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Date: 28 November 2023

Origin: International

Latest date for receipt of comments: 21 January 2024

Project No. 2022/01978

Responsible committee: FSH/12 Fire detection and alarm systems

Interested committees:

Title: Draft BS ISO 7240-32 Fire detection and alarm systems. Part 32: Non-resettable line-type heat detectors.

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

DRAFT INTERNATIONAL STANDARD

ISO/DIS 7240-32

ISO/TC 21/SC 3

Secretariat: SA

Voting begins on:
2023-11-28

Voting terminates on:
2024-02-20

Fire detection and alarm systems —

Part 32:

Non-resettable line-type heat detectors

ICS: 13.220.20

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Reference number
ISO/DIS 7240-32:2023(E)

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Published in Switzerland

Contents

Page

Foreword	vii
Introduction	viii
1 Scope	1
2 Normative references	1
3 Terms and definitions and abbreviations	1
3.1 Terms and definitions	2
3.2 Abbreviations	2
4 Requirements	3
4.1 General.....	3
4.1.1 Compliance	3
4.1.2 NLTHD performance type.....	3
4.1.3 Heat response for class A application	3
4.1.4 Environmental groups	4
4.2 Individual alarm indication	4
4.3 Signalling.....	4
4.4 Maximum ambient temperature.....	4
4.5 Connection of ancillary devices.....	4
4.6 Manufacturer's adjustments	5
4.7 Software	5
4.7.1 General	5
4.7.2 Software design	5
4.7.3 The storage of programs and data	5
4.8 Sensing element fault.....	5
4.9 On-site adjustment of response behaviour	5
4.10 Variation in supply parameters.....	6
4.11 Low voltage fault.....	6
4.12 Performance parameters under fire condition	6
4.13 Fire sensitivity for Class A application	6
4.14 Static response temperature test for Class A application	6
4.15 Dry heat (operational) for sensor control unit.....	6
4.16 Cold (operational) for sensing element.....	6
4.17 Cold (operational) for sensor control unit	6
4.18 Damp heat, steady-state (endurance) for sensor control unit and sensing element.....	6
4.19 Damp heat, cyclic (operational) for sensing element	7
4.20 Damp heat, cyclic (operational) for sensor control unit.....	7
4.21 Damp heat, steady-state (operational) for sensor control unit.....	7
4.22 Damp heat, cyclic (endurance) for sensor control unit and sensing element	7
4.23 Shock (operational) for sensor control unit	7
4.24 Impact (operational) for sensor control unit.....	7
4.25 Impact (operational) for sensing element.....	7
4.26 Vibration, sinusoidal (operational) for sensor control unit.....	7
4.27 Vibration, sinusoidal (operational) for sensing element.....	7
4.28 Vibration, sinusoidal (endurance) for sensor control unit.....	7
4.29 Vibration, sinusoidal (endurance) for sensing element.....	7
4.30 Sulphur dioxide (SO ₂) corrosion (endurance) for sensing element.....	8
4.31 Sulphur dioxide (SO ₂) corrosion (endurance) for sensor control unit.....	8
4.32 Electrical stability	8
5 Test methods	8
5.1 General.....	8
5.1.1 Atmospheric conditions for tests.....	8
5.1.2 Operating conditions for tests.....	8
5.1.3 Mounting arrangements.....	8

5.1.4	Tolerances.....	9
5.1.5	Procedure for measurement of response temperature.....	9
5.1.6	Provision for tests.....	9
5.1.7	Test schedule.....	10
5.2	Individual alarm indication.....	11
5.3	Signalling.....	11
5.4	Maximum ambient temperature test (endurance) for sensing element.....	12
5.4.1	Object of the test.....	12
5.4.2	Mounting of the sensing element.....	12
5.4.3	Test procedure.....	12
5.4.4	Requirements.....	12
5.5	Connection of ancillary devices.....	13
5.6	Manufacturer's adjustments.....	13
5.7	Requirements for software controlled detectors.....	13
5.8	Sensing element fault.....	13
5.8.1	Object of the test.....	13
5.8.2	Test procedure.....	13
5.8.3	Requirements.....	13
5.9	On-site adjustment of response behaviour.....	13
5.10	Variation in supply parameters.....	13
5.10.1	Object.....	13
5.10.2	Test procedure.....	14
5.10.3	Requirements.....	14
5.11	Low voltage fault (sensor control unit with external power supply).....	14
5.11.1	Object.....	14
5.11.2	Test procedure.....	14
5.11.3	Requirements.....	14
5.12	Performance parameters under fire condition.....	14
5.12.1	Object.....	14
5.12.2	Test procedure.....	14
5.12.3	Requirements.....	14
5.13	Fire sensitivity for Class A application (optional function).....	15
5.13.1	Object.....	15
5.13.2	Principle.....	15
5.13.3	Fire test room.....	15
5.13.4	Test fires for Class A application.....	15
5.13.5	Mounting of the specimens.....	15
5.13.6	Initial conditions.....	16
5.13.7	Recording of the fire parameters and response times.....	16
5.13.8	Requirements.....	16
5.14	Static response temperature test for Class A application (optional function).....	16
5.14.1	Object.....	16
5.14.2	Test procedure for NLTHD.....	16
5.14.3	Requirements.....	17
5.15	Dry heat (operational) for sensor control unit.....	17
5.15.1	Object.....	17
5.15.2	Test procedure.....	17
5.15.3	Requirements.....	18
5.16	Cold (operational) for sensing element.....	18
5.16.1	Object.....	18
5.16.2	Test procedure.....	18
5.16.3	Requirements.....	19
5.17	Cold (operational) for sensor control unit.....	19
5.17.1	Object.....	19
5.17.2	Test procedure.....	20
5.17.3	Requirements.....	20
5.18	Damp heat, steady-state (endurance) for sensor control unit and sensing element.....	20
5.18.1	Object.....	20

