors, one or more single sensors of the multipoint detector shall be placed in the centre of the tunnel measuring section (see Annex E). All other sensors shall be outside the heat tunnel and shall remain at ambient temperature (23 ± 5) °C during the measurement unless otherwise stated in the individual tests.

NOTE The manufacturer can specify a minimum length of sensing element that needs to be connected before and/or after the section of the sensing element being heated.

5.1.6 Provision for tests

Three specimens of sensor control unit, at least three specimens of sensing element and, if applicable, at least three specimens of each functional unit shall be provided to conduct the tests in 5.1.7. The exact number and length of sensing elements shall be agreed between the manufacturer and the testing laboratory.

If there are different types of sensor control units, sensing elements and/or functional units (e.g. with different environment groups), at least three specimens shall be provided for each type.

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 time of the three specimens as found in the reproducibility test should also represent the production mean. The limits specified in the reproducibility test should also be applicable to the manufacturer's production.

5.1.7 Test schedule

The specimens shall be tested according to the following test schedule (see Table 3).

Table 3 —Test schedule

Test[d]	Clause	Specimen No[a]		
		Sensor control units	**Sensing elements**	**Functional units**
Repeatability	5.2.3	One specimen, chosen arbitrarily	One specimen, chosen arbitrarily	One specimen (of each type), chosen arbitrarily
Reproducibility[c]	5.2.4	1 to 3	1 to 3[b]	1 to 3[b]
Sensing element fault	5.3.4	2	2	2
Variation in supply parameters	5.4.1	1	1	1
Low voltage fault (sensor control unit with external power supply)	5.4.2	2	2	2
Fire sensitivity for room protection application	5.5.1	1	1	1
Static response temperature test	5.5.2	1	2	2
Dry heat (operational) sensor control unit	5.6.1.1	1	2	2
Maximum ambient temperature test (sensing element)	5.3.6	2	3	3
Dry heat (endurance) sensing element	5.6.1.2	2	3	3
Cold (operational) sensing element	5.6.1.3	2	3	3
Cold (operational) for sensor control unit	5.6.1.4	2	3	3
Damp heat, steady state (endurance) for sensor control unit and sensing element	5.6.2.1	3	2	2
Damp heat, cyclic (operational) for sensing element	5.6.2.2	2	3	3
Damp heat, cyclic (operational) for sensor control unit	5.6.2.3	2	3	3
Damp heat, steady state (operational) for sensor control unit	5.6.2.4	2	3	3

Damp heat, cyclic (endurance) for sensor control unit and sensing element	5.6.2.5	2	3	3
Shock (operational) for sensor control unit	5.6.3.1	2	2	2
Impact (operational) for sensor control unit	5.6.3.2	2	2	2
Impact (operational) for sensing element	5.6.3.3	2	2	2
Vibration, sinusoidal (operational) for sensor control unit	5.6.3.4	2	2	2
Vibration, sinusoidal (operational) for sensing element	5.6.3.5	2	2	2
Vibration, sinusoidal (endurance) for sensor control unit	5.6.3.6	2	2	2
Vibration, sinusoidal (endurance) for sensing element	5.6.3.7	2	2	2
Sulphur dioxide (SO_2) corrosion (endurance) for sensing element	5.6.4.1	2	3	3
Sulphur dioxide (SO_2) corrosion (endurance) for sensor control unit	5.6.4.2	3	3	3
Electromagnetic compatibility (EMC), immunity tests (operational)	5.6.5.1	2	2	2

[a] The schedule shows the specimen numbers recommended for each test. Other arrangements can be used by agreement between the various parties (e.g. approval body, testing laboratory, manufacturer etc.) in order to improve the efficiency or cost of testing, or to reduce the number of specimens damaged by the testing. However, the reproducibility of the sensitivity of at least three specimens shall be measured in the reproducibility test. If fewer specimens are to be used for the rest of the tests then, the possible damaging effects of subjecting a specimen to a number of tests, especially endurance tests have to be considered.

[b] Assigned arbitrarily to the sensor control units. If more than 2 sensing elements may be connected to the sensor control unit (single ended or loop configuration) and/or there are sensing elements for different environment groups, then the number of tests shall be agreed between the manufacturer and the testing laboratory.

[c] For the reproducibility test only combinations of sensor control units with functional units and sensing elements that are used in 5.2 to 5.5 shall be used.

[d] The test order remains open to allow optimization of test program to minimize test time and cost.

5.2 Test procedures nominal activation conditions/sensitivity

5.2.1 Individual alarm indication

The general visual indicator shall be visually inspected from a distance of 6 m, in a line through the indicator perpendicular to the mounting surface of the enclosure, in an ambient light intensity up to 500 lux as specified in 4.2.1.

If more than one sensing element is connected to the sensor control unit, check the presence of the separate alarm indication by visual inspection.

5.2.2 Signalling

An engineering assessment shall be carried out for the correct signalling of the alarm and fault signal(s). The following test methods shall apply to generate the alarm or fault status:

a) Sensing element faults (see 5.3.4)

b) Low voltage (see 5.4.2)

c) Procedure for measuring response time (see 5.1.5)

If there is more than one sensing element the assessment has to be carried out for every sensing element.

5.2.3 Repeatability

5.2.3.1 Object

To show that the RLTHD is stable with respect to its sensitivity, even after a number of alarm conditions.

5.2.3.2 Test procedure

The response time of the specimen to be tested shall be measured as described in 5.1.5 three times each at rates of rise of temperature of 3 $Kmin^{-1}$ and 20 $Kmin^{-1}$.

A recovery period as specified by the manufacturer shall be allowed between consecutive tests.

At the 3 $Kmin^{-1}$ rate, the maximum response time shall be designated $t(3)_{max}$ and the minimum response time $t(3)_{min}$.

At the 20 $Kmin^{-1}$ rate, the maximum response time shall be designated $t(20)_{max}$ and the minimum response time $t(20)_{min}$.

5.2.3.3 Requirements

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall not be greater than 1,3.

The ratio of the response times $t(20)_{max}$: $t(20)_{min}$ shall not be greater than 1,6.

5.2.4 Reproducibility

5.2.4.1 Object

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

5.2.4.2 Test procedure

The response time of the specimen to be tested shall be measured as described in 5.1.5 at rates of rise of temperature of 3 $Kmin^{-1}$ and 20 $Kmin^{-1}$.

A recovery period as specified by the manufacturer shall be allowed between consecutive tests.

At the 3 $Kmin^{-1}$ rate, the maximum response time shall be designated $t(3)_{max}$ and the minimum response time $t(3)_{min}$.

At the 20 $Kmin^{-1}$ rate, the maximum response time shall be designated $t(20)_{max}$ and the minimum response time $t(20)_{min}$.

5.2.4.3 Requirements

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

The ratio of the response times $t(20)_{max}$: $t(20)_{min}$ shall be not greater than 1,6.

5.3 Test procedures operational reliability

5.3.1 Connection of ancillary devices

Open- and short-circuit shall be applied at the connections for ancillary devices.

An engineering assessment shall be carried out for the correct operation of the detector as specified in 4.3.1.

5.3.2 Manufacturer's adjustments

A visual inspection of a specimen shall be conducted to verify that the detector meets the requirements for manufacturer adjustments as specified in 4.3.2

5.3.3 Requirements for software controlled detectors

For detectors that rely on software for their operation, a visual inspection of samples of documentation provided by the manufacturer shall be conducted to verify that the device complies with the requirements specified in 4.3.3.

5.3.4 Sensing element fault

5.3.4.1 Object of the test

To ensure that faults on the sensing element which may prevent the proper function of the RLTHD are monitored and signalled.

5.3.4.2 Sensing element operational continuity

A fault condition corresponding to an interruption of the sensing element(s) in operation shall be generated while the RLTHD is monitored.

If a sensing element consists of more than one conductor/optical fibre/tube, each of them shall also be interrupted individually.

5.3.4.3 Requirements

The fault condition shall be detected and signalled within 300 s.

No alarm signal shall be triggered.

5.3.5 On-site adjustment of response behaviour

A visual inspection shall be conducted to verify that the detector meets the requirements for on-site adjustment of response behaviour as specified in 4.3.5.

5.3.6 Maximum ambient temperature test (sensing element)

5.3.6.1 Object

To demonstrate the ability of the RLTHD to function correctly even if the sensing element is exposed to high ambient temperature appropriate to the anticipated service temperature.

5.3.6.2 Mounting of the sensing element

The maximum length of sensing element shall be mounted in a heat chamber in a way that allows it to be heated up such that the temperature difference between any two points at the surface of the sensing element is not more than 5 K. A suitable test arrangement shall be agreed between the testing laboratory and the manufacturer and shall be supplied by the manufacturer.

5.3.6.3 Test procedure

The sensor control unit is in operation and remains at normal ambient conditions (23 ± 5) °C.

Starting from the typical application temperature the temperature inside the heat chamber shall be increased with a rate of rise of temperature of ≤0,1 $Kmin^{-1}$ up to the maximum application temperature (see 4.1.2). This temperature level shall be maintained for 16 h.

Immediately after the exposure period the sensing element shall be stimulated by a means, agreed between manufacturer and testing laboratory, to trigger an alarm signal.

5.3.6.4 Requirements

No alarm or fault signal shall be given during the initial temperature increase and the 16 h stabilisation period.

The RLTHD shall give an alarm signal by stimulation after the exposure period.

5.4 Tolerance to supply voltage

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 RLTHD is not unduly dependent on these parameters.

5.4.1.2 Test procedure

The response time of the specimen to be tested shall be measured as described in 5.1.5 at a rate of rise of temperature of 3 $Kmin^{-1}$ and at the upper and lower limits of the supply parameter (e.g. voltage) range(s) specified by the manufacturer.

A recovery period as specified by the manufacturer shall be allowed between consecutive tests.

The maximum response time shall be designated $t(3)_{max}$ and the minimum response time $t(3)_{min}$.

NOTE For conventional RLTHD the supply parameter is the dc voltage applied to the sensor control unit. For other types of detector signal levels and timing may 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

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

5.4.2 Low voltage fault

5.4.2.1 Object

To show that, the sensor control unit is able to signal a fault condition when its input power supply falls below the minimum voltage specified by the manufacturer (see 5.4.1).

5.4.2.2 Test procedure

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. The sensor control unit shall be operated at its maximum loading and at the lower voltage specified by the manufacturer (as tested in 5.4.1).

The supply voltage to the sensor control unit shall then be lowered by 15 %.

NOTE Maximum loading can include optional cards, power consuming sensor cables, etc.

5.4.2.3 Requirements

The sensor control unit shall signal a fault condition within 100 s following the voltage being lowered.

5.5 Performance parameters under fire conditions

5.5.1 Fire sensitivity for room protection application

5.5.1.1 Object

To show that the RLTHD (for room protection application) has, depending on its classification, an adequate sensitivity to the heat release of a real test fire as required for general application in fire detection systems.

5.5.1.2 Principle

A part of the sensing element of the RLTHD is mounted as described in Annex A and is exposed to three defined test fires described in Annex B. That part of the sensing element not installed in the fire test room shall remain in stable environmental conditions, as specified in 5.5.1.5.

5.5.1.3 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 a temperature probe arranged as indicated in Annex A.

5.5.1.4 Test fires

The sensing element of the specimen shall be subjected to the three test fires TF6F, TF6 and TF6S (see Annex B).

The type, quantity and arrangement of the fuel and the method of ignition are described in Annex B 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 test validity criteria in Annex B are fulfilled. It is permissible, and may be necessary, to adjust the quantity, condition and arrangement of the fuel to obtain valid test fires.

5.5.1.5 Mounting of the specimens

A length of (10 ± 0,2) m of the sensing element of the specimen shall be mounted on the fire test room ceiling in the designated area (see Annex A) in such a manner, that the sensing element has at least a horizontal distance of 2 m from the centre of the test fire. The specimen shall be mounted in accordance to the manufacturer's instructions. If these instructions describe more than one method of mounting then the method considered to be most unfavourable shall be chosen for each test.

Sensing elements of multipoint RLTHD shall be installed so that at least 1 sensor is arranged within the fire test room. This sensor shall be located on the 3 m radius (Position D). If there is more than 1 sensor in the test room then one sensor shall be located on the 3 m radius (Position D).

The part of sensing element in the fire test room shall have a spacing from the ceiling of (3 ± 2) cm.

