BRITISH STANDARD

BS EN 54-5:2001
Incorporating Amendment No. 1

Fire detection and fire alarm systems —

Part 5: Heat detectors — Point detectors

The European Standard EN 54-5:2000, with the incorporation of amendment A1:2002, has the status of a British Standard

ICS 13.220.20

British Standards

National foreword

This British Standard is the official English language version of EN 54-5:2000, including amendment A1:2002. It supersedes BS 5445-5:1977 and BS 5445-8:1984 which will be withdrawn on 06-2003. It is one of a series of standards for fire detection and fire alarm systems (see BS EN 54-1 for a full list of current and proposed standards).

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1⟩ ⟨A1]. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by [A1⟩ ⟨A1].

The UK participation in its preparation was entrusted by Technical Committee FSH/12, Fire detection and alarm systems, to Subcommittee FSH/12/2, Fire detectors, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

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

Compliance with a British Standard does not of itself confer immunity from legal obligations.

This British Standard, having been prepared under the direction of the Health and Environment Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 March 2001

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English version

Fire detection and fire alarm systems — Part 5: Heat detectors — Point detectors
(includes amendment A1:2002)

Systèmes de détection et d'alarme incendie — Partie 5: Détecteurs de chaleur — Détecteurs ponctuels (inclut l'amendement A1:2002)

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This European Standard was approved by CEN on 2 June 2000. Amendment A1 was approved by CEN on 5 April 2002.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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Contents

Foreword

This European Standard 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 replaces EN 54-5:1976, EN 54-5:1976/A1:1988, EN 54-6:1982, EN 54-8:1982.

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 June 2001, and conflicting national standards shall be withdrawn at the latest by June 2003. For products which have complied with the relevant national standard before the date of withdrawal (dow), as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until June 2006.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This standard has been prepared in cooperation with the CEA (Comité Européen des Assurances) and with EURALARM (Association of European Manufacturers of Fire and Intruder Alarm Systems).

The significant differences from EN 54-5:1976+A1:1988 include:

- changes in the title of the EN 54 series and in the title of this part;
- the integration of the requirements for high temperature heat detectors, previously covered in EN 54-8:1982, and the partial integration of the requirements for rate of rise heat sensitive detectors without a static element, previously covered by EN 54-6:1982, into this part;
- a new classification system, combining the systems of EN 54-5:1976 and EN 54-8:1982, together with the introduction of optional suffices giving additional information on response characteristics (N.B. this allows detectors with certain rate-of-rise characteristics to be identified; such detectors were previously covered by EN 54-6 :1982);
- changes to the lower limits of response times at high rates of rise of temperature;
- changes in the environmental test procedures to use IEC tests where possible, to harmonize with test procedures applied to other types of detectors and to include EMC immunity tests;
- the requirement for an integral alarm indication.

EN 54-5:1976, EN 54-6:1982, EN 54-8:1982 and their amendments will all be withdrawn on publication of this revision.

Information on the relationship between this European Standard and other standards of the EN 54 series is given in annex A of EN 54-1:1996.

Foreword to amendment A1

This document EN 54-5:2000/A1:2002 has been prepared by Technical Committee CEN/TC 72, Fire detection and fire alarm systems, the Secretariat of which is held by BSI.

This amendment to the European Standard EN 54-5:2000 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2002, and conflicting national standards shall be withdrawn at the latest by June 2005.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of the EU Construction Products Directive (89/106/EEC).

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

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies the requirements, test methods and performance criteria for point heat detectors for use in fire detection and fire alarm systems for buildings (see EN 54-1:1996).

For other types of heat detector, or for detectors intended for use in other environments, this standard should only be used for guidance. Heat detectors with special characteristics and developed for specific risks are not covered by this standard.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

ISO/IEC Publication	Year	Title	EN/HD Publication	Year
-	-	*Fire detection and fire alarm systems — Part 1: Introduction*.	EN 54-1	1996
-	-	*Alarm Systems — Part 4: Electromagnetic compatibility — Product family standard: Immunity requirements for components of fire, intruder and social alarm systems, +A1:1998.*	EN 50130-4	1995
IEC 60068-1	1988	*Environmental testing — Part 1: General and guidance, +A1:1992.*	EN 60068-1	1994
IEC 60068-2-1	1990	*Environmental testing — Part 2: Tests — Tests A: Cold, +A1:1993, A2:1994.*	EN 60068-2-1	1993
IEC 60068-2-2	1974	*Basic Environmental testing procedures — Part 2: Tests — Tests B: Dry heat, + Supp. A:1976, A1:1993, A2:1994.*	EN 60068-2-2	1993
IEC 60068-2-3	1969	*Basic Environmental testing procedures — Part 2: Tests — Test Ca: Damp heat, steady state, +A1:1984.*	HD 323.2.3 S2	1987
IEC 60068-2-6	1995	*Environmental testing — Part 2: Tests — Test Fc. Vibration (sinusoidal), +Corr.:1995*	EN 60068-2-6	1995
IEC 60068-2-27	1987	*Basic Environmental testing procedures — Part 2: Tests — Test Ea & Guidance: Shock.*	EN 60068-2-27	1993

ISO/IEC Publication	Year	Title	EN/HD Publication	Year
IEC 60068-2-30	1980	*Basic Environmental testing procedures — Part 2: Tests — Test Db & Guidance: Damp heat, cyclic (12 + 12 hour cycle), +A1:1985.*	HD 323.2.30 S3	1988
IEC 60068-2-42	1982	*Basic Environmental testing procedures — Part 2: Tests — Test Kc: Sulphur dioxide test for contacts and connections.*	-	-
IEC 60068-2-56	1988	*Environmental testing — Part 2: Tests — Test Cb: Damp heat, steady state, primarily for equipment.*	HD 323.2.56 S1	1990
ISO 209-1	1989	*Wrought aluminium and aluminium alloys — Chemical composition and forms of products — Part 1: Chemical composition.*	-	-

3 Terms and definitions

For the purposes of this standard, the following terms and definitions and those given in EN 54-1:1996 apply:

3.1
typical application temperature
temperature that an installed detector can be expected to experience for long periods of time in the absence of a fire condition

NOTE: This temperature is deemed to be 29 °C below the minimum static response temperature, according to the class marked on the detector, as specified in Table 1.