5.18.2	Test procedure.....	21
5.18.3	Requirements.....	21
5.19	Damp heat, cyclic (operational) for sensing element	21
5.19.1	Object of the test.....	21
5.19.2	Test procedure.....	21
5.19.3	Requirements.....	22
5.20	Damp heat, cyclic (operational) for sensor control unit.....	23
5.20.1	Object of the test.....	23
5.20.2	Test procedure.....	23
5.20.3	Requirements.....	24
5.21	Damp heat, steady-state (operational) for sensor control unit.....	24
5.21.1	Object of the test.....	24
5.21.2	Test Procedure	24
5.21.3	Requirements.....	25
5.22	Damp heat, cyclic (endurance) for sensor control unit and sensing element	25
5.22.1	Object.....	25
5.22.2	Test procedure.....	25
5.22.3	Requirements.....	26
5.23	Shock (operational) for sensor control unit	26
5.23.1	Object.....	26
5.23.2	Test procedure.....	26
5.23.3	Requirements.....	27
5.24	Impact (operational) for sensor control unit.....	27
5.24.1	Object.....	27
5.24.2	Test procedure.....	27
5.24.3	Requirements.....	28
5.25	Impact (operational) for sensing element.....	28
5.25.1	Object.....	28
5.25.2	Test procedure.....	28
5.25.3	Requirements.....	29
5.26	Vibration, sinusoidal (operational) for sensor control unit.....	29
5.26.1	Object.....	29
5.26.2	Test procedure.....	29
5.26.3	Requirements.....	30
5.27	Vibration, sinusoidal (operational) for sensing element.....	30
5.27.1	Object.....	30
5.27.2	Test procedure.....	30
5.27.3	Requirements.....	31
5.28	Vibration, sinusoidal (endurance) for sensor control unit.....	31
5.28.1	Object.....	31
5.28.2	Test procedure.....	31
5.28.3	Requirements.....	32
5.29	Vibration, sinusoidal (endurance) for sensing element.....	32
5.29.1	Object.....	32
5.29.2	Test procedure.....	32
5.29.3	Requirements.....	33
5.30	Sulphur dioxide (SO ₂) corrosion (endurance) for sensing element.....	33
5.30.1	Object.....	33
5.30.2	Test procedure.....	33
5.30.3	Requirements.....	34
5.31	Sulphur dioxide (SO ₂) corrosion (endurance) for sensor control unit.....	34
5.31.1	Object.....	34
5.31.2	Test procedure.....	34
5.31.3	Requirements.....	35
5.32	Electromagnetic compatibility (EMC), immunity (operational).....	35
5.32.1	General.....	35
5.32.2	State of the specimen during conditioning.....	35
5.32.3	Final measurements.....	35

	5.32.4 Requirements.....	35
6	Test report.....	35
7	Marking.....	36
	7.1 General.....	36
	7.2 Marking of sensor control unit.....	36
	7.3 Marking of sensing element.....	36
	7.4 Marking of functional units.....	37
8	Data.....	37
	8.1 Hardware documentation.....	37
	8.2 Software documentation.....	37
	Annex A (normative) Arrangement of the sensing element in the fire test room.....	39
	Annex B (normative) Flaming liquid test fires (TF6F, TF6 and TF6S).....	41
	Annex C (normative) Mounting of the sensing element of NLTHD in the heat tunnel.....	43
	Annex D (normative) Heat tunnel for response temperature measurements.....	45
	Annex E (informative) Construction of the heat tunnel.....	46
	Annex F (normative) Test arrangement for vibration tests for sensing element.....	48
	Annex G (normative) Test apparatus for impact test on the sensing element.....	49

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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This document was prepared by Technical Committee ISO/TC 21, *[Equipment for fire protection and fire fighting]*, Subcommittee SC 03 *[Fire detection and alarm systems]*.