That part of the sensing element not installed in the fire test room and the sensor control unit shall remain at an air temperature T = (23 ± 5) °C, and the air movement negligible.

The length of the sensing element under test (10 m) plus the length of the sensing element not installed in the fire test room shall be the maximum length of sensing element in accordance with manufacturer's specification.

The position of the part of the sensing element under test shall be chosen such that it represents the least sensitive response behaviour of the RLTHD. A typical example of a test setup is shown in Figure A.2.

The RLTHD 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 the 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.

5.5.1.6 Initial conditions

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

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

— air temperature: (23 ± 5) °C;

— air movement: negligible.

5.5.1.7 Recording of the fire parameters and response times

During each test fire the temperature *T* [°C] (measuring defined in Annex B on the 3 m circle) shall be recorded continuously or at least once per second.

The alarm signal given by the RLTHD 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 test fire temperature *T* at the moment of response.

5.5.1.8 Requirements

The RLTHD shall generate an alarm signal, in its assigned response class, according to the response time in Table 4.

Table 4 — Response times for room protection

Heat response classes	Response times					
	TF6S		TF6		TF6F	
	Lower value s	Upper value s	Lower value s	Upper value s	Lower value s	Upper value s
A1N, A1I	50	400	30	210	20	130
A2N, A2I	120	600	60	300	40	180

5.5.2 Static response temperature test

5.5.2.1 Object

To show that the RLTHD has, depending on its classification, an adequate sensitivity to a slow rate of rise of temperature.

5.5.2.2 Test procedure for non-integrating linear and multipoint RLTHD

5.5.2.2.1 Principle

A part of the sensing element of the RLTHD is mounted in a heat tunnel as described in Annex C and Annex E and is exposed to a static temperature test.

5.5.2.2.2 Test procedure for non-integrating linear RLTHD

5.5.2.2.2.1 Mounting of the sensing element

For measurement of the sensitivity of the non-integrating linear RLTHD the length of sensing element, L_1 that shall be connected to the sensor control unit shall be chosen to be the worst case for the technology employed. This shall be agreed between the manufacturer and the testing laboratory.

NOTE 1 It is advised to determine the worst case taking into account the effect on the temperature measurement of noise and losses in the sensing element.

A section of (10 ± 0,1) m (L_{test}) of sensing element shall be wrapped around a test frame as described in Annex C and heated in the heat tunnel.

The position of the part of the sensing element under test shall be chosen such that it represents the least sensitive response behaviour of the RLTHD. A typical example of a test setup is shown in Figure C.1.

NOTE 2 To facilitate the test procedure, it may be necessary to introduce easily detachable connections between different sections of the sensing element. It is advised to take into account the losses introduced by these connections when determining L_1.

NOTE 3 The manufacturer can specify a minimum length of sensing element that needs to be connected before and after the section of the sensing element being heated (L_{test}).

5.5.2.2.2.2 Initial conditions

Before the measurement, the temperature of the air stream and the section of sensing element at the typical ambient temperature for the appropriate response class as specified in 4.1.2 shall be stabilized.

For non-integrating linear RLTHD the remaining section of the sensing element ($L_1 – L_{test}$) not exposed to the induced test temperature shall be stabilised at an ambient temperature of (23 ± 5) °C during the measurement.

The sensor control unit shall be operated at an ambient temperature of (23 ± 5) °C during the measurement.

5.5.2.2.2.3 Measurement of response temperature

The measurement shall then be done by increasing the air temperature in the tunnel from the initial condition at a rate of rise of 1 K min^{-1} until the applicable maximum application temperature is reached as specified in 4.1.2 according to the appropriate class. Thereafter the test shall be continued at a maximum rate of rise of air temperature of 0,2 K min^{-1} until the sensor control unit annunciate an alarm.

During the measurement, the airflow in the tunnel shall be maintained at a constant mass flow, equivalent to (0,8 ± 0,1) m/s at 25 °C. The air temperature shall be controlled to within ± 2 K of the nominal temperature required at any time during the test.

The measured temperature at the moment the sensor control unit indicates an alarm shall be recorded.

5.5.2.2.3 Test procedure for multipoint RLTHD

5.5.2.2.3.1 Mounting of the sensing element

For measurement of the sensitivity of the multipoint RLTHD the length of sensing element, L_1 that is to be connected to the sensor control unit shall be chosen to be the worst case for the technology employed. This shall be agreed between the manufacturer and the testing laboratory.

NOTE It is advised to determine the worst case taking into account the effect on the temperature measurement of noise and losses in the sensing element.

When testing the response temperature of multipoint detectors, the minimum number of sensors within a 10 m section of sensing element L_{test} shall be placed in the tunnel measuring section as described in Annex E.

The position of the part of the sensing element under test shall be chosen such that it represents the least sensitive response behaviour of the RLTHD. A typical example of a test setup is shown in Figure E.1.

5.5.2.2.3.2 Initial conditions

Before the measurement, the temperature of the air stream and the section of sensing element L_{test} at the typical ambient temperature for the appropriate response class as specified in 4.1.2 shall be stabilized.

The remaining section of the sensing element ($L_1 - L_{test}$) not exposed to the induced test temperature shall be stabilised at an ambient temperature of (23 ± 5) °C during the measurement.

The sensor control unit shall be operated at an ambient temperature of (23 ± 5) °C during the measurement.

5.5.2.2.3.3 Measurement of response temperature

The measurement shall then be done by increasing the air temperature in the tunnel from the initial condition at a rate of rise of 1 $Kmin^{-1}$ until the applicable maximum application temperature is reached as specified in 4.1.2 according to the appropriate class. Thereafter the test shall be continued at a maximum rate of rise of air temperature of 0,2 K min^{-1} until the sensor control unit annunciate an alarm.

During the measurement, the airflow in the tunnel shall be maintained at a constant mass flow, equivalent to (0,8 ± 0,1) m/s at 25°C. The air temperature shall be controlled to within ± 2 K of the nominal temperature required at any time during the test (see Annex E).

The measured temperature at the moment the sensor control unit indicates an alarm shall be recorded.

5.5.2.3 Test procedure for integrating linear RLTHD

5.5.2.3.1 Principle

The maximum length of the sensing element of the integrating linear RLTHD as specified by the manufacturer is exposed to the heat.

5.5.2.3.2 Mounting of the sensing element

The sensing element shall be mounted in a heat chamber in a way that allows the sensing element to be heated homogeneously. A suitable test arrangement shall be agreed between the testing laboratory and the manufacturer and shall be supplied by the manufacturer.

5.5.2.3.3 Initial conditions

Before the measurement, the temperature in the heat chamber at the typical ambient temperature for the appropriate response class as specified in 4.1.2. shall be stabilized.

The sensor control unit shall be operated at an ambient temperature of (23 ± 5) °C during the measurement.

5.5.2.3.4 Measurement of response temperature

The measurement shall then be done by increasing the air temperature in the heat chamber from the initial condition at a rate of rise of ≤ 0,5 K min^{-1} until the applicable maximum application temperature is reached as specified in 4.1.2 according to the appropriate class. Thereafter the test shall be continued at a maximum rate of rise of air temperature of 0,2 K min^{-1} until the sensor control unit annunciate an alarm.

The air temperature shall be controlled to within ± 2 K of the nominal temperature required at any time during the test.

The measured temperature at the moment the sensor control unit indicates an alarm shall be recorded.

5.5.2.4 Requirements

The detector tested shall respond between the minimum and maximum static response temperatures shown in 4.1.2, according to the class of the detector.

5.6 Durability of nominal activation conditions/sensitivity

5.6.1 Temperature resistance

5.6.1.1 Dry heat (operational) test for sensor control unit

5.6.1.1.1 Object

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

5.6.1.1.2 Reference

The test apparatus and procedure shall be as described in EN 60068-2-2:2007, Test Bb or Bd, and as indicated below.

5.6.1.1.3 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.

The length of sensing element used in the test shall correspond to the most unfavourable operating condition of the RLTHD technology under test. The configuration shall be the same as chosen in 5.1.5.

The sensing element shall be maintained at normal atmospheric conditions (see 5.1.1).

5.6.1.1.4 Conditioning

The conditioning shall be applied to the sensor control unit in accordance with the applicable environmental group shown in Table 5.

Table 5 — Conditions for dry heat (operational) test for sensor control unit

Environmental group	Temperature °C	Duration h
I	40 ± 2	16
II	55 ± 2	16
III	70 ± 2	16
NOTE If a sensor control unit is specified for more than one environmental group, the test needs only be carried out for the most severe group.		

5.6.1.1.5 Measurements during conditioning

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

During the last hour of the conditioning stimulate an alarm condition by means agreed with the manufacturer.

5.6.1.1.6 Final measurements

After the conditioning and a recovery period of at least 1 h, the functional test as described in 5.1.5 shall be conducted at a rate of rise of 3 $Kmin^{-1}$ and the response time recorded.

The greater response time value measured in this test and that measured for the same specimen in the reproducibility test, shall be designated $t(3)_{max}$ and the lesser shall be designated $t(3)_{min}$.

5.6.1.1.7 Requirements

No alarm or fault signal shall be given during the period that the temperature is increasing to the stabilization temperature or during the stabilized period.

An alarm shall be generated when stimulated according to 5.6.1.1.5.

An alarm shall be generated during the functional test in 5.6.1.1.6.

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

5.6.1.2 Dry heat (endurance) for sensing element

5.6.1.2.1 Object of the test

To demonstrate the ability of the RLTHD sensing element to withstand long term ageing effects.

5.6.1.2.2 Principle

The test consists of exposure of the sensing element specimen to the high temperature, for a long period to accelerate ageing effects.

5.6.1.2.3 Reference

The test apparatus and procedure shall be as described in EN 60068-2-2:2007.

5.6.1.2.4 State of the specimen during conditioning

The specimen shall not be supplied with power during conditioning and tests for non heat-dissipating specimens shall apply (i.e. Tests Ba or Bb).

NOTE 1 Test Ba (with sudden changes in temperature) can be used, to improve test economy, if it is known that the sudden change in temperature will not be detrimental to the specimen.

The length of sensing element used in the test shall correspond to the most unfavourable operating condition of the RLTHD technology under test. The configuration shall be the same as chosen in 5.1.5.

The length of sensing element to be exposed to the heat shall be the 10 m section L_{Test} which is to be used for the response test (see 5.1.5).

NOTE 2 The section of the sensing element to be exposed to the dry heat can be disconnected from the remainder of the sample and its open ends can be sealed in accordance with the manufacturer's instructions.

5.6.1.2.5 Conditioning

Conditioning shall be applied to the specimen as indicated in the Table 6.

Table 6 — Conditions for dry heat (endurance) test for sensing elements

Environmental group	Class	Temperature °C	Duration days
II	A1I, A2I, BI, A1N, A2N and BN	No test	
	class CI and CN	80 ± 2	21
	class DI and DN	95 ± 2	
	class EI and EN	110 ± 2	
	class FI and FN	125 ± 2	
	class GI and GN	140 ± 2	
III	A1I, A2I, BI, A1N, A2N and BN	70 ± 2	21
	class CI and CN	80 ± 2	21
	class DI and DN	95 ± 2	
	class EI and EN	110 ± 2	
	class FI and FN	125 ± 2	
	class GI and GN	140 ± 2	

5.6.1.2.6 Final measurements

After the conditioning and a recovery period of at least 1 h, the functional test as described in 5.1.5 shall be conducted at a rate of rise of 3 $Kmin^{-1}$ and the response time recorded.

The greater response time value measured in this test and that measured for the same specimen in the reproducibility test, shall be designated $t(3)_{max}$ and the lesser shall be designated $t(3)_{min}$.

5.6.1.2.7 Requirements

No alarm or fault signal shall be given after powering the sensing element at the end of the conditioning and recovery periods.

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

5.6.1.3 Cold (operational) for sensing element

5.6.1.3.1 Object

To demonstrate the ability of the RLTHD to function correctly even if the sensing element is exposed to low ambient temperatures appropriate to the anticipated service environment.

5.6.1.3.2 Reference

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

5.6.1.3.3 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.

The length of sensing element used in the test shall correspond to the most unfavourable operating condition of the RLTHD technology under test. The configuration shall be the same as chosen in 5.1.5.

The sensor control unit shall be maintained at normal ambient conditions defined in 5.1.1.

5.6.1.3.4 Conditioning

Conditioning shall be applied to the specimen as indicated in the Table 7.