3.2
maximum application temperature
maximum temperature that an installed detector can be expected to experience, even for short periods of time, in the absence of a fire condition

NOTE: This temperature is deemed to be 4 °C below the minimum static response temperature, according to the class marked on the detector, as specified in Table 1.

3.3
static response temperature
temperature at which the detector would produce an alarm signal if subjected to a vanishingly small rate of rise of temperature

NOTE: Rates of rise of temperature of approximately 0,2 K min^{-1} are normally found to be suitable for measuring this, however lower rates can be required in some instances (see 5.3).

4 Requirements

4.1 Compliance

In order to comply with this standard the detector shall meet the requirements of this clause, which shall be verified by visual inspection or engineering assessment, shall be tested as described in clause 5 and if applicable clause 6, and shall meet the requirements of the tests in accordance with its marked class(es).

4.2 Classification

Detectors shall conform to one or more of the following classes: A1, A2, B, C, D, E, F or G according to the requirements of the tests specified in clause 5 (see Table 1).

Table 1 — Detector classification temperatures

Detector Class	Typical Application Temperature °C	Maximum Application Temperature °C	Minimum Static Response Temperature °C	Maximum Static Response Temperature °C
A1	25	50	54	65
A2	25	50	54	70
B	40	65	69	85
C	55	80	84	100
D	70	95	99	115
E	85	110	114	130
F	100	125	129	145
G	115	140	144	160

Manufacturers may optionally give additional information concerning the type of response exhibited by the detector, by adding the suffix S or R to the above classes[1)]. Detectors, which are marked with the letter S or R as a suffix to the class marking, shall be tested in accordance with the applicable test, specified in clause 6, and shall meet the requirements of that test, in addition to the tests of clause 5.

4.3 Position of heat sensitive elements

Each detector shall be constructed such that at least part of its heat sensitive element(s), except elements with auxiliary functions (e.g. characteristic correctors), shall be ≥ 15 mm from the mounting surface of the detector.

[1)] Detectors with a suffix S to their class do not respond below the minimum static response temperature applicable to their classification (see Table 1), even at high rates of rise of air temperature. Detectors with a suffix R to their class incorporate a *rate-of-rise* characteristic, which meets the response time requirements (see Table 4) for high rates of rise of air temperature even when starting at air temperatures substantially below the typical application temperature.

4.4 Individual alarm indication

Class A1, A2, B, C or D detectors shall be provided with an integral red visual indicator, by which the individual detector, which released an alarm, can be identified, until the alarm condition is reset. Where other conditions of the detector can be visually indicated, they shall be clearly distinguishable from the alarm indication, except when the detector is switched into a service mode. For detachable detectors the indicator may be integral with the base or the detector head. The visual indicator shall be visible from a distance of 6 m directly below the detector, in an ambient light intensity up to 500 lux.

Class E, F or G detectors shall be provided with either an integral red indicator, or with another means for locally indicating the alarm status of the detector.

4.5 Connection of ancillary devices

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

4.6 Monitoring of detachable detectors

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

4.7 Manufacturer’s adjustments

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

4.8 On-site adjustment of response behaviour

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

a) for each setting at which the manufacturer claims compliance with this standard, he shall declare a corresponding class, and for each such setting the detector shall comply with the requirements of this standard for the corresponding class, and access to the adjustment means shall only be possible by the use of a code or special tool or by removing the detector from its base or mounting;

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

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

4.9 Marking

Each detector shall be clearly marked with the following information:

a) the number of this standard (i.e. EN 54-5);

b) the class(es) of the detector (e.g. A1, A1R, A1S, A2, B etc.). If the detector has provision for on-site adjustment of the class (see 4.8), then the marking of the class may be replaced by the symbol P;

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

d) the model designation (type or number);

e) the wiring terminal designations;

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 detector.

For detachable detectors, the detector head shall be marked with a), b), c), d) and f), and the base shall be marked with at least d) (i.e. its own model designation) and e).

Where any marking on the device uses symbols or abbreviations not in common use then these shall be explained in the data supplied with the device.

The marking shall be visible during installation of the detector and shall be accessible during maintenance.

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

4.10 Data

Detectors shall either be supplied with sufficient technical, installation and maintenance data to enable their correct installation and operation[2] or, if all of these data are not supplied with each detector, reference to the appropriate data sheet(s) shall be given on or with each detector.

For detectors with provision for on-site adjustment of their class, these data shall identify the applicable classes and shall describe the method of programming (e.g. by selecting a switch position on the detector or a setting from a menu in the control and indicating equipment).

NOTE: Additional information may be required by organizations certifying that detectors conform to the requirements of this standard.

[2] To enable correct operation of the detectors, these data should describe the requirements for the correct processing of the signals from the detector. This can be in the form of a full technical specification of these signals, a reference to the appropriate signalling protocol, or a reference to suitable types of control and indicating equipment etc.