A list of all parts in the ISO 7240 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Non-resettable line-type heat detectors (NLTHD – also called in the market linear heat detector or digital detector) have been used for a considerable number of years and are incorporated into fire detection systems and in some countries even into fire alarm systems if accepted by the relevant authorities. 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 NLTHD products.

Due to the various applications for NLTHD, 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 NLTHD should be used in applications.

Generally, NLTHD operate using the same basic principle. However, they can have different performance with respect to their temperature response. Therefore, they have been differentiated by a type code which reflects the nominal alarm temperature, the tolerance range and the maximum ambient temperature at which they could be used. There are also options for room protection classes.

Fire detection and alarm systems —

Part 32:

Non-resettable line-type heat detectors

1 Scope

This part of ISO 7240 applies to non-resettable line-type heat detectors consisting of a sensing element distributed either continuously or discretely at close intervals along its length, which can be connected either directly or through a sensor control unit or an interface module to control and indicating equipment, and intended for use in fire detection and fire alarm systems installed in and around buildings and other civil engineering works.

This Standard specifies the requirements and performance criteria, the corresponding test methods and provides for the assessment.

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

Non-resettable line-type heat detectors with special characteristics and developed for specific risks are not covered by this standard..

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 7240-1, *Fire detection and alarm systems — Part 1: General and definitions*

ISO 7240-4, *Fire detection and alarm systems — Part 4: Power supply equipment*

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

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

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

IEC 60068-2-27, *Environmental testing — Part 2-27: Tests — Test Ea and guidance: Shock*

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

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

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

IEC 62599-2, *Alarm systems — Part 2: Electromagnetic compatibility — Immunity requirements for components of fire and security alarm systems*

3 Terms and definitions and abbreviations

For the purposes of this document, the terms and definitions given in ISO 7240-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

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

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).

3.1.3

non-resettable line-type heat detectors

NLTHD

detector which responds to heat sensed in the vicinity of a continuous line or a series of discrete elements at close interval along its length, and which can only respond once.

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

3.1.4

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, aircraft hangars, spray shops, chemical storehouses, ammunition depots, refineries, silos, etc.

3.1.5

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.

Note 2 to entry: The sensing element may be connected directly to control and indicating equipment, an input/output device or via a dedicated sensor control unit (see [3.1.6](#)).

3.1.6

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 ISO 7240-2.

3.2 Abbreviations

For the purposes of this document, the following abbreviation applies.

NLTHD: non-resettable line-type heat detector

4 Requirements

4.1 General

4.1.1 Compliance

To comply with this part of ISO 7240, the detector shall meet the requirements of [Clause 4](#), which shall be verified by inspection and engineering assessment, and when tested in accordance with the tests described in [Clause 5](#), shall meet the requirements of the tests.

The manufacturer shall define a performance type (see [4.1.2](#)) or heat response class (see [4.1.3](#)) or both.

4.1.2 NLTHD performance type

To simplify/standardize/rationalize product marking (see [Clause 7](#)), the performance type of the NLTHD is described using the following format, Txxx-Vyy-Azzz, where:

- Txxx is the nominal alarm temperature in the range 54 °C to 160 °C;
- Vyy is the tolerance of the nominal alarm temperature in $\pm$ %, which is either 05 or 10;
- Azzz is the maximum ambient temperature in °C, i.e. the maximum environment temperature at which the sensing element of the NLTHD could be installed and operated without generating an alarm.

EXAMPLE T085-V10-A066 means a NLTHD with a nominal alarm temperature of 85 °C having a tolerance of 10 % (i.e. a minimum alarm temperature of 76,5 °C and a maximum alarm temperature of 93,5 °C) which can be used for an application in which the ambient temperature is no greater than 66 °C.

The difference between the maximum ambient temperature and the minimum alarm temperature is to be at least 4 °C.

4.1.3 Heat response for class A application

For Class A application, the heat response of NLTHD is classified as indicated in [Table 1](#).

NOTE Test fires TF6S, TF6 and TF6F are specified in [Annex A](#).