Table 7 — Conditions for cold (operational) test for sensing element

Environmental group	Temperature °C	Duration h
II	-10 ± 3	16
III	-25 ± 3[a]	16
[a]In countries with very cold outside temperatures test condition of (- 40 ± 3) °C should be used.		

NOTE If the sensor control unit and the sensing element belong to the same environmental group the test can be done concurrently with 5.6.1.4.

5.6.1.3.5 Measurements during conditioning

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

5.6.1.3.6 Final measurements

After the conditioning and a recovery period of at least 1 h, the functional test as described in 5.1.5 shall be conducted at a rate of rise of 3 $Kmin^{-1}$ and the response time recorded.

The greater response time value measured in this test and that measured for the same specimen in the reproducibility test, shall be designated $t(3)_{max}$ and the lesser shall be designated $t(3)_{min}$.

5.6.1.3.7 Requirements

No alarm or fault signal shall be given during the period that the temperature is decreasing to the stabilization temperature or during the stabilized period.

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

5.6.1.4 Cold (operational) for sensor control unit

5.6.1.4.1 Object

To demonstrate the ability of the RLTHD sensor control unit to function correctly at low ambient temperatures appropriate to the anticipated service environment.

5.6.1.4.2 Reference

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

The tests with gradual changes in temperature shall be used. Test Ad shall be used for heat-dissipating specimens (as defined in EN 60068-2-1) and test Ab for non heat-dissipating specimens.

5.6.1.4.3 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.

The length of sensing element used in the test shall correspond to the most unfavourable operating condition of the RLTHD technology under test. The configuration shall be the same as chosen in 5.1.5.

The sensing element shall be maintained at normal ambient conditions defined in 5.1.1.

5.6.1.4.4 Conditioning

Conditioning shall be applied to the specimen as indicated in the Table 8.

Table 8 — Conditions for cold (operational) test for sensor control unit

Environmental group	Temperature °C	Duration h
I	-5 ± 3	16
II	-10 ± 3	16
III	-25 ± 3	16

NOTE If the sensor control unit and the sensing element belongs to the same environmental group the test can be done concurrently with 5.6.1.3.

5.6.1.4.5 Measurements during conditioning

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

During the last hour of the conditioning simulate an alarm condition by means agreed with the manufacturer.

5.6.1.4.6 Final measurements

After the conditioning and a recovery period of at least 1 h, the functional test as described in 5.1.5 shall be conducted at a rate of rise of 3 $Kmin^{-1}$ and the response time recorded.

The greater response time value measured in this test and that measured for the same specimen in the reproducibility test, shall be designated $t(3)_{max}$ and the lesser shall be designated $t(3)_{min}$.

5.6.1.4.7 Requirements

No alarm or fault signal shall be given during the period that the temperature is decreasing to the stabilization temperature or during the stabilized period.

An alarm shall be generated during the functional test in 5.6.1.4.6.

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

5.6.2 Humidity resistance

5.6.2.1 Damp heat, steady state (endurance) for sensor control unit and sensing element

5.6.2.1.1 Object

To demonstrate the ability of the RLTHD (sensor control unit and sensing element) to withstand the long-term effects of humidity in the service environment (e.g. changes in electrical properties of materials, chemical reactions involving moisture, galvanic corrosion etc.).

5.6.2.1.2 Reference

The test apparatus and procedure shall be as described in EN 60068-2-78:2001, test Cab.

5.6.2.1.3 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.

The length of sensing element used in the test shall correspond to the most unfavourable operating condition of the RLTHD technology under test. The configuration shall be the same as chosen in 5.1.5

5.6.2.1.4 Conditioning

Conditioning shall be applied to the specimen as indicated in the Table 9.

Table 9 — Conditions for damp heat, steady state (endurance) test

Environmental group	**Temperature** °C	**Relative humidity** %	**Duration** days
I, II and III	40 ± 2	93 ± 3	21

5.6.2.1.5 Final measurements

After the conditioning and a recovery period of at least 1 h at standard laboratory conditions, the functional test as described in 5.1.5 shall be conducted at a rate of rise of 3 $Kmin^{-1}$ and the response time recorded.

The greater response time value measured in this test and that measured for the same specimen in the reproducibility test, shall be designated $t(3)_{max}$ and the lesser shall be designated $t(3)_{min}$.

5.6.2.1.6 Requirements

No alarm or fault signal shall be given after powering the RLTHD at the end of the conditioning and recovery periods.

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

5.6.2.2 Damp heat, cyclic (operational) for sensing element

5.6.2.2.1 Object of the test

To demonstrate the ability of the RLTHD to function correctly even if the sensing element is exposed to high relative humidity which may occur for short periods in the anticipated service environment.

5.6.2.2.2 Principle

The lower severity (with an upper temperature of 40 °C) is intended for areas where light condensation may infrequently occur for short periods (e.g. during the warming up of storage areas with limited or no temperature control).

The higher severity (with an upper temperature of 55 °C) is intended for areas where heavy and/or frequent condensation can occur (e.g. outdoors or in wet rooms etc.)

5.6.2.2.3 Reference

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

NOTE The test consists of exposing the specimen to cyclic temperature variations between 25 °C and the appropriate upper temperature (40 °C or 55°C). The relative humidity is maintained at (93 ± 3) % during the high temperature phase and above 95 % during the low temperature and temperature changing phases. The rates of increase of temperature are such that condensation should occur on the surface of the specimen.

5.6.2.2.4 State of the specimen during conditioning

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

The length of sensing element used in the test shall correspond to the most unfavourable operating condition of the RLTHD technology under test. The configuration shall be the same as chosen in 5.1.5.

The sensor control unit shall be maintained at normal ambient conditions defined in 5.1.1.

5.6.2.2.5 Conditioning

Conditioning shall be applied to the specimen as indicated in the Table 10.

Table 10 — Conditions for damp heat, cyclic (operational) test for sensing element

Environmental group	**Lower temperature** °C	**Upper temperature** °C	**Relative humidity** %		**Number of cycles**
			At lower temperature	At upper temperature	
II	25 ± 2	40 ± 2	≥ 95	93 ± 3	2
III	25 ± 2	55 ± 2	≥ 95	93 ± 3	2

NOTE 1 If the sensor control unit and the sensing element belong to the same environmental group the test can be done concurrently with 5.6.2.3.

NOTE 2 For RLTHD class A1 and A2 system under environmental group III the minimum static response temperature is 54°C so it could be possible that the system triggers an alarm if it works at the lower end of the tolerance. Therefore the minimum static response temperature needs to be greater than 55 °C plus the tolerance of 2 °C.

5.6.2.2.6 Measurements during conditioning

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

5.6.2.2.7 Final measurements

After the conditioning and a recovery period of at least 1 h, the functional test as described in 5.1.5 shall be conducted at a rate of rise of 3 $Kmin^{-1}$ and the response time recorded.

The greater response time value measured in this test and that measured for the same specimen in the reproducibility test, shall be designated $t(3)_{max}$ and the lesser shall be designated $t(3)_{min}$.

5.6.2.2.8 Requirements

No alarm or fault signal shall be given during the conditioning and the following recovering period.

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

5.6.2.3 Damp heat, cyclic (operational) for sensor control unit

5.6.2.3.1 Object of the test

To demonstrate the ability of the RLTHD sensor control unit to function correctly at high relative humidity which may occur for short periods during the anticipated service environment.

5.6.2.3.2 Principle

The lower severity (with an upper temperature of 40 °C) is intended for areas where light condensation may infrequently occur for short periods (e.g. during the warming up of storage areas with limited or no temperature control).

The higher severity (with an upper temperature of 55 °C) is intended for areas where heavy and/or frequent condensation can occur (e.g. outdoors or in wet rooms etc.)

5.6.2.3.3 Reference

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

NOTE The test consists of exposing the specimen to cyclic temperature variations between 25 °C and the appropriate upper temperature (40 °C or 55 °C). The relative humidity is maintained at (93 ± 3) % during the high temperature phase and above 95 % during the low temperature and temperature changing phases. The rates of increase of temperature are such that condensation should occur on the surface of the specimen.

5.6.2.3.4 State of the specimen during conditioning

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

The length of sensing element used in the test shall correspond to the most unfavourable operating condition of the RLTHD technology under test. The configuration shall be the same as chosen in 5.1.5.

The sensing element shall be maintained at normal ambient conditions defined in 5.1.1.

5.6.2.3.5 Conditioning

Conditioning shall be applied to the specimen as indicated in the Table 11.

Table 11 — Conditions for damp heat, cyclic (operational) test for sensor control unit

Environmental group	Lower Temperature °C	Upper Temperature °C	Relative humidity %		Number of cycles
			At lower temperature	At upper temperature	
I	No test				
II	25 ± 2	40 ± 2	≥ 95	93 ± 3	2
III	25 ± 2	55 ± 2	≥ 95	93 ± 3	2

NOTE 1 If the sensor control unit and the sensing element belong to the same environmental group the test can be done concurrently with 5.6.2.2.

NOTE 2 If the sensor control unit is classified in environmental group I then the damp heat, steady state (operational) test for sensor control units is conducted instead.

5.6.2.3.6 Measurements during conditioning

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

During the last hour of the conditioning simulate an alarm condition by means agreed with the manufacturer.

5.6.2.3.7 Final measurements

After the conditioning and a recovery period of at least 1 h, the functional test as described in 5.1.5 shall be conducted at a rate of rise of 3 $Kmin^{-1}$ and the response time recorded.

The greater response time value measured in this test and that measured for the same specimen in the reproducibility test, shall be designated $t(3)_{max}$ and the lesser shall be designated $t(3)_{min}$.

5.6.2.3.8 Requirements

No alarm or fault signal shall be given during the conditioning and the following recovering period.

An alarm shall be generated during the functional test in 5.6.2.3.7.

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3

5.6.2.4 Damp heat, steady state (operational) for sensor control unit

5.6.2.4.1 Object of the test

To demonstrate the ability of the sensor control unit to function correctly at high relative humidity (without condensation) which may occur for short periods in the service environment.

5.6.2.4.2 Principle

The test consists of exposing the specimen to a constant temperature and a constant high relative humidity, in such a manner that condensation does not occur on the specimen.

The period of exposure is chosen to allow surface effects due to adsorption to be identified.

5.6.2.4.3 Reference

The test apparatus and procedure shall be as described in EN 60068-2-78:2001 Test Cab.

5.6.2.4.4 State of the specimen during conditioning

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

The length of sensing element used in the test shall correspond to the most unfavourable operating condition of the RLTHD technology under test. The configuration shall be the same as chosen in 5.1.5.

The sensing element shall be maintained at normal ambient conditions defined in 5.1.1.

5.6.2.4.5 Conditioning

Conditioning shall be applied to the specimen as indicated in the Table 12:

Table 12 — Conditions for damp heat, steady state (operational) test for sensor control unit

Environmental group	**Temperature** °C	**Relative humidity** %	**Duration** days
I	40 ± 2	93 ± 3	4
II, III	No test		

NOTE If the sensor control unit is classified in environmental group II or III then the damp heat, cyclic (operational) test for sensor control units is conducted instead.

5.6.2.4.6 Measurements during conditioning

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

During the last hour of the conditioning simulate an alarm condition by means agreed with the manufacturer.

5.6.2.4.7 Final measurements

After the conditioning and a recovery period of at least 1 h, the functional test as described in 5.1.5 shall be conducted at a rate of rise of 3 $Kmin^{-1}$ and the response time recorded.

The greater response time value measured in this test and that measured for the same specimen in the reproducibility test, shall be designated $t(3)_{max}$ and the lesser shall be designated $t(3)_{min}$.

5.6.2.4.8 Requirements

No alarm or fault signal shall be given during the conditioning and the following recovering period.

An alarm shall be generated during the functional test in 5.6.2.4.7.

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

5.6.2.5 Damp heat, cyclic (endurance) for sensor control unit and sensing element

5.6.2.5.1 Object

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

5.6.2.5.2 Principle

The conditioning to this test is applicable to the sensing element and/or sensor control unit of environmental group III.

5.6.2.5.3 Reference

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

NOTE The test consists of exposing the specimen to cyclic temperature variations between 25 °C and 55 °C. The relative humidity is maintained at (93 ± 3) % during the high temperature phase and above 95 % during the low temperature and temperature changing phases. The rates of increase of temperature are such that condensation should occur on the surface of the specimen.