4.11 Additional requirements for software controlled detectors

4.11.1 General

For detectors which rely on software control in order to fulfil the requirements of this standard, the requirements of 4.11.2, 4.11.3 and 4.11.4 shall be met.

4.11.2 Software documentation

4.11.2.1 The manufacturer shall submit documentation which gives an overview of the software design. This documentation shall be in sufficient detail for the design to be inspected for compliance with this standard and shall include at least the following:

a) a functional description of the main program flow (e.g. as a flow diagram or structogram) including:

   1) a brief description of the modules and the functions that they perform;

   2) the way in which the modules interact;

   3) the overall hierarchy of the program;

   4) the way in which the software interacts with the hardware of the detector;

   5) the way in which the modules are called, including any interrupt processing.

b) a description of which areas of memory are used for the various purposes (e.g. the program, site specific data and running data);

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

4.11.2.2 The manufacturer shall have available detailed design documentation, which only needs to be provided if required by the testing authority. It shall comprise at least the following:

a) an overview of the whole system configuration, including all software and hardware components;

b) a description of each module of the program, containing at least:

   1) the name of the module;

   2) a description of the tasks performed;

   3) a description of the interfaces, including the type of data transfer, the valid data range and the checking for valid data.

c) full source code listings, as hard copy or in machine-readable form (e.g. ASCII-code), including all global and local variables, constants and labels used, and sufficient comment for the program flow to be recognized;

d) details of any software tools used in the design and implementation phase (e.g. CASE-tools, compilers).

4.11.3 Software design

In order to ensure the reliability of the detector, the following requirements for software design shall apply:

a) the software shall have a modular structure;

b) the design of the interfaces for manually and automatically generated data shall not permit invalid data to cause error in the program operation;

c) the software shall be designed to avoid the occurrence of deadlock of the programme flow.

4.11.4 The storage of programs and data

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

Site-specific data shall be held in memory which will retain data for at least 2 weeks without external power to the detector, unless provision is made for the automatic renewal of such data, following loss of power, within 1 h of power being restored.

5 Tests

5.1 General

5.1.1 Atmospheric conditions for tests

Unless otherwise stated in a test procedure, the testing shall be carried out after the test specimen has been allowed to stabilize in the standard atmospheric conditions for testing as described in IEC 60068-1:1988+A1:1992 as follows:

a) temperature: (15 to 35) °C;

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

c) air pressure: (86 to 106) kPa.

NOTE: If variations in these parameters have a significant effect on a measurement, then such variations should be kept to a minimum during a series of measurements carried out as part of one test on one specimen.

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).

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

5.1.3 Mounting arrangements

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

5.1.4 Tolerances

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

If a requirement or test procedure does not specify a tolerance or deviation limits, then deviation limits of ±5 % shall be applied.

5.1.5 Measurement of response time

The specimen for which the response time is to be measured shall be mounted in a heat tunnel as described in 5.1.3 and annex A. It shall be connected to suitable supply and monitoring equipment in accordance with 5.1.2. The orientation of the specimen, relative to the direction of airflow, shall be that which gave the maximum response time in the directional dependence test 5.2, unless otherwise specified.

Before the measurement, the temperature of the air stream and the specimen shall be stabilized to the temperature specified in the applicable test procedure. The measurement is then made by increasing the air temperature in the heat tunnel linearly with respect to time, at the rate of rise specified in the applicable test procedure until the supply and monitoring equipment indicates an alarm or until the upper limit of response time for the test is exceeded. During the measurement the air flow shall be maintained at a constant mass flow, equivalent to (0,8 ± 0,1) m s^{-1} at 25 °C, and the air temperature shall be controlled to within ±2 K of the nominal temperature required at any time during the test (see annex A). The response time is the time interval between the start of the temperature increase and 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 may be used to establish the effective start time of the temperature increase.

NOTE 2: Care should be taken not to subject detectors to a damaging thermal shock when transferring them to and from a stabilization or alarm temperature.

NOTE 3: Details and information concerning the design of the heat tunnel are given in annexes A and B.

5.1.6 Provision for tests

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

a) For resettable detectors: 15 detectors.
   For non-resettable detectors: 62 detectors.
   For non-resettable suffix S detectors: 63 detectors.
   For non-resettable suffix R detectors: 68 detectors.

b) The data required in 4.10.

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

5.1.7 Test schedule

Resettable specimens shall be arbitrarily numbered 1 to 15 by the testing organization and tested according to the test schedule in Table 2.

For detectors with provision for on-site adjustment of their class:

a) tests in accordance with 5.3, 5.4, 5.5, 5.6, 5.8, 6.1 and 6.2 shall be applied for each applicable class;

b) the test in accordance with 5.10 shall be applied for the class with the highest temperature rating;

c) all other tests shall be applied for at least one class.

Non-resettable specimens shall be arbitrarily numbered 1 to 62, 1 to 63, or 1 to 68 according to class by the testing organization and tested according to the test schedule in Table 3.