For NLTHD which have a heat response for class A application the manufacturer shall declare a maximum ambient temperature to conduct the response time measurements as indicated in [5.1.5](#). This maximum ambient temperature shall be at minimum the Maximum application temperature (see [table 1](#)).

Table 1 — Heat response, for Class A

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	
					Lower values	Upper values	Lower values	Upper values	Lower values	Upper values
A1S	25	50	54	65	50	400	30	210	20	130
A2S	25	50	54	70	120	600	60	300	40	180

4.1.4 Environmental groups

Different environmental groups are necessary to reflect the different service environment of the components of an NLTHD:

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.

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 and in harsh environments such as tunnels.

4.2 Individual alarm indication

Each sensor control unit shall be provided with an integral latched red visual indicator, by which the individual sensor control unit, which released an alarm, 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 separate alarm indication for each sensing element.

To confirm this, the detector shall be assessed in accordance with [5.2](#).

4.3 Signalling

The NLTHD 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.

In the case of an electrical sensor cable, a short circuit may generate an alarm condition.

To confirm this, the detector shall be assessed in accordance with [5.3](#).

4.4 Maximum ambient temperature

The sensing element of the NLTHD shall be capable of withstanding long term exposure to temperatures as specified in [5.4](#).

4.5 Connection of ancillary devices

Where the NLTHD 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 NLTHD.

Where such connections are present the detector shall be assessed in accordance with [5.5](#).

4.6 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 [5.6](#).

4.7 Software

4.7.1 General

For NLTHD, which rely on software control in order to fulfil the requirements of this standard, the requirements in [4.7.2](#) and [4.7.3](#) shall be met.

4.7.2 Software design

In order to ensure the reliability of the NLTHD, 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.

4.7.3 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 NLTHD.

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 [5.7](#).

4.8 Sensing element fault

The NLTHD shall signal a fault condition when the sensing element is interrupted.

To confirm this, the detector shall be assessed in accordance with [5.8](#).

4.9 On-site adjustment of response behaviour

The effective response behaviour of a NLTHD is dependent upon both the sensitivity settings of the sensor control unit and the heat sensing element. Some types of NLTHD therefore may have facilities to adjust the sensitivity of the NLTHD 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.

These adjustments may 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 [5.9](#).

4.10 Variation in supply parameters

The NLTHD shall function correctly within the specified range(s) of the supply parameters as specified in [5.10](#).

4.11 Low voltage fault

The NLTHD shall signal a fault condition when its input power supply falls below the minimum voltage specified by the manufacturer. To confirm this, the detector shall be assessed in accordance with [5.11](#).

4.12 Performance parameters under fire condition

The response temperature of the tested NLTHD's shall be within the manufacturer's performance type declaration as specified in [5.12](#).

4.13 Fire sensitivity for Class A application

Heat response Class A1S, and A2S NLTHD 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 [4.1.3](#) and tested as specified in [5.13](#).

4.14 Static response temperature test for Class A application

The NLTHD shall be capable of alarming when the temperature rise is very slow and shall generate the alarm within a temperature range as specified in [4.1.3](#) for its class when tested as specified in [5.14](#).

4.15 Dry heat (operational) for sensor control unit

The sensor control unit of the NLTHD shall function correctly at high ambient temperatures as specified in [5.15](#).

4.16 Cold (operational) for sensing element

The sensing element of the NLTHD shall function correctly at low ambient temperatures as specified in [5.16](#).

4.17 Cold (operational) for sensor control unit

The sensor control unit of the NLTHD shall function correctly at low ambient temperatures as specified in [5.17](#).

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

The NLTHD shall be capable of withstanding long term exposure to a high level of continuous humidity as specified in [5.18](#).

4.19 Damp heat, cyclic (operational) for sensing element

The sensing element of the NLTHD shall function correctly at high relative humidity (with condensation) as specified in [5.19](#).

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

The sensor control unit of the NLTHD shall function correctly at high relative humidity (with condensation) as specified in [5.20](#).

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

The sensor control unit of the NLTHD shall function correctly at high relative humidity (without condensation) as specified in [5.21](#).

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

The NLTHD shall be capable of withstanding the long term effect of cyclic high humidity levels (with condensation) as specified in [5.22](#).

4.23 Shock (operational) for sensor control unit

The sensor control unit of the NLTHD shall function correctly when submitted to mechanical shocks which are likely to occur in the service environment as specified in [5.23](#).

4.24 Impact (operational) for sensor control unit

The sensor control unit of the NLTHD shall operate correctly when submitted to mechanical impacts as specified in [5.24](#).

4.25 Impact (operational) for sensing element

The sensing element of the NLTHD shall operate correctly when submitted to mechanical impacts as specified in [5.25](#).