5.6.2.5.4 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.

The length of sensing element used in the test shall correspond to the most unfavourable operating condition of the RLTHD technology under test. The configuration shall be the same as chosen in 5.1.5.

The part of the RLTHD which is not exposed to conditioning shall be maintained at normal ambient conditions defined in 5.1.1.

5.6.2.5.5 Conditioning

Conditioning shall be applied to the specimen as indicated in the Table 13:

Table 13 — Damp heat, cyclic (endurance)

Environmental group	**Lower Temperature** °C	**Upper Temperature** °C	**Relative humidity** %		**Number of cycles**
			At lower temperature	At upper temperature	
I and II	No test				
III	25 ± 2	55 ± 2	≥ 95	93 ± 3	6

5.6.2.5.6 Final measurements

After the conditioning and a recovery period of at least 1 h at standard laboratory conditions, the functional test as described in 5.1.5 shall be conducted at a rate of rise of 3 $Kmin^{-1}$ and the response time recorded.

The greater response time value measured in this test and that measured for the same specimen in the reproducibility test, shall be designated $t(3)_{max}$ and the lesser shall be designated $t(3)_{min}$.

5.6.2.5.7 Requirements

No alarm or fault signal shall be given after powering the RLTHD at the end of the conditioning and recovery periods.

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

5.6.3 Shock and vibration resistance

5.6.3.1 Shock (operational) for sensor control unit

5.6.3.1.1 Object

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

5.6.3.1.2 Reference

The test apparatus and procedure shall be as described in EN 60068-2-27:2009, test Ea, except that the conditioning shall be as described below.

5.6.3.1.3 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.

The length of sensing element used in the test shall correspond to the most unfavourable operating condition of the RLTHD technology under test. The configuration shall be the same as chosen in 5.1.5.

5.6.3.1.4 Conditioning

For specimens with a mass ≤ 4,75 kg conditioning shall be applied to the specimen as indicated in the Table 14. For specimens with a mass > 4,75 kg no test shall be applied.

Table 14 — Shock (operational) test for sensor control unit

Environmental group	Pulse type	Pulse duration ms	Max. acceleration related to the specimen mass M (kg) ms^{-2}	Number of shock directions	Number of pulses per direction
I	No test				
II and III	Half sine	6	1000 – (200 × M)	6 (i.e. 2 per axis)	3

5.6.3.1.5 Measurements during conditioning

The specimen shall be monitored during the conditioning period and for a further 2 min to detect any change.

5.6.3.1.6 Final measurements

After the conditioning and the further 2 min, the functional test as described in 5.1.5 shall be conducted at a rate of rise of 3 $Kmin^{-1}$ and the response time recorded.

The greater response time value measured in this test and that measured for the same specimen in the reproducibility test, shall be designated $t(3)_{max}$ and the lesser shall be designated $t(3)_{min}$.

5.6.3.1.7 Requirements

No alarm or fault signal shall be given during conditioning and the further 2 min.

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

5.6.3.2 Impact (operational) for sensor control unit

5.6.3.2.1 Object

To demonstrate the immunity of the RLTHD sensor control unit 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 Reference

The test apparatus and procedure shall be as described in EN 60068-2-75:1997, test Eh.

5.6.3.2.3 State of the specimen during conditioning

The specimen shall be mounted as described in 5.1.3 to a rigid structure, as required by EN 60068-2-75:1997, and shall be connected to its supply and monitoring equipment as described in 5.1.2.

The length of sensing element used in the test shall correspond to the most unfavourable operating condition of the RLTHD technology under test. The configuration shall be the same as chosen in 5.1.5.

5.6.3.2.4 Conditioning

Impacts shall be applied to all accessible surfaces of the specimen. For all such surfaces three blows shall be applied to any point(s) considered likely to cause damage to or impair the operation of the specimen.

Care should be taken to ensure that the results from a series of three blows do not influence subsequent series. In case of doubts, the defect shall be disregarded and a further three blows shall be applied to the same position on a new specimen.

Conditioning shall be applied to the specimen as indicated in the Table 15.

Table 15 — Impact (operational) test for sensor control unit

Environmental group	**Impact energy** J	**Number of impacts per point**
I, II and III	0,5 ± 0,04	3

5.6.3.2.5 Measurements during conditioning

The specimen shall be monitored during the conditioning period and for a further 2 min to detect any change.

5.6.3.2.6 Final measurements

After the conditioning and the further 2 min, the functional test as described in 5.1.5 shall be conducted at a rate of rise of 3 $Kmin^{-1}$ and the response time recorded.

The greater response time value measured in this test and that measured for the same specimen in the reproducibility test, shall be designated $t(3)_{max}$ and the lesser shall be designated $t(3)_{min}$.

5.6.3.2.7 Requirements

No alarm or fault signal shall be given during conditioning and the further 2 min.

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

5.6.3.3 Impact (operational) for sensing element

5.6.3.3.1 Object

To demonstrate the ability of the RLTHD to function correctly even if the sensing element is exposed to mechanical impacts upon its surface, which it may sustain in the normal service environment, and which it can reasonably be expected to withstand.

5.6.3.3.2 Test Apparatus

The test apparatus shall be as shown in Annex I.

5.6.3.3.3 State of the specimen(s) 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.

The length of sensing element used in the test shall correspond to the most unfavourable operating condition of the RLTHD technology under test. The configuration shall be the same as chosen in 5.1.5.

5.6.3.3.4 Conditioning

A section of the sensing element shall be placed on the base of the apparatus described in Annex I either under a round edged intermediate piece or, at a right angle, under the chisel edged intermediate piece. The section of the sensing element shall be chosen as that most likely to impair the normal functioning of the specimen.

The first part of the conditioning is to be conducted using the round edged intermediate piece with the sensing element placed beneath it. Allow the hammer to fall from a height of (200 ± 10) mm.

After a period of at least 2 min the second part of the conditioning is to be applied to a different position of the sensing element, using the chisel edged intermediate piece with the sensing element placed in a right angle beneath it. Allow the hammer to fall from a height of (200 ± 10) mm.

Conditioning shall be applied to the specimen as indicated in the Table 16.

Table 16 — Impact (operational) test for sensing element

Environmental group	**Intermediate piece**	**Fall height** mm	**Hammer weight** g	**Number of impacts**
II and III	Round edged	200 ± 10	500 ± 10	1
II and III	Chisel edged	200 ± 10	500 ± 10	1

5.6.3.3.5 Measurements during conditioning

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

5.6.3.3.6 Final measurements

After the conditioning and the further 2 min, the functional test as described in 5.1.5 shall be conducted at a rate of rise of 3 $Kmin^{-1}$ and the response time recorded.

The greater response time value measured in this test and that measured for the same specimen in the reproducibility test, shall be designated $t(3)_{max}$ and the lesser shall be designated $t(3)_{min}$.

5.6.3.3.7 Requirements

No alarm or fault signal shall be given during conditioning and the further 2 min.

Although there may be visible distortion to the sheath of the sensing element where it was impacted, there shall be no visible cracking or cutting of the sheath.

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

5.6.3.4 Vibration, sinusoidal (operational) for sensor control unit

5.6.3.4.1 Object

To demonstrate the immunity of the RLTHD sensor control unit to vibration at levels considered appropriate to the normal service environment.

5.6.3.4.2 Reference

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

5.6.3.4.3 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.

The length of sensing element used in the test shall correspond to the most unfavourable operating condition of the RLTHD technology under test. The configuration shall be the same as chosen in 5.1.5.

5.6.3.4.4 Conditioning

Conditioning shall be applied to the specimen as indicated in the Table 17.

Table 17 — Vibration, sinusoidal, (operational) test for sensor control unit

Environmental group	**Frequency range** Hz	**Acceleration amplitude** ms^{-2} {g_n}	**Number of axes**	**Sweep rate** octaves x min^{-1}	**Number of sweep cycles per axis**
I	10 - 150	1,0 {≈0,1}	3	1	1
II and III	10 - 150	5,0 {≈0,5}	3	1	1

NOTE The vibration operational and endurance tests can 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 to be made.

5.6.3.4.5 Measurements during conditioning

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

5.6.3.4.6 Final measurements

After the conditioning, the functional test as described in 5.1.5 shall be conducted at a rate of rise of 3 $Kmin^{-1}$ and the response time recorded.

The greater response time value measured in this test and that measured for the same specimen in the reproducibility test, shall be designated $t(3)_{max}$ and the lesser shall be designated $t(3)_{min}$.

5.6.3.4.7 Requirements

No alarm or fault signal shall be given during conditioning.

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

5.6.3.5 Vibration, sinusoidal (operational) for sensing element

5.6.3.5.1 Object

To demonstrate the ability of the RLTHD to function correctly even if the sensing element is exposed to vibration at levels considered appropriate to the normal service environment.

5.6.3.5.2 Reference

The test apparatus and the procedure shall be as described in EN 60068-2-6:2008 and as defined below.

5.6.3.5.3 State of the specimen during conditioning

The length of sensing element used in the test shall correspond to the most unfavourable operating condition of the RLTHD technology under test. The configuration shall be the same as chosen in 5.1.5.

A section of approximately 2 m of sensing element shall be mounted on the test apparatus as described in Annex H and shall be connected to its supply and monitoring equipment as described in 5.1.2. The vibration shall be applied in the vertical axis.

For multipoint sensing elements a sensor shall be within the 2 m section under test located centrally between two of the three mounting brackets.

5.6.3.5.4 Conditioning

Conditioning shall be applied to the specimen as indicated in the Table 18.

Table 18 — Vibration, sinusoidal, (operational) for sensing element

Environmental group	**Frequency range** Hz	**Acceleration amplitude** ms^{-2} {g_n}	**Number of axes**	**Sweep rate** octaves x min^{-1}	**Number of sweep cycles per axis**
II and III	10 - 150	5,0 {≈0,5}	1	1	1

NOTE The vibration operational and endurance tests can be combined such that the specimen is subjected to the operational test conditioning followed by the endurance test conditioning. Only one final measurement needs to be made.

5.6.3.5.5 Measurements during conditioning

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

5.6.3.5.6 Final measurements

After the conditioning, the functional test as described in 5.1.5 shall be conducted at a rate of rise of 3 $Kmin^{-1}$ and the response time recorded.

The greater response time value measured in this test and that measured for the same specimen in the reproducibility test, shall be designated $t(3)_{max}$ and the lesser shall be designated $t(3)_{min}$.

5.6.3.5.7 Requirements

No alarm or fault signal shall be given during conditioning.

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

5.6.3.6 Vibration, sinusoidal (endurance) for sensor control unit

5.6.3.6.1 Object

To demonstrate the ability of the RLTHD sensor control unit to withstand the long term effects of vibration at levels appropriate to the service environment.

5.6.3.6.2 Reference

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

5.6.3.6.3 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.

The length of sensing element used in the test shall correspond to the most unfavourable operating condition of the RLTHD technology under test. The configuration shall be the same as chosen in 5.1.5.

5.6.3.6.4 Conditioning

Conditioning shall be applied to the specimen as indicated in the Table 19.

Table 19 —Vibration, sinusoidal (endurance) for sensor control unit

Environmental group	**Frequency range** Hz	**Acceleration amplitude** ms^{-2} {g_n}	**Number of axes**	**Sweep rate** octave x min^{-1}	**Number of sweep cycles per axis**
I	10 - 150	5,0 {≈0,5}	3	1	20
II and III	10 - 150	10,0 {≈1,0}	3	1	20

NOTE The vibration operational and endurance tests can 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 to be made.

5.6.3.6.5 Final measurements

After the conditioning, the functional test as described in 5.1.5 shall be conducted at a rate of rise of 3 $Kmin^{-1}$ and the response time recorded.

The greater response time value measured in this test and that measured for the same specimen in the reproducibility test, shall be designated $t(3)_{max}$ and the lesser shall be designated $t(3)_{min}$.

5.6.3.6.6 Requirements

No alarm or fault signal shall be given after powering the RLTHD at the end of the conditioning.

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

5.6.3.7 Vibration, sinusoidal (endurance) for sensing element

5.6.3.7.1 Object

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

5.6.3.7.2 Reference

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

5.6.3.7.3 State of the specimen during conditioning

A section of approximately 2 m of sensing element shall be mounted on the test apparatus as described in Annex H and shall not be supplied with power during the conditioning. The vibration shall be applied in the vertical axis.