Table 2 — Test schedule for resettable detectors

Test	Clause	Specimen Number(s)							
		Rate of rise of air temperature (K min^{-1})							
		< 0,2	1	3	5	10	20	30	Plunge
Directional dependence	5.2					1			
Static response temperature	5.3	1, 2							
Response times from typical application temperature	5.4		1, 2	1, 2	1, 2	1, 2	1, 2	1, 2	
Response times from 25 °C	5.5			1			1		
Response times from high ambient temperature	5.6			1			1		
Variation in supply parameters	5.7			1, 2			1, 2		
Reproducibility (response times before environmental tests)	5.8			3 to 15			3 to 15		
Cold (operational)	5.9			3			3		
Dry heat (endurance)	5.10			4			4		
Damp heat, cyclic (operational)	5.11			5			5		
Damp heat, steady state (endurance)	5.12			6			6		
Sulfur dioxide (SO_2) corrosion (endurance)	5.13			7			7		
Shock (operational)	5.14			8			8		
Impact (operational)	5.15			9			9		
Vibration, sinusoidal (operational)	5.16			10			10		
Vibration, sinusoidal (endurance)	5.17			10			10		
Electrostatic discharge (operational)	5.18			11*			11*		
Radiated electromagnetic fields (operational)	5.18			12*			12*		
Conducted disturbances induced by electromagnetic fields (operational)	5.18			13*			13*		
Fast transient burst (operational)	5.18			14*			14*		
Slow high energy voltage surge (operational)	5.18			15*			15*		
Additional test for suffix S detectors	6.1								1
Additional test for suffix R detectors	6.2					1, 2	1, 2	1, 2	

* In the interests of test economy, it is permitted to use the same specimen for more than one EMC test. In that case, intermediate functional test(s) on the specimen(s) used for more than one test may be deleted, and the functional test conducted at the end of the sequence of tests. However, it should be noted that in the event of a failure it may not be possible to identify which test exposure caused the failure (see clause 4 of EN 50130-4:1995+A1:1998).

Table 3 — Test schedule for non-resettable detectors

Test	Clause	Specimen Number(s)							
		Rate of rise of air temperature (K min^{-1})							
		< 0,2	1	3	5	10	20	30	Plunge
Directional dependence	5.2					1 to 8			
Static response temperature	5.3	9, 10							
Response times from typical application temperature	5.4		11, 12	13, 14	15, 16	17, 18	19, 20	21, 22	
Response times from 25 °C	5.5			23			24		
Response times from high ambient temperature	5.6			25			26		
Variation in supply parameters	5.7			27, 28			29, 30		
Reproducibility (response times before environmental tests)	5.8			31, 32			33, 34		
Cold (operational)	5.9			35			36		
Dry heat (endurance)	5.10			37			38		
Damp heat, cyclic (operational)	5.11			39			40		
Damp heat, steady state (endurance)	5.12			41			42		
Sulfur dioxide (SO_2) corrosion (endurance)	5.13			43			44		
Shock (operational)	5.14			45			46		
Impact (operational)	5.15			47			48		
Vibration, sinusoidal (operational)	5.16			49			50		
Vibration, sinusoidal (endurance)	5.17			51			52		
Electrostatic discharge (operational)	5.18			53*			54*		
Radiated electromagnetic fields (operational)	5.18			55*			56*		
Conducted disturbances induced by electromagnetic fields (operational)	5.18			57*			58*		
Fast transient burst (operational)	5.18			59*			60*		
Slow high energy voltage surge (operational)	5.18			61*			62*		
Additional test for suffix S detectors	6.1								63
Additional test for suffix R detectors	6.2					63, 64	65, 66	67, 68	

* In the interests of test economy, it is permitted to use the same specimen for more than one EMC test. In that case, intermediate functional test(s) on the specimen(s) used for more than one test may be deleted, and the functional test conducted at the end of the sequence of tests. However, it should be noted that in the event of a failure it may not be possible to identify which test exposure caused the failure (see clause 4 of EN 50130-4:1995+A1:1998).

5.2 Directional dependence

5.2.1 Object

To confirm that the response time of the detector is not unduly dependent on the direction of airflow around the detector.

5.2.2 Test procedure

The specimen(s) shall be tested as described in 5.1.5 at a rate of rise of air temperature of 10 K min^{-1}. Eight such tests shall be made, the specimen being rotated about a vertical axis by 45° between successive tests so that tests are made with eight different orientations. Before each test, the specimen shall be stabilized to the typical application temperature specified in Table 1 according to the class marked on the specimen. The response time at the eight orientations shall be recorded. The orientations at which the maximum and minimum response times were measured shall be noted.

5.2.3 Requirements

Class A1 detectors shall respond between 1 min 0 s and 4 min 20 s at all eight orientations.

Classes A2, B, C, D, E, F and G detectors shall respond between 2 min 0 s and 5 min 30 s at all eight orientations.

5.3 Static response temperature

5.3.1 Object

To confirm the ability of a detector to respond correctly to a slow rate of rise of air temperature.

5.3.2 Test procedure

The specimens shall be tested as described in 5.1.5 at a rate of rise of air temperature of 1 K min^{-1} until the applicable maximum application temperature is reached as specified in Table 1 according to the class marked on the specimen. Thereafter the test shall be continued at a maximum rate of rise of air temperature of 0,2 K min^{-1}. One specimen shall be tested at the orientation which gave the maximum response time, and the other at the orientation which gave the minimum response time in test 5.2. Before each test the specimen shall be stabilized to the typical application temperature specified in Table 1 according to the class marked on the specimen. The temperature at which the specimens respond shall be recorded.

5.3.3 Requirements

The response temperatures of the detectors tested shall lie between the minimum and maximum static response temperatures, shown in Table 1, according to the class of the detector.

5.4 Response times from typical application temperature

5.4.1 Object

To confirm the ability of the detector stabilized at its typical application temperature to respond correctly over a range of rates of rise of air temperature.