4.26 Vibration, sinusoidal (operational) for sensor control unit

The sensor control unit of the NLTHD shall operate correctly when submitted to sinusoidal vibration as specified in [5.26](#).

4.27 Vibration, sinusoidal (operational) for sensing element

The sensing element of the NLTHD shall operate correctly when submitted to sinusoidal vibration as specified in [5.27](#).

4.28 Vibration, sinusoidal (endurance) for sensor control unit

The sensor control unit of the NLTHD shall be capable of withstanding the effect of sinusoidal vibration as specified in [5.28](#).

4.29 Vibration, sinusoidal (endurance) for sensing element

The sensing element of the NLTHD shall be capable of withstanding the effect of sinusoidal vibration as specified in [5.29](#).

4.30 Sulphur dioxide (SO₂) corrosion (endurance) for sensing element

The sensing element of the NLTHD shall be capable of withstanding exposure to an SO₂ corrosive atmosphere as specified in [5.30](#).

4.31 Sulphur dioxide (SO₂) corrosion (endurance) for sensor control unit

The sensor control unit of the NLTHD shall be capable of withstanding exposure to an SO₂ corrosive atmosphere as specified in [5.31](#).

4.32 Electrical stability

The NLTHD shall operate correctly when submitted to electromagnetic interference as specified in [5.32](#).

5 Test methods

5.1 General

5.1.1 Atmospheric conditions for tests

Unless otherwise stated in a test procedure, the testing shall be carried out after the test specimen has been allowed to stabilize in the standard atmospheric conditions for testing as specified in IEC 60068-1: and 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 substantially constant throughout the tests. The value chosen for each parameter shall normally be the nominal value, or the mean of the specified range. If a test procedure requires a specimen to be monitored to detect any alarm or fault signals, then connections shall be made to any necessary ancillary devices (e.g. through wiring to an end-of-line device for conventional detectors to allow a fault signal to be 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 IEC 60068).

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

5.1.5 Procedure for measurement of response temperature

This procedure is to verify the manufacturer's performance type declaration and to establish any deviation in system response temperature following the environmental tests.

The NLTHD shall be connected to a suitable supply and monitoring equipment in accordance with [5.1.2](#).

The response temperature of the NLTHD shall be measured using the heat tunnel described in [Annex C](#) and [Annex D](#).

The orientation of the sensing element in the heat tunnel shall be chosen arbitrarily.

Before the measurement, stabilize the temperature of the air stream and the section of sensing element to be heated to a temperature $25\text{ }^{\circ}\text{C}$ below the manufacturer's declared maximum ambient temperature, A_{zzz} or to $25\text{ }^{\circ}\text{C}$, whichever is the higher. 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 or the manufacturer's limits have been exceeded at least by 5 K . During the measurement, the airflow in the tunnel shall be maintained at a constant mass flow, equivalent to $(0,8 \pm 0,1)\text{ m/s}$ at $25\text{ }^{\circ}\text{C}$. The air temperature shall be controlled to within $\pm 2\text{ K}$ of the nominal temperature required at any time during the test.

The response temperature, T_r , shall be recorded at the moment an alarm is indicated.

Care should be taken not to subject detectors to a damaging thermal shock when transferring them to and from a stabilized or alarm temperature.

The length of sensing element, used, L_1 , shall be 10 m , unless specified otherwise in the appropriate test.

A section of minimum $0,1\text{ m}$ and limited by the size of the heat tunnel (L_{test}) of sensing element shall be placed in the centre of the heat tunnel (see [Annex C](#)), perpendicular to the air flow.

The remaining section of the sensing element ($L_1 - L_{\text{test}}$) not exposed to the induced test temperature shall remain at ambient temperature $(23 \pm 5)\text{ }^{\circ}\text{C}$ during the measurement unless otherwise stated in the individual tests.

To facilitate the test procedure, it may be necessary to introduce easily detachable connections between different sections of the sensing element. The losses introduced by these connections should be taken into account when determining L_1 .

NOTE The manufacturer may 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}).

5.1.6 Provision for tests

Two continuous samples of at least 300 m of sensing element and one continuous sample of sensing element of the maximum length as defined by the manufacturer (all taken from different production batches numbered from 1 to 3) shall be provided to conduct the tests in [5.1.7](#). If applicable, at least three specimens of sensor control unit and/or, at least three specimens of each functional unit shall also be provided. The exact length of sensing elements and the number of sensor control units and/or functional units shall be agreed between the manufacturer and the testing laboratory. If more than three sensor control units and/or functional units are provided then the test schedule (see [5.1.7](#)) can be modified as appropriate.