For multipoint sensing elements a sensor shall be within the 2 m section under test located centrally between two of the three mounting brackets.

The length of sensing element used in the test shall correspond to the most unfavourable operating condition of the RLTHD technology under test. The configuration shall be the same as chosen in 5.1.5.

5.6.3.7.4 Conditioning

Conditioning shall be applied to the specimen as indicated in the Table 20.

Table 20 — Vibration, sinusoidal, (endurance) for sensing element

Environmental group	**Frequency range** Hz	**Acceleration amplitude** ms^{-2} {g_n}	**Number of axes**	**Sweep rate** octave x min^{-1}	**Number of sweep cycles per axis**
II and III	10 - 150	10,0 {≈1,0}	1	1	20

NOTE The vibration operational and endurance tests can be combined such that the specimen is subjected to the operational test conditioning followed by the endurance test conditioning. Only one final measurement needs to be made.

5.6.3.7.5 Final measurements

After the conditioning, the functional test as described in 5.1.5 shall be conducted at a rate of rise of 3 $Kmin^{-1}$ and the response time recorded.

The greater response time value measured in this test and that measured for the same specimen in the reproducibility test, shall be designated $t(3)_{max}$ and the lesser shall be designated $t(3)_{min}$.

5.6.3.7.6 Requirements

No alarm or fault signal shall be given after powering the RLTHD at the end of the conditioning.

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

5.6.4 Corrosion resistance

5.6.4.1 Sulphur dioxide (SO_2) corrosion (endurance) for sensing element

5.6.4.1.1 Object

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

5.6.4.1.2 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.

5.6.4.1.3 State of the specimen during conditioning

The length of sensing element used in the test shall correspond to the most unfavourable operating condition of the RLTHD technology under test. The configuration shall be the same as chosen in 5.1.5. except that the length of sensing element to be exposed shall be the 10 m section L_{Test} which is to be used for the response test (see 5.1.5.). In order to conduct the test, the section of the sensing element to be exposed to the corrosive atmosphere shall be disconnected from the remainder of the sample and its open ends shall be sealed in accordance with the manufacturer's instructions.

5.6.4.1.4 Conditioning

Conditioning shall be applied to the specimen as indicated in the Table 21.

Table 21 — Sulphur dioxide (SO_2) corrosion (endurance) test for sensing element

Environmental group	**Sulphur dioxide content** µl/l	**Temperature** °C	**Relative humidity** %	**Duration** days
II and III	25 ± 5	25 ± 2	93 ± 3	21

NOTE If the sensor control unit and the sensing element belong to the same environmental group the test can be done concurrently with 5.6.4.2.

5.6.4.1.5 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 the recovery period the section L_{Test} shall be reconnected to the remainder of the sensing element and the functional test as described in 5.1.5 shall be conducted at a rate of rise of 3 $Kmin^{-1}$ and the response time recorded.

The greater response time value measured in this test and that measured for the same specimen in the reproducibility test, shall be designated $t(3)_{max}$ and the lesser shall be designated $t(3)_{min}$.

5.6.4.1.6 Requirements

No alarm or fault signal shall be given after powering the RLTHD at the end of the conditioning and recovery periods.

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

5.6.4.2 Sulphur dioxide (SO_2) corrosion (endurance) for sensor control unit

5.6.4.2.1 Object

To demonstrate the ability of the RLTHD sensor control unit to withstand the corrosive effects of sulphur dioxide as an atmospheric pollutant.

5.6.4.2.2 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.

5.6.4.2.3 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.

The length of sensing element used in the test shall correspond to the most unfavourable operating condition of the RLTHD technology under test. The configuration shall be the same as chosen in 5.1.5.

5.6.4.2.4 Conditioning

Conditioning shall be applied to the specimen as indicated in the Table 22:

Table 22 — Sulphur dioxide (SO_2) corrosion (endurance) test for sensor control unit

Environmental group	**Sulphur dioxide content** µl/l	**Temperature** °C	**Relative Humidity** %	**Duration** days
I	No test			
II and III	25 ± 5	25 ± 2	93 ± 3	21

NOTE If the sensor control unit and the sensing element belongs to the same environmental group the test can be done concurrently with 5.6.4.1.

5.6.4.2.5 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 the recovery period, the functional test as described in 5.1.5 shall be conducted at a rate of rise of 3 $Kmin^{-1}$ and the response time recorded.

The greater response time value measured in this test and that measured for the same specimen in the reproducibility test, shall be designated $t(3)_{max}$ and the lesser shall be designated $t(3)_{min}$.

5.6.4.2.6 Requirements

No alarm or fault signal shall be given after powering the RLTHD at the end of the conditioning and recovery periods.

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

5.6.5 Electrical stability

5.6.5.1 Electromagnetic compatibility (EMC), immunity tests (operational)

5.6.5.1.1 General

The following EMC immunity tests as specified in EN 50130-4:2011 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.

5.6.5.1.2 State of the specimen during conditioning

The length of sensing element used in the test shall correspond to the most unfavourable operating condition of the RLTHD technology under test. The configuration shall be the same as chosen in 5.1.5.

5.6.5.1.3 Final measurements

After the conditioning, the functional test as described in 5.1.5 shall be conducted at a rate of rise of 3 $Kmin^{-1}$ and the response time recorded.

The greater response time value measured in this test and that measured for the same specimen in the reproducibility test, shall be designated $t(3)_{max}$ and the lesser shall be designated $t(3)_{min}$.

5.6.5.1.4 Requirements

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

No alarm or fault signal shall be given during conditioning.

The ratio of the response times $t(3)_{max}$: $t(3)_{min}$ shall be not greater than 1,3.

6 Assessment and verification of constancy of performance (AVCP)

6.1 General

The compliance of the resettable line-type heat detectors with the requirements of this Standard and with the performance 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 can be in different families for different characteristics.

NOTE 3 It is advised to make reference to the assessment method standards 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 resettable line-type heat detector (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 resettable line-type heat detector design, 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 resettable line-type heat detector 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 resettable line-type heat detectors to be tested/assessed shall be in accordance with Table 23.

Table 23 — 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	3	4.2
Operational reliability	4.3	5.3	3	4.3
Tolerance to supply voltage	4.4	5.4	3	4.4
Performance parameters under fire conditions	4.5	5.5	3	4.5
Durability of nominal activation conditions/sensitivity	4.6	5.6	3	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 resettable line-type heat detector 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, tests and/or assessments,

— 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 (in case of sensor control unit) and batches (in case of sensing elements) 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 Clauses 4 and 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 conformity 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 finalised 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, prototypes and products produced in very low quantities

The resettable line-type heat detector produced as a one-off, prototypes assessed before full production is established and products produced in very low quantities (less than 20 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 required by 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 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

No classification of resettable line-type heat detectors is specified in this European Standard.

8 Marking, labelling and packaging

8.1 General

The marking of resettable line-type heat detectors shall be visible during installation and shall be accessible during maintenance.

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

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.

NOTE 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.

8.2 Marking of sensor control unit

The sensor control unit shall be clearly marked with the following information:

a) the number and date of this standard (i.e. EN 54-22:2015);

b) the heat response Class(es) of the RLTHD (e.g. A1N, A2N, BN, CN, or A1I - GI).

c) environmental group (I, II or III);

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

e) the model designation (type or number);

f) the wiring terminal designations;

g) 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 sensor control unit.

8.3 Marking of sensing element

Each sensing element (batch) shall be marked with the following information:

a) name or trademark of the manufacturer or supplier;

b) model designation (type or number);

c) environment group (II or III);

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 sensing element, if applicable.

e) marking of sensor location and orientation (if applicable, e.g. for multipoint heat detector);

If it is not possible to mark directly on the sensing element then the marking shall be affixed to the coil or other packaging used to protect the sensing element during transport and the use of at least one label securely fixed to the sensing element once installed is permitted.

8.4 Marking of functional units

Each functional unit shall be marked with the following information:

a) the number and date of this standard (i.e. EN 54-22:2015);

b) name or trademark of the manufacturer or supplier;

c) model designation (type or number);

d) environment group (I, II or III);

e) the wiring terminal designations (if applicable);

f) 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 functional unit.

Annex A
(normative)

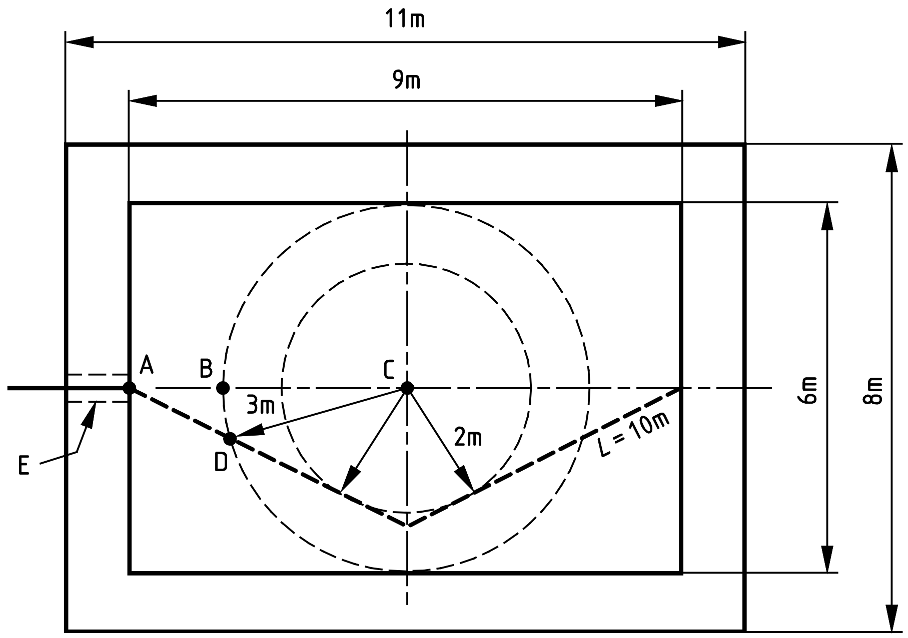
Arrangement of the sensing element in the fire test room

A.1 General

This annex specifies the arrangement of the sensing element for the fire tests (see 5.5.1).

A.2 Fire test room arrangement

A part of sensing element shall be mounted as shown in Figure A.1 in a fire test room as described in EN 54-7:2000.



Key

A Starting point of the sensing element

B Location of the temperature probe (distance from ceiling (50 ± 10) mm)

C Location of the test fire (centre of the floor)

D In case of a multipoint sensing element: location of one sensor

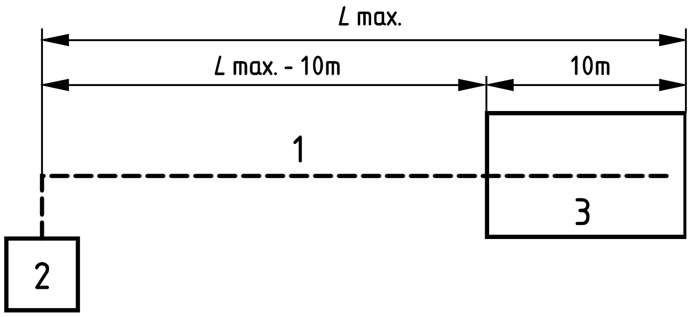
E Thermal insulation in case of a fire test room exceeding the minimum dimensions

NOTE The inner rectangle shows the arrangement of sensing element in the smallest permissible size of the fire test room. The outer rectangle shows the arrangement of sensing element in the largest permissible size of the fire test room.

Figure A.1 — Arrangement of the sensing element in the fire test room

A.3 Sensing element outside the fire test room

The remaining part of the sensing element shall be arranged in a stable environment at (23 ± 5) °C as shown in Figure A.2.



Key

1 Sensing element

2 Sensor control unit

3 Fire test room as in Figure A.1.

Figure A.2 — Arrangement of sensing element outside the fire test room

Annex B
(normative)

Flaming liquid test fires (TF6F, TF6 and TF6S)

B.1 General

This annex specifies the details of the test fires (see 5.5.1).

B.2 Arrangement

The fuel shall be burnt in a square steel tray. The precise dimension of the steel tray and quantity of fuel may be varied to obtain valid tests. The proposed dimensions are mentioned in Table B.1.