5.4.2 Test Procedure

The specimens shall be tested as described in 5.1.5 at rates of rise of air temperature of 1, 3, 5, 10, 20 and 30 K min^{-1}. One specimen shall be tested at the orientation which gave the maximum response time, and the other at the orientation which gave the minimum response time in test 5.2. Before each test the specimen shall be stabilized to the typical application temperature specified in Table 1 according to the class marked on the specimen. The response time for each rate of rise of air temperature shall be recorded for each specimen.

5.4.3 Requirements

The response times of the detectors shall lie between the lower and upper response time limits specified in Table 4 for the appropriate detector class.

Table 4 — Response time limits

Rate of rise of air temperature	Class A1 detectors				Class A2, B, C, D, E, F and G detectors			
	Lower limit of response time		Upper limit of response time		Lower limit of response time		Upper limit of response time	
K min^{-1}	min	s	min	s	min	s	min	s
1	29	0	40	20	29	0	46	0
3	7	13	13	40	7	13	16	0
5	4	9	8	20	4	9	10	0
10	1	0	4	20	2	0	5	30
20		30	2	20	1	0	3	13
30		20	1	40		40	2	25

NOTE: Information concerning the derivation of the limits given in Table 4 is given in annex C.

5.5 Response times from 25 °C

5.5.1 Object

To confirm that detectors in a class with a typical application temperature above 25 °C (see Table 1) do not exhibit an abnormally fast response to normal increases in temperature. Therefore this test is not applicable to class A1 or A2 detectors.

5.5.2 Test procedure

The specimen(s) shall be tested as described in 5.1.5 at rates of rise of air temperature of 3 K min^{-1} and 20 K min^{-1}. The specimen shall be tested at the orientation which gave the minimum response time in test 5.2. Before each test the specimen shall be stabilized to 25 °C. The response times of the specimen shall be recorded.

5.5.3 Requirements

The response time at 3 K min^{-1} shall exceed 7 min 13 s, and the response time at 20 K min^{-1} shall exceed 1 min 0 s.

5.6 Response times from high ambient temperature (dry heat operational)

5.6.1 Object

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

5.6.2 Test procedure

The specimen(s) shall be tested as described in 5.1.5 at rates of rise of air temperature of 3 K min^{-1} and 20 K min^{-1}. The specimen shall be tested at the orientation which gave the maximum response time in test 5.2. Before each test the specimen shall be stabilized for 2 h at the maximum application temperature specified in Table 1 according to the class marked on the specimen. The rate of rise of air temperature up to the stabilization temperature shall be ≤ 1 K min^{-1}. The response times of the specimen shall be recorded.

5.6.3 Requirements

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

Detectors shall respond, according to their class, between the lower and upper response time limits specified in Table 5.

Table 5 — Response time limits from maximum application temperature

Detector class	Lower limit of response time at air temperature rise of:				Upper limit of response time at air temperature rise of:			
	3 K min^{-1}		20 K min^{-1}		3 K min^{-1}		20 K min^{-1}	
	min	s	min	s	min	s	min	s
A1	1	20		12	13	40	2	20
All others	1	20		12	16	0	3	13

5.7 Variation in supply parameters

5.7.1 Object

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

5.7.2 Test procedure

The specimens shall be tested as described in 5.1.5 at rates of rise of air temperature of 3 K min^{-1} and 20 K min^{-1} at the upper and lower limits of the supply parameters (e.g. voltage) range specified by the manufacturer. One specimen shall be tested at the orientation which gave the maximum response time, and the other at the orientation which gave the minimum response time in test 5.2. Before each test the specimen shall be stabilized to the typical application temperature specified in Table 1 according to the class marked on the specimen. The response times for both rates of rise of air temperature at each supply parameter limit shall be recorded.

NOTE: For conventional detectors the supply parameter is the dc voltage applied to the detector. For other types of detector (e.g. analogue addressable), signal levels and timing 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.

5.7.3 Requirements

The response times of the detectors shall lie between the lower and upper response time limits specified in Table 4 for the appropriate detector class.

5.8 Reproducibility

5.8.1 Object

To show that the response times of the detectors are within the required limits and, for resettable detectors, to establish response time base data for comparison with the response times measured after the environmental tests.

5.8.2 Test procedure

The response time of the specimens shall be measured as described in 5.1.5 at rates of rise of air temperature of 3 K min^{-1} and 20 K min^{-1} in the orientation which gave the maximum response time as determined by test 5.2. Before each measurement the specimen shall be stabilized to the typical application temperature specified in Table 1 according to the class marked on the specimen.

5.8.3 Requirements

The response times of the detectors shall lie between the lower and upper response time limits specified in Table 4 for the appropriate detector class.

5.9 Cold (operational)

5.9.1 Object

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

5.9.2 Test procedure

5.9.2.1 Reference

The test apparatus and procedure shall be as described in IEC 60068-2-1:1990+A1:1993+A2:1994 Test Ab, and as described below.

5.9.2.2 State of the specimen(s) during conditioning

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

5.9.2.3 Conditioning

The following conditioning shall be applied:

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

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

5.9.2.4 Measurements during conditioning

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

5.9.2.5 Final measurements

The response time of the specimen(s) shall be measured as described in 5.1.5 at rates of rise of air temperature of 3 K min^{-1} and 20 K min^{-1} in the orientation which gave the maximum response time in test 5.2. Before each measurement the specimen shall be stabilized to the typical application temperature specified in Table 1 according to the class marked on the specimen.

5.9.3 Requirements

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

For resettable detectors the response time at 3 K min^{-1} shall not be less than 7 min 13 s and any change in the response time compared with the time obtained in the equivalent test 5.8 shall not exceed 2 min 40 s.

For resettable detectors the response time at 20 K min^{-1} shall not be less than 30 s for class A1 detectors, 1 min 0 s for all other classes, and any change in response time compared with the time obtained in the equivalent test 5.8 shall not exceed 30 s.

For non-resettable detectors, the response times shall lie between the lower and upper response time limits specified in Table 4 for the appropriate detector class.

5.10 Dry heat (endurance)

5.10.1 Object

To demonstrate the ability of the detector to withstand a high ambient temperature appropriate to its class. This test is not applicable to class A1, A2 and B detectors.

5.10.2 Test Procedure

5.10.2.1 Reference

The test apparatus and procedure shall be as described in IEC 60068-2-2:1974+Supp.A:1976 +A1:1993+A2:1994 Test Ba or Bb, and as indicated below.

5.10.2.2 State of the specimen(s) during conditioning

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

5.10.2.3 Conditioning

The applicable conditioning temperature specified in Table 6 shall be applied for 21 days.

Table 6 — Dry heat (endurance) conditioning temperatures

Detector class	Conditioning temperature °C
C	80 ± 2
D	95 ± 2
E	110 ± 2
F	125 ± 2
G	140 ± 2

5.10.2.3 Final measurements

The response time of the specimen(s) shall be measured as described in 5.1.5 at rates of rise of air temperature of 3 K min^{-1} and 20 K min^{-1} in the orientation which gave the maximum response time in test 5.2. Before each measurement the specimen shall be stabilized to the typical application temperature specified in Table 1 according to the class marked on the specimen.

5.10.3 Requirements

No fault signal attributable to the endurance conditioning shall be given on reconnection of the specimen.

For resettable detectors the response time at 3 K min^{-1} shall not be less than 7 min 13 s and any change in the response time compared with the time obtained in the equivalent test 5.8 shall not exceed 2 min 40 s.

For resettable detectors the response time at 20 K min^{-1} shall not be less than 1 min 0 s and any change in response time compared with the time obtained in the equivalent test 5.8 shall not exceed 30 s.

For non-resettable detectors, the response times shall lie between the lower and upper response time limits specified in Table 4 for the appropriate detector class.

5.11 Damp heat, cyclic (operational)

5.11.1 Object

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

5.11.2 Test procedure

5.11.2.1 Reference

The test apparatus and procedure shall be as described in IEC 60068-2-30:1980+A1:1985, using the Variant 1 test cycle and controlled recovery conditions, and as described below.

5.11.2.2 State of the specimen(s) during conditioning

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

5.11.2.3 Conditioning

The following severity of conditioning (IEC 60068-2-30 Severity 1) shall be applied:

Lower temperature:	(25 ± 3) °C.
Upper temperature:	(40 ± 2) °C.
Relative humidity:	
a) at lower temperature:	≥ 95 % ;
b) at upper temperature:	(93 ± 3) %.
Number of cycles:	2.

5.11.2.4 Measurements during conditioning

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

5.11.2.5 Final measurements

After the recovery period the response time of the specimen(s) shall be measured as described in 5.1.5 at rates of rise of air temperature of 3 K min^{-1} and 20 K min^{-1} in the orientation which gave the maximum response time in test 5.2. Before each measurement the specimen shall be stabilized to the typical application temperature specified in Table 1 according to the class marked on the specimen.

5.11.3 Requirements

No alarm or fault signal shall be given during the conditioning.

For resettable detectors the response time at 3 K min^{-1} shall not be less than 7 min 13 s and any change in the response time compared with the time obtained in the equivalent test 5.8 shall not exceed 2 min 40 s.

For resettable detectors the response time at 20 K min^{-1} shall not be less than 30 s for class A1 detectors, 1 min 0 s for all other classes, and any change in response time compared with the time obtained in the equivalent test 5.8 shall not exceed 30 s.

For non-resettable detectors, the response times shall lie between the lower and upper response time limits specified in Table 4 for the appropriate detector class.

5.12 Damp heat, steady state (endurance)

5.12.1 Object

To demonstrate the ability of the detector 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.).

5.12.2 Test procedure

5.12.2.1 Reference

The test apparatus and procedure shall be as described in IEC 60068-2-56:1988 Test Cb or IEC 60068-2-3:1969+A1:1984 Test Ca, and as described below.

5.12.2.2 State of the specimen(s) during conditioning

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

5.12.2.3 Conditioning

The following conditioning shall be applied:

Temperature:	(40 ± 2) °C.
Relative humidity:	(93 ± 3) %.
Duration:	21 days.

5.12.2.4 Final measurements

After a recovery period of at least 1 h in standard laboratory conditions, the response time of the specimen(s) shall be measured as described in 5.1.5 at rates of rise of air temperature of 3 K min^{-1} and 20 K min^{-1} in the orientation which gave the maximum response time in test 5.2. Before each measurement the specimen shall be stabilized to the typical application temperature specified in Table 1 according to the class marked on the specimen.

5.12.3 Requirements

No fault signal attributable to the endurance conditioning shall be given on reconnection of the specimen.

For resettable detectors the response time at 3 K min^{-1} shall not be less than 7 min 13 s and any change in the response time compared with the time obtained in the equivalent test 5.8 shall not exceed 2 min 40 s.

For resettable detectors the response time at 20 K min^{-1} shall not be less than 30 s for class A1 detectors, 1 min 0 s for all other classes, and any change in response time compared with the time obtained in the equivalent test 5.8 shall not exceed 30 s.