Table B.1 — Test fires for RLTHD

Test fire	**Dimensions of steel tray** mm	**Fuel (by volume)**	**Amount of fuel** kg
TF6F	500 x 500 x 50	Methylated spirit [90 % Ethanol – C_2H_5OH to which has been added 10 % denaturant impurity (Methanol)]	2
TF6	435 x 435 x 50	Methylated spirit [90 % Ethanol – C_2H_5OH to which has been added 10 % denaturant impurity (Methanol)]	2
TF6S	330 x 330 x 50	Methylated spirit [90 % Ethanol – C_2H_5OH to which has been added 10 % denaturant impurity (Methanol)]	2
NOTE TF6F (= fast) and TF6S (= slow) are fast and slow developing fires obtained by varying the size of the standard TF6 steel tray.			

B.3 Ignition

Ignition shall be by flame or spark, etc.

B.4 End of test condition

The end of test condition shall be as shown in Table B.2.

Table B.2 — End of test

Test fire	ΔT_E K
TF6F	75
TF6	62
TF6S	56

B.5 Test validity criteria

The development of the fire shall be such that the temperature, *T*, versus time, *t*, is within the limits given in Tables B.3 to B.5.

Table B.3 — Test validity criteria for test fire TF6F

Time from ignition *t* s	**Min. temperature T_{min}** °C	**Max. temperature T_{max}** °C
0	18	28
50	43	57
100	57	77
200	80	103
300	95	120

Table B.4 — Test validity criteria for test fire TF6

Time from ignition *t* s	**Min. temperature T_{min}** °C	**Max. temperature T_{max}** °C
0	18	28
50	39	54
100	47	67
200	65	88
300	75	100

Table B.5 — Test validity criteria for test fire TF6S

Time from ignition *t* s	**Min. temperature T_{min}** °C	**Max. temperature T_{max}** °C
0	18	28
100	38	50
200	47	62
300	50	70
600	62	82

Annex C
(normative)

Test arrangement for the sensing element of linear heat detector in the heat tunnel

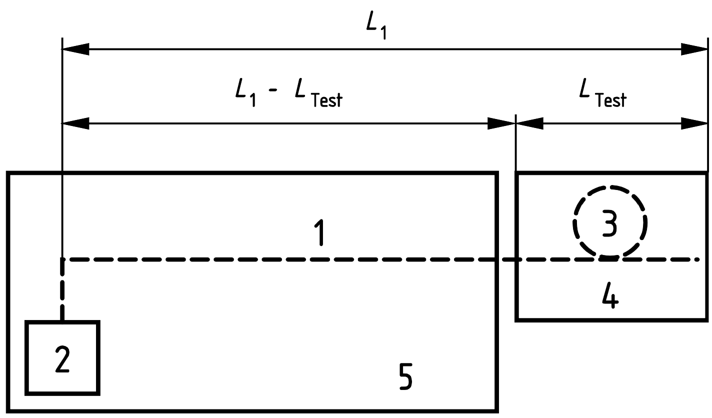
C.1 General

This annex specifies those properties of the sensing element test arrangement and mounting apparatus which are of primary importance for making repeatable and reproducible measurements of response time and static response temperature (see 5.1.5)

C.2 Test arrangement for the sensing element

Approximately ten windings of sensing element shall be wrapped around a conical frame (see Annex D). The total length of sensing element in the tunnel shall be (10 ± 0,1) m.

The apparatus with the sensing element shall be placed in the heat tunnel so the air flows from the smaller to the larger diameter of the apparatus. See Figure C.1.



Key

1 sensing element
2 sensor control unit
3 test apparatus with the sensing element wrapped tightly around it
4 heat tunnel working section
5 standard atmospheric conditions

Figure C.1 — Test arrangement

Annex D
(informative)

Apparatus for mounting of the sensing element of linear heat detector in the heat tunnel

D.1 General

This Annex describes an example of a mounting frame for testing the sensing element of linear heat detectors in the heat tunnel as described in Annex C.

D.2 Test apparatus

The apparatus (Figure D.1) should have a conical working section with a smaller diameter of (250 ± 10) mm, a larger diameter of (350 ± 10) mm.

The apparatus should be constructed of materials capable of withstanding temperature of at least 160 °C. Means should be provided for thermally insulating the sensing element from the apparatus.

NOTE Teflon or Polyamide would be a suitable thermal insulation.

All dimensions in mm

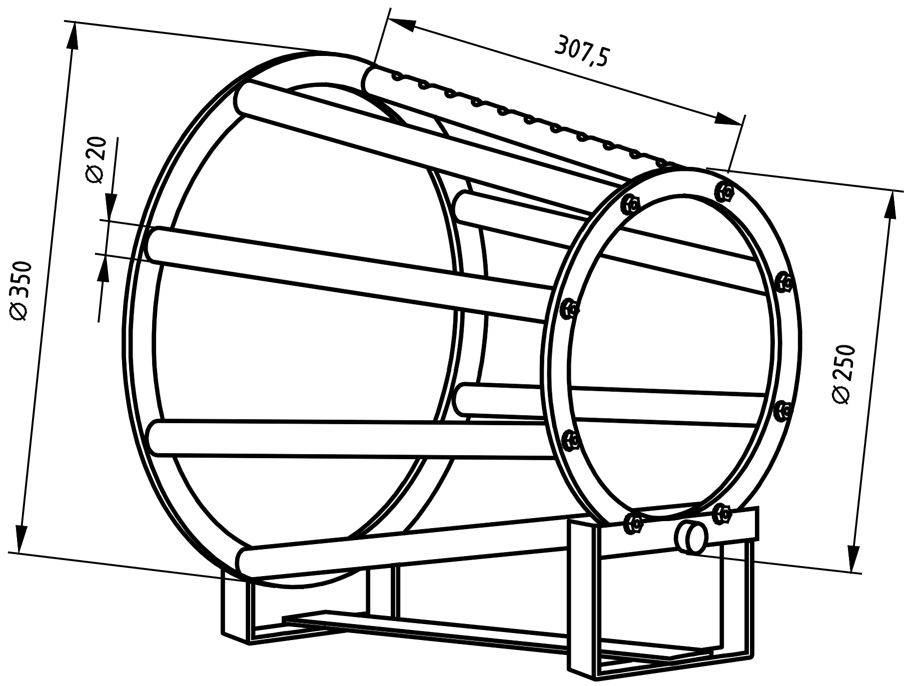


Figure D.1 — Test apparatus — mounting arrangement for testing linear heat detectors

Annex E
(normative)

Mounting of the sensing element of multipoint RLTHD in the heat tunnel

E.1 General

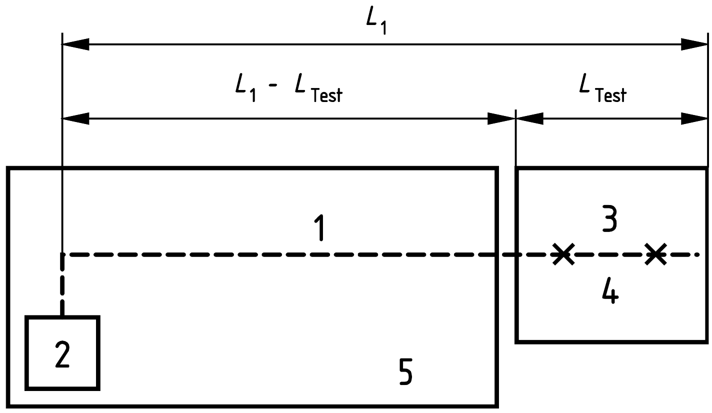
This annex specifies those properties of multipoint sensing element mounting arrangement which are of primary importance for making repeatable and reproducible measurements of response time and static response temperature (see 5.1.5).

E.2 Mounting arrangement of multipoint sensing element

The multipoint sensing element shall be vertically placed in the working section of the heat tunnel. The amount of discrete temperature sensors placed in the heat tunnel shall be the minimum amount of sensors in a 10 m piece of sensing element, but shall be at least 1.

EXAMPLE: With 4 m sensor spacing there would be 2 discrete temperature sensors in the heat tunnel (see Figure E.2).

The multipoint sensing element to be tested shall be mounted vertically in the middle of the heat tunnel. If there are 2 or more discrete temperature sensors to put into the heat tunnel (sensor spacing < 5 m) the sensing elements shall have a horizontally spacing of 50 mm. 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) ms^{-1} at 25 °C (see Figure E.1 and Figure E.2).



Key

1 sensing element

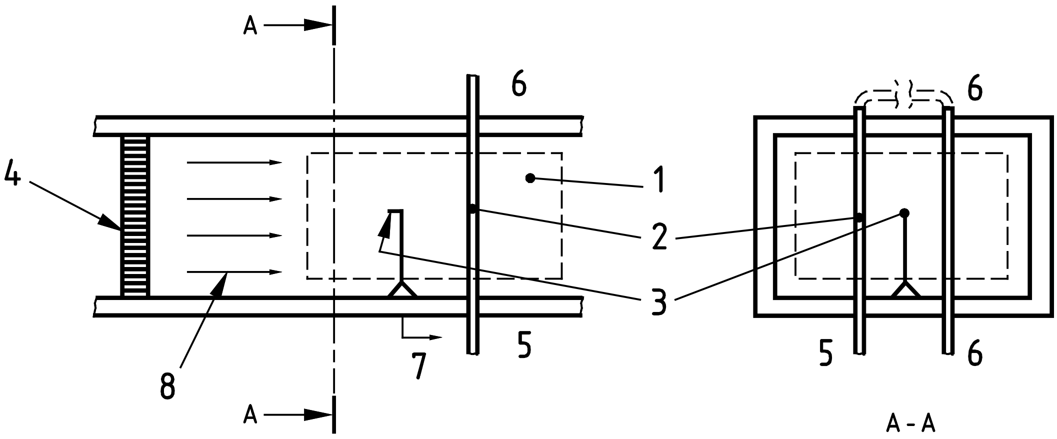
2 sensor control unit

3 discrete temperature sensor(s) (vertical arrangement, see Figure E.2)

4 heat tunnel working section

x position of discrete temperature sensor(s) as a part of the multipoint RLTHD

Figure E.1 — Test arrangement



Key

1 working volume

2 multipoint sensing element under test

3 temperature sensor

4 turbulence reducer

5 from sensor control unit

6 remainder of sensing element

7 output control and measuring equipment

8 air flow

Figure E.2 — Heat tunnel - working section and cross-section showing the mounting arrangement for testing a multipoint sensing element

Annex F
(normative)

Heat tunnel for response time and response temperature measurements

F.1 General

This annex specifies those properties of the heat tunnel which are of primary importance for making repeatable and reproducible measurements of response time and static response temperature of RLTHD (see 5.1.5 and 5.4.2). However, since it is not practical to specify and measure all parameters which may influence the measurements, the background information in Annex G should be carefully considered and taken into account when a heat tunnel is designed and used to make measurements in accordance with this part of EN 54.

F.2 Description of the heat tunnel

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

The heat 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 conditions are within ± 2 K and ± 0,1 ms^{-1}, 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 part of the sensing element under test and the temperature-measuring sensor.

The temperature-measuring sensor shall be positioned at least 50 mm upstream of the RLTHD. The air temperature shall be controlled to within ± 2 K of the nominal temperature required at any time during the test.

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) ms^{-1} at 25 °C.

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

Annex G
(informative)

Construction of the heat tunnel

G.1 General

This annex gives information on the construction of a heat tunnel used in Annex F.

G.2 Heat tunnel construction

RLTHD respond when the signal(s) from one or more sensing elements fulfil(s) certain criteria. The temperature of the sensing elements is related to the air temperature surrounding it, 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 RLTHD is evaluated by testing in accordance with this part of EN 54.

Many different heat-tunnel designs are suitable for the tests specified in this part of EN 54 but the following points should be considered when designing and characterizing a heat tunnel.

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) ms^{-1};

— 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 air flow. It should not be assumed that an automatically temperature-compensated anemometer will 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. 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 air flow from the heater is mixed to a uniform temperature before entering.

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 shall 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 air flow.