For non-resettable detectors, the response times shall lie between the lower and upper response time limits specified in Table 4 for the appropriate detector class.

5.13 Sulfur dioxide (SO_2) corrosion (endurance)

5.13.1 Object

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

5.13.2 Test procedure

5.13.2.1 Reference

The test apparatus and procedure shall be as described in IEC 60068-2-42:1982 Test Kc, except that the conditioning shall be as described below.

5.13.2.2 State of the specimen(s) during conditioning

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

5.13.2.3 Conditioning

The following conditioning shall be applied:

Temperature:	(25 ± 2) °C.
Relative humidity:	(93 ± 3) %.
SO_2 concentration:	(25 ± 5) ppm (by volume).
Duration:	21 days.

5.13.2.4 Final measurements

Immediately after the conditioning, the specimen(s) shall be subjected to a drying period of 16 h at (40 ± 2)°C, ≤ 50% RH, followed by a recovery period of at least 1 h at the standard laboratory conditions. After this the response time of the specimen(s) shall be measured as described in 5.1.5 at rates of rise of air temperature of 3 K min^{-1} and 20 K min^{-1} in the orientation which gave the maximum response time in test 5.2. Before each measurement the specimen shall be stabilized to the typical application temperature specified in Table 1 according to the class marked on the specimen.

5.13.3 Requirements

No fault signal attributable to the endurance conditioning shall be given on reconnection of the specimen.

For resettable detectors the response time at 3 K min^{-1} shall not be less than 7 min 13 s and any change in the response time compared with the time obtained in the equivalent test 5.8 shall not exceed 2 min 40 s.

For resettable detectors the response time at 20 K min^{-1} shall not be less than 30 s for class A1 detectors, 1 min 0 s for all other classes, and any change in response time compared with the time obtained in the equivalent test 5.8 shall not exceed 30 s.

For non-resettable detectors, the response times shall lie between the lower and upper response time limits specified in Table 4 for the appropriate detector class.

5.14 Shock (operational)

5.14.1 Object

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

5.14.2 Test procedure

5.14.2.1 Reference

The test apparatus and procedure shall be as described in IEC 60068-2-27:1987 Test Ea, except that the conditioning shall be as described below.

5.14.2.2 State of the specimen(s) during conditioning

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

5.14.2.3 Conditioning

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

Shock pulse type:	Half sine.
Pulse duration:	6 ms.
Peak acceleration:	$10 \times (100 - 20\, M)$ m s^{-2} (Where M is the specimen's mass in kg).
Number of directions:	6.
Pulses per direction:	3.

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

5.14.2.4 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.

5.14.2.5 Final measurements

The response time of the specimen(s) shall be measured as described in 5.1.5 at rates of rise of air temperature of 3 K min^{-1} and 20 K min^{-1} in the orientation which gave the maximum response time in test 5.2. Before each measurement the specimen shall be stabilized to the typical application temperature specified in Table 1 according to the class marked on the specimen.

5.14.3 Requirements

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

For resettable detectors the response time at 3 K min^{-1} shall not be less than 7 min 13 s and any change in the response time compared with the time obtained in the equivalent test 5.8 shall not exceed 2 min 40 s.

For resettable detectors the response time at 20 K min^{-1} shall not be less than 30 s for class A1 detectors, 1 min 0 s for all other classes, and any change in response time compared with the time obtained in the equivalent test 5.8 shall not exceed 30 s.

For non-resettable detectors, the response times shall lie between the lower and upper response time limits specified in Table 4 for the appropriate detector class.

5.15 Impact (operational)

5.15.1 Object

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

5.15.2 Test procedure

5.15.2.1 Apparatus

The test apparatus shall consist of a swinging hammer incorporating a rectangular section aluminium alloy head (aluminium alloy Al Cu_4 Si Mg complying with ISO 209-1:1989, solution treated and precipitation treated condition) with the plane impact face chamfered to an angle of 60° to the horizontal when in the striking position (i.e. when the hammer shaft is vertical). The hammer head shall be (50 ± 2,5) mm high, (76 ± 3,8) mm wide and (80 ± 4) mm long at mid height, as shown in Figure D.1. A suitable apparatus is described in annex D.

5.15.2.2 State of the specimen(s) during conditioning

The specimen(s) shall be rigidly mounted to the apparatus by its normal mounting means and shall be positioned so that it is struck by the upper half of the impact face when the hammer is in the vertical position (i.e. when the hammer head is moving horizontally). The azimuthal direction and position of impact relative to the specimen shall be chosen as that most likely to impair the normal functioning of the specimen. The specimen(s) shall be connected to its supply and monitoring equipment as described in 5.1.2.

5.15.2.3 Conditioning

The following conditioning shall be applied:

Impact energy:	(1,9 ± 0,1) J.
Hammer velocity:	(1,5 ± 0,13) m s^{-1}.
Number of impacts:	1.

5.15.2.4 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.

5.15.2.5 Final measurements

The response time of the specimen(s) shall be measured as described in 5.1.5 at rates of rise of air temperature of 3 K min^{-1} and 20 K min^{-1} in the orientation which gave the maximum response time in test 5.2. Before each measurement the specimen shall be stabilized to the typical application temperature specified in Table 1 according to the class marked on the specimen.

5.15.3 Requirements

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

For resettable detectors the response time at 3 K min^{-1} shall not be less than 7 min 13 s and any change in the response time compared with the time obtained in the equivalent test 5.8 shall not exceed 2 min 40 s.