Annex H
(normative)

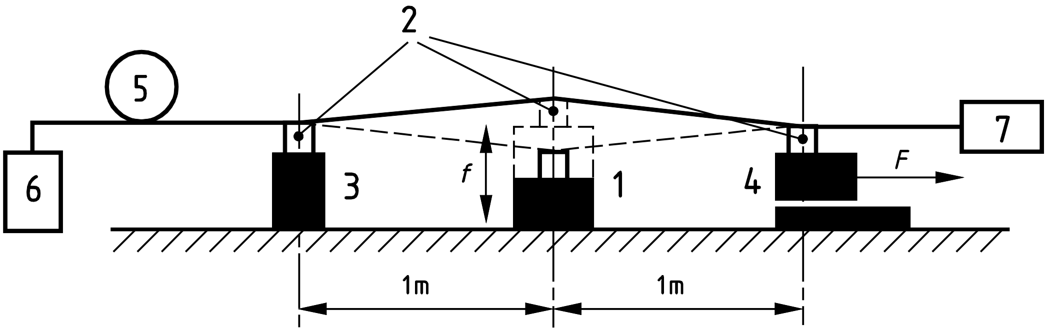
Test arrangement for vibration tests for sensing element

H.1 General

This annex specifies the test arrangement used in vibration tests (see 5.6.3.5 and 5.6.3.7).

H.2 Test setup

A typical arrangement which shall be used for vibration test is shown in Figure H.1.



Key

1 vibration apparatus (moving with frequency f)

2 mounting brackets

3 fixed support

4 moveable end support (to stretch the sensing element with force F = 20 N)

5 remaining length of sensing element

6 sensor control unit

7 functional unit (e.g. end equipment - if necessary)

Figure H.1 — Vibration test arrangement

The test sample shall be mounted in place using brackets in accordance with the manufacturer’s instruction. If the sensing element is not completely fixed then there should be discussed means with the manufacturer to fix the brackets during this test. Mounting points are the fixed support, the vibration apparatus and the end support. The sensing element shall be held firmly in place at the fixed support (3) and the end support (4). The end support shall be moveable to enable a length force to the sensing element of 20 N.

Annex I
(normative)

Test apparatus for impact test on the sensing element

I.1 General

This annex specifies the test apparatus for the impact test (see 5.6.3.3). It gives parameters which are of primary importance for making repeatable and reproducible tests.

I.2 Test apparatus

The apparatus (Figure I.1) shall have a rigid steel base with a mass of at least 10 kg and a fixture to allow a (500 ± 10) g steel hammer to fall from a height of (200 ± 10) mm, guided by a triangular shaped steel rod as shown in Figure I.2.

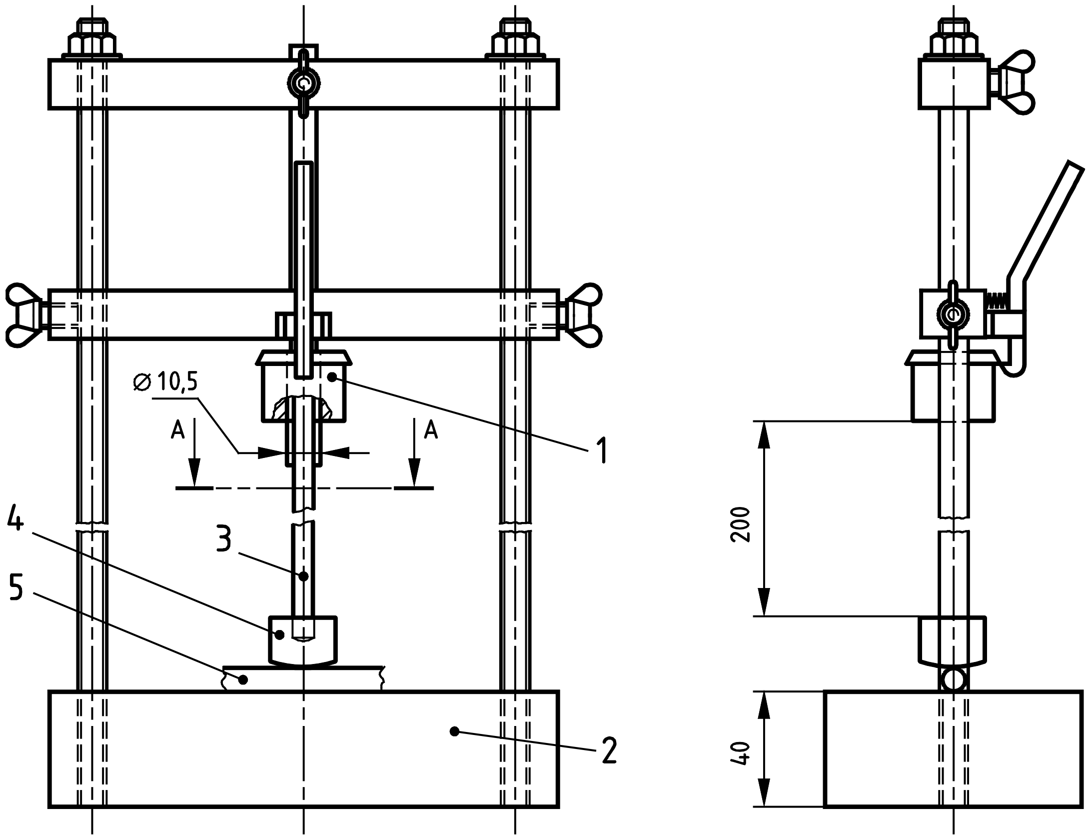
At its lower end the steel rod shall allow to adapt either a round edged intermediate piece as given in Figure I.3 or a chisel edged intermediate piece as specified in Figure I.4.

Both intermediate pieces shall be made of steel. The sensing element under test will be placed between the base of the test apparatus and the intermediate piece. Subsequently the intermediate piece shall be hit by the falling hammer.

I.3 Test setup

A typical arrangement which shall be used for the impact test is shown in Figure I.1.

All dimensions in mm



Key

1 hammer (500 ± 10) g

2 steel base > 10 kg

3 triangular shaped steel rod

4 intermediate piece (round edged or chisel edged)

5 sensing element under test

Figure I.1 — impact test arrangement

All dimensions in mm

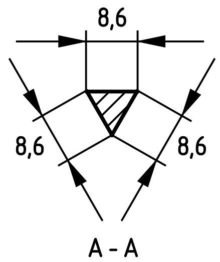


Figure I.2 — Cross section A –A of the steel rod

All dimensions in mm

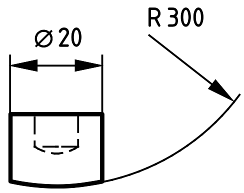


Figure I.3 — Round edged intermediate piece

All dimensions in mm

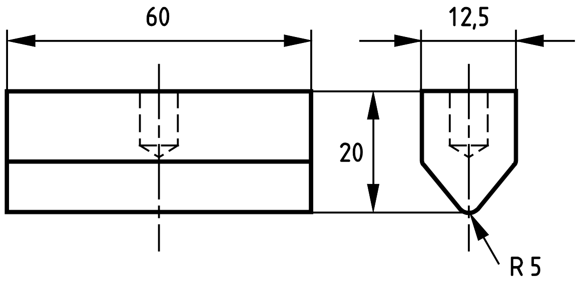


Figure I.4 — Chisel-edged intermediate piece

Annex J
(informative)

Data supplied with resettable line-type heat detectors

To ensure correct operation of resettable line-type heat detectors, manufacturers should make available, in addition to the marking information listed in Clause 8, the following data:

RLTHD should either be supplied with sufficient technical, installation and maintenance data to enable their correct installation and operation or, if all of these data are not supplied with each detector, reference to the appropriate data sheet should be given with each RLTHD.

To understand correct operation of the detectors, additional data should be available that describe the processing of the signals from the detector. This may be in the form of a full technical specification of these signals, a reference to the appropriate signalling protocol or a reference to suitable types of sensor control unit and/or control and indicating equipment, etc.

For integrating RLTHD the manufacturer should declare the relation between the maximum application temperature and the corresponding sensing element length for each class for which compliance is claimed.

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 fire fighting, 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 resettable line-type heat 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: Fire detection and fire alarm systems – Resettable line-type heat detector **Intended use:** Fire detection and fire alarm systems installed in and around buildings and civil engineering works			
Essential characteristics	**Clauses in this and other European Standard(s) related to essential characteristics**	**Regulatory classes**	**Notes**
Nominal activation conditions/sensitivity Individual alarm indication Signalling Repeatability Reproducibility	4.2.1 4.2.2 4.2.3 4.2.4		description description ratios ratios
Operational reliability Connection of ancillary devices Manufacturer's adjustments Requirements for software controlled detectors Sensing element fault On-site adjustment of response behaviour Maximum ambient temperature test (sensing element)	4.3.1 4.3.2 4.3.3 4.3.4 4.3.5 4.3.6	none	description description description description description description
Tolerance to supply voltage Variation in supply parameters Low voltage fault	4.4.1 4.4.2		ratio description
Performance parameters under fire condition Fire sensitivity for room protection application Static response temperature test	4.5.1 4.5.2		response class(es) response class(es)
Durability of Nominal activation conditions/sensitivity Temperature resistance: Dry heat (operational) sensor control unit Dry heat (endurance) sensing element Cold (operational) sensing element Cold (operational) for sensor control unit Humidity resistance: Damp heat, steady state (endurance) for sensor control unit and sensing element Damp heat, cyclic (operational) for sensing element Damp heat, cyclic (operational) for sensor control unit Damp heat, steady state (operational) for sensor control unit Damp heat, cyclic (endurance) for sensor control unit and sensing element Shock and vibration resistance: Shock (operational) for sensor control unit Impact (operational) for sensor control unit Impact (operational) for sensing element Vibration, sinusoidal (operational) for sensor control unit Vibration, sinusoidal (operational) for sensing element Vibration, sinusoidal (endurance) for sensor control unit Vibration, sinusoidal (endurance) for sensing element Corrosion resistance Sulphur dioxide (SO_2) corrosion (endurance) for sensing element Sulphur dioxide (SO_2) corrosion (endurance) for sensor control unit Electrical stability EMC, immunity	4.6.1.1 4.6.1.2 4.6.1.3 4.6.1.4 4.6.2.1 4.6.2.2 4.6.2.3 4.6.2.4 4.6.2.5 4.6.3.1 4.6.3.2 4.6.3.3 4.6.3.4 4.6.3.5 4.6.3.6 4.6.3.7 4.6.4.1 4.6.4.2 4.6.5.1		ratio + description ratio + description ratio + description ratio + description ratio + description ratio + description ratio + description ratio + description ratio + description ratio + description ratio + description ratio + description ratio + description ratio + description ratio + description ratio + description ratio + description ratio + description ratio + 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 resettable line-type heat detectors

ZA.2.1 System of AVCP

The AVCP system(s) of resettable line-type heat detectors 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 and relevant level(s) or class(es) of performance.

Table ZA.2 — System of AVCP

Product	Intended use	Levels or classes	AVCP system
Smoke, heat, flame detectors	Fire safety	--	1
System 1: See Regulation (EU) No. 305/2011 (CPR) Annex V, 1.2			

The AVCP of the resettable line-type heat detectors 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 resettable line-type heat detector under system 1

<table>
<tr><th colspan="2">Tasks</th><th>Content of the task</th><th>AVCP clauses to apply</th></tr>
<tr><td rowspan="2">Tasks for the manufacturer</td><td>Factory production control (FPC)</td><td>Parameters related to essential characteristics of Table ZA.1 relevant for the intended use which are declared</td><td>6.3</td></tr>
<tr><td>Further testing of samples taken at factory according to the prescribed test plan</td><td>Essential characteristics of Table ZA.1 relevant for the intended use which are declared</td><td>6.3.2.6</td></tr>
<tr><td rowspan="2">Tasks for the notified product certification body</td><td>Determination of the product type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product</td><td>Essential characteristic of Table ZA.1 relevant for the intended use</td><td>6.2</td></tr>
<tr><td>Initial inspection of the manufacturing plant and of FPC</td><td>Parameters related to essential characteristics of Table ZA.1, relevant for the intended use, which are declared, documentation of FPC</td><td>6.3.4</td></tr>
</table>

	Continuous surveillance, assessment and approval of FPC	Parameters related to essential characteristics of Table ZA.1, relevant for the intended use, which are declared, documentation of FPC	6.3.5

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 harmonised 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 harmonised technical specification;

b) the list of essential characteristics, as determined in the harmonised 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 a resettable line-type heat detector:

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 manufacturer's identification code of the product to which the DoP applies e.g. LTHD XYZ123 resettable line-type heat detector]

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

[e.g. 2013/07-02/000026]

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

Fire detection and fire alarm systems installed in and around buildings and civil engineering works

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

SomeCo Ltd,

PO Box 210

CH 1234 Anywhere-Switzerland

Tel. +44207123456

Fax: +44207123457

Email: sales@someco.ch

5. Where applicable, name and contact address of the authorised 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 harmonised standard: The notified product certification body No 1234 issued the certificate of constancy of performance on the basis of determination of the product type on the basis of type testing (including sampling) of the product; initial inspection of the manufacturing plant and of factory production control and continuous surveillance, assessment and evaluation of factory production control.

8. Declared performance;

Essential characteristic	Performance	Harmonized technical specification
Nominal activation conditions/sensitivity		EN 54-22:2015
Individual alarm indication	Red LED	
Signalling	Alarm and fault status signalled	
Repeatability	t(3)max : t(3)min ≤ 1,3; t(20)max : t(20)min ≤ 1,6	
Reproducibility	t(3)max : t(3)min ≤ 1,3; t(20)max : t(20)min ≤ 1,6	
Operational reliability		
Connection of ancillary devices (if applicable)	No functional effect	
Manufacturer's adjustments (if applicable)	Special means required	
Requirements for software controlled detectors (if applicable)	Documentation available / modular structure / invalid data not permitted / program deadlock avoided / site specific data in non-volatile memory with two-week retention	
Sensing element fault	Fault signal ≤ 300 sec, no alarm	
On-site adjustment of response behaviour (if applicable)	Special means required, settings clearly marked	
Maximum ambient temperature test (sensing element)	No alarm or fault during conditioning. Afterwards alarm given	
Tolerance to supply voltage		
Variation in supply parameters	t(3)max : t(3)min ≤ 1,3	
Low voltage fault	Fault signal ≤ 100 sec	
Performance parameters under fire condition		
Fire sensitivity for room protection application (if applicable)	Alarm at assigned response class(es) (A1I, A1N, A2I, A2N)	
Static response temperature test	Alarm at assigned response class(es) (BI,	

	BN, ... GI, GN)	
Durability of Nominal activation conditions/sensitivity		
Temperature resistance:		
Dry heat (operational) sensor control unit	t(3)max : t(3)min ≤ 1,3; no false operation during 16 h at 40 °C (Group I) / at 55 °C (Group II) / at 70 °C (Group III)	
Dry heat (endurance) sensing element (if applicable)	t(3)max : t(3)min ≤ 1,3; no false operation after 21 d at high temperature (Group II, III; response Class A to G)	
Cold (operational) sensing element	t(3)max : t(3)min ≤ 1,3; no false operation during 16 h at -10 °C (Group II) / at -25 °C (Group III)	
Cold (operational) for sensor control unit	t(3)max : t(3)min ≤ 1,3; no false operation during 16 h at -5 °C (Group I) / at -10 °C (Group II) / at -25 °C (Group III)	
Humidity resistance:		
Damp heat, steady state (endurance) for sensor control unit and sensing element	t(3)max : t(3)min ≤ 1,3; no false operation after 21 d at 40 °C and 93 % RH	
Damp heat, cyclic (operational) for sensing element	t(3)max : t(3)min ≤ 1,3; no false operation during 2 cycles at 40 °C and 93 % RH (Group II) / 2 cycles at 55 °C and 93 % RH (Group III)	
Damp heat, cyclic (operational) for sensor control unit (if applicable)	t(3)max : t(3)min ≤ 1,3; no false operation during 2 cycles at 40 °C and 93 % RH (Group II) / 2 cycles at 55 °C and 93 % RH (Group III)	
Damp heat, steady state (operational) for sensor control unit (if applicable)	t(3)max : t(3)min ≤ 1,3; no false operation during 4 d at 40 °C and 93 % RH (Group I)	
Damp heat, cyclic (endurance) for sensor control unit and sensing element (if applicable)	t(3)max : t(3)min ≤ 1,3; no false operation after 6 cycles at 55 °C and 93 % RH (Group III)	
Shock and vibration resistance:		
Shock (operational) for sensor control unit (if applicable)	t(3)max : t(3)min ≤ 1,3; no false operation during 18 6 ms shock pulses of 1000 - (200 x M) m s^{-2} (Group II and III)	
Impact (operational) for sensor control unit	t(3)max : t(3)min ≤ 1,3; no false operation after 3 0,5 J impacts	
Impact (operational) for sensing element	t(3)max : t(3)min ≤ 1,3; no false operation during impact	
Vibration, sinusoidal (operational) for sensor control unit	t(3)max : t(3)min ≤ 1,3; no false operation during vibration for a sweep between 10 and 150 Hz at 1 m s^{-2} (Group I) / at 5 m s^{-2} (Group II and III)	
Vibration, sinusoidal (operational) for sensing element	t(3)max : t(3)min ≤ 1,3; no false operation during vibration for a sweep between 10 and 150 Hz at 5 m s^{-2} (Group II and III)	
Vibration, sinusoidal (endurance) for sensor control unit	t(3)max : t(3)min ≤ 1,3; no false operation after vibration for 20 sweeps between 10 and 150 Hz at 5 m s^{-2} (Group I) / at 10 m s^{-2}	

	(Group II and III)	
Vibration, sinusoidal (endurance) for sensing element	t(3)max : t(3)min ≤ 1,3; no false operation after vibration for 20 sweeps between 10 and 150 Hz at 10 m s^{-2} (Group II and III)	
Corrosion resistance:		
Sulphur dioxide (SO_2) corrosion (endurance) for sensing element	t(3)max : t(3)min ≤ 1,3; no false operation after 21 d at 25 °C, 93 % RH and 25 µl/l SO_2 content (Group II and III)	
Sulphur dioxide (SO_2) corrosion (endurance) for sensor control unit (if applicable)	t(3)max : t(3)min ≤ 1,3; no false operation after 21 d at 25 °C, 93 % RH and 25 µl/l SO_2 content (Group II and III)	
Electrical stability:		
EMC, immunity	t(3)max : t(3)min ≤ 1,3; no false operation when applying electrostatic discharge, radiated electromagnetic fields, conducted disturbances induced by electromagnetic fields, fast transient burst and slow high energy voltage surges	

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 sensor control unit of the resettable line-type heat detector.

The CE marking symbol shall also be placed in the documents accompanying the resettable line-type heat detector 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 54-22:2015];

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 related to be placed on the resettable line-type heat detector subject to AVCP under system 1.

Figure ZA.2 gives an example of the information related to be placed in the commercial documents accompanying the resettable line-type heat detector.

CE	*CE marking, consisting of the "CE"-symbol given in Directive 93/68/EEC.*
1234	*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 resettable line-type heat detector

CE 1234	*CE marking, consisting of the "CE"-symbol given in Directive 93/68/EEC.* *Identification number of the certification body*
AnyCo Ltd, PO Box 21, B-1050 **15** 001CPR2013-07-14	*Name or identifying mark and registered address of the producer* *Last two digits of the year in which the marking was affixed* *Reference number of the DoP*
EN 54-22 *[insert here the unique identification code of the product-type]* Fire detection and fire alarm systems - resettable line-type heat detector intended for use in and around buildings and civil engineering works **Nominal activation conditions/sensitivity** - Individual alarm indication: Red LED - Signalling: Alarm and fault status signalled - Repeatability: t(3)max : t(3)min ≤ 1,3; t(20)max : t(20)min ≤ 1,6 - Reproducibility: t(3)max : t(3)min ≤ 1,3; t(20)max : t(20)min ≤ 1,6 **Operational reliability** - Connection of ancillary devices: No functional effect - Manufacturer's adjustments: Special means required - Requirements for software controlled detectors:	*No. of European Standard* *Description of product* *Intended use as laid down in the European standard applied* *Level or class of the performance declared*

Documentation available / modular structure / invalid data not permitted / program deadlock avoided / site specific data in non-volatile memory with two-week retention - Sensing element fault: Fault signal ≤ 300 sec, no alarm - On-site adjustment of response behaviour: Special means required, settings clearly marked - Maximum ambient temperature test (sensing element): No alarm or fault during conditioning. Afterwards alarm given **Tolerance to supply voltage** - Variation in supply parameters: t(3)max : t(3)min ≤ 1,3 - Low voltage fault: Fault signal ≤ 100 sec **Performance parameters under fire condition** - Fire sensitivity for room protection application: Alarm at assigned response class(es) (A1I, A1N, A2I, A2N) - Static response temperature test: Alarm at assigned response class(es) (BI, BN, ... GI, GN) **Durability of Nominal activation conditions/sensitivity** **Temperature resistance:** - Dry heat (operational) sensor control unit: t(3)max : t(3)min ≤ 1,3; no false operation during 16 h at 40 °C (Group I) / at 55 °C (Group II) / at 70 °C (Group III) - Dry heat (endurance) sensing element: t(3)max : t(3)min ≤ 1,3; no false operation after 21 d at high temperature (Group II, III; response Class A to G) - Cold (operational) sensing element: t(3)max : t(3)min ≤ 1,3; no false operation during 16 h at -10 °C (Group II) / at -25 °C (Group III) - Cold (operational) for sensor control unit: t(3)max : t(3)min ≤ 1,3; no false operation during 16 h at -5 °C (Group I) / at -10 °C (Group II) / at -25 °C (Group III) **Humidity resistance:** - Damp heat, steady state (endurance) for sensor control unit and sensing element: t(3)max : t(3)min ≤ 1,3; no false operation after 21 d at 40 °C and 93 % RH - Damp heat, cyclic (operational) for sensing element: t(3)max : t(3)min ≤ 1,3; no false operation during 2 cycles at 40 °C and 93 % RH (Group II) / 2 cycles at 55 °C and 93 % RH (Group III) - Damp heat, cyclic (operational) for sensor control unit: t(3)max : t(3)min ≤ 1,3; no false operation during 2 cycles at 40 °C and 93 % RH (Group II) / 2 cycles at 55 °C and 93 % RH (Group III) - Damp heat, steady state (operational) for sensor control unit: t(3)max : t(3)min ≤ 1,3; no false operation during 4 d at 40 °C and 93 % RH (Group	

I) - Damp heat, cyclic (endurance) for sensor control unit and sensing element: t(3)max : t(3)min ≤ 1,3; no false operation after 6 cycles at 55 °C and 93 % RH (Group III) **Shock and vibration resistance:** - Shock (operational) for sensor control unit: t(3)max : t(3)min ≤ 1,3; no false operation during 18 6 ms shock pulses of 1000 - (200 x M) m s^{-2} (Group II and III) - Impact (operational) for sensor control unit: t(3)max : t(3)min ≤ 1,3; no false operation after 3 0,5 J impacts - Impact (operational) for sensing element: t(3)max : t(3)min ≤ 1,3; no false operation during impact - Vibration, sinusoidal (operational) for sensor control unit: t(3)max : t(3)min ≤ 1,3; no false operation during vibration for a sweep between 10 and 150 Hz at 1 m s^{-2} (Group I) / at 5 m s^{-2} (Group II and III) - Vibration, sinusoidal (operational) for sensing element: t(3)max : t(3)min ≤ 1,3; no false operation during vibration for a sweep between 10 and 150 Hz at 5 m s^{-2} (Group II and III) - Vibration, sinusoidal (endurance) for sensor control unit: t(3)max : t(3)min ≤ 1,3; no false operation after vibration for 20 sweeps between 10 and 150 Hz at 5 m s^{-2} (Group I) / at 10 m s^{-2} (Group II and III) - Vibration, sinusoidal (endurance) for sensing element: t(3)max : t(3)min ≤ 1,3; no false operation after vibration for 20 sweeps between 10 and 150 Hz at 10 m s^{-2} (Group II and III) **Corrosion resistance** - Sulphur dioxide (SO_2) corrosion (endurance) for sensing element: t(3)max : t(3)min ≤ 1,3; no false operation after 21 d at 25 °C, 93 % RH and 25 µl/l SO_2 content (Group II and III) - Sulphur dioxide (SO_2) corrosion (endurance) for sensor control unit: t(3)max : t(3)min ≤ 1,3; no false operation after 21 d at 25 °C, 93 % RH and 25 µl/l SO_2 content (Group II and III) **Electrical stability** - Electromagnetic compatibility (EMC), immunity tests (operational): t(3)max : t(3)min ≤ 1,3; no false operation when applying electrostatic discharge, radiated electromagnetic fields, conducted disturbances induced by electromagnetic fields, fast transient burst and slow high energy voltage surges	

Figure ZA.2 — Example of CE marking information in the documentation accompanying the resettable line-type heat detector

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