For resettable detectors the response time at 20 K min^{-1} shall not be less than 30 s for class A1 detectors, 1 min 0 s for all other classes, and any change in response time compared with the time obtained in the equivalent test 5.8 shall not exceed 30 s.

For non-resettable detectors, the response times shall lie between the lower and upper response time limits specified in Table 4 for the appropriate detector class.

5.16 Vibration, sinusoidal (operational)

5.16.1 Object

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

5.16.2 Test procedure

5.16.2.1 Reference

The test apparatus and procedure shall be as described in IEC 60068-2-6:1995+Corr:1995 Test Fc, and as described below.

5.16.2.2 State of the specimen(s) during conditioning

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

5.16.2.3 Conditioning

The following conditioning shall be applied:

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

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

5.16.2.4 Measurements during conditioning

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

5.16.2.5 Final measurements

The final measurements specified in 5.17.2.4 are normally made after the vibration endurance test and only need be made here if the operational test is conducted in isolation.

5.16.3 Requirements

No alarm or fault signal shall be given during the conditioning.

For resettable detectors the response time at 3 K min^{-1} shall not be less than 7 min 13 s and any change in the response time compared with the time obtained in the equivalent test 5.8 shall not exceed 2 min 40 s.

For resettable detectors the response time at 20 K min^{-1} shall not be less than 30 s for class A1 detectors, 1 min 0 s for all other classes, and any change in response time compared with the time obtained in the equivalent test 5.8 shall not exceed 30 s.

For non-resettable detectors, the response times shall lie between the lower and upper response time limits specified in Table 4 for the appropriate detector class.

5.17 Vibration, sinusoidal (endurance)

5.17.1 Object

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

5.17.2 Test procedure

5.17.2.1 Reference

The test apparatus and procedure shall be as described in IEC 60068-2-6:1995+Corr:1995 Test Fc, and as described below.

5.17.2.2 State of the specimen(s) during conditioning

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

5.17.2.3 Conditioning

The following conditioning shall be applied:

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

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

5.17.2.4 Final measurements

The response time of the specimen(s) shall be measured as described in 5.1.5 at rates of rise of air temperature of 3 K min^{-1} and 20 K min^{-1} in the orientation which gave the maximum response time in test 5.2. Before each measurement the specimen shall be stabilized to the typical application temperature specified in Table 1 according to the class marked on the specimen.

5.17.3 Requirements

No fault signal attributable to the endurance conditioning shall be given on reconnection of the specimen.

For resettable detectors the response time at 3 K min^{-1} shall not be less than 7 min 13 s and any change in the response time compared with the time obtained in the equivalent test 5.8 shall not exceed 2 min 40 s.

For resettable detectors the response time at 20 K min^{-1} shall not be less than 30 s for class A1 detectors, 1 min 0 s for all other classes, and any change in response time compared with the time obtained in the equivalent test 5.8 shall not exceed 30 s.

For non-resettable detectors, the response times shall lie between the lower and upper response time limits specified in Table 4 for the appropriate detector class.

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

The following EMC immunity tests shall be carried out, as described in EN 50130-4:1995+A1:1998:

a) electrostatic discharge;

b) radiated electromagnetic fields;

c) conducted disturbances induced by electromagnetic fields;

d) fast transient bursts;

e) slow high energy voltage surges.

For these tests the criteria for compliance specified in EN 50130-4:1995+A1:1998 and the following shall apply:

1) The functional test, called for in the initial and final measurements, shall be as follows:

The response time of the specimen(s) shall be measured as described in 5.1.5 at rates of rise of air temperature of 3 K min^{-1} and 20 K min^{-1} in the orientation which gave the maximum response time in test 5.2. Before each measurement the specimen shall be stabilized to the typical application temperature specified in Table 1 according to the class marked on the specimen.

2) The required operating condition shall be as described in 5.1.2.

3) The acceptance criteria for the functional test after the conditioning shall be as follows:

For resettable detectors the response time at 3 K min^{-1} shall not be less than 7 min 13 s and any change in the response time compared with the time obtained in the equivalent test 5.8 shall not exceed 2 min 40 s.

For resettable detectors the response time at 20 K min^{-1} shall not be less than 30 s for class A1 detectors, 1 min 0 s for all other classes, and any change in response time compared with the time obtained in the equivalent test 5.8 shall not exceed 30 s.

For non-resettable detectors, the response times shall lie between the lower and upper response time limits specified in Table 4 for the appropriate detector class.

6 Additional tests for detectors with class suffixes

6.1 Test for suffix S detectors

6.1.1 Object

To confirm that a suffix S detector does not respond below the minimum static response temperature applicable to the class of the detector. This test is only applicable to suffix S detectors.

NOTE: Suffix S detectors may be particularly suitable for use in applications, such as boiler rooms and kitchens, where high rates of temperature rise may be sustained for long periods.

6.1.2 Test procedure

6.1.2.1 Plunge test

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 specimen shall be stabilized to the conditioning temperature specified in Table 7 according to the class marked on the specimen. At the end of the conditioning period the specimen shall be transferred, in a period not exceeding 10 s, into an airflow of 0,8 m s^{-1} (mass equivalent at 25 °C) maintained at the temperature specified in Table 7. The specimen shall be tested in the orientation which gave the minimum response time as determined by the test in 5.2. The specimen shall be exposed to the airflow for at least 10 min. Any response from the specimen during this time or during the transfer period shall be noted.

Table 7 — Conditioning and airflow temperatures

Detector class	Conditioning temperature °C	Airflow temperature °C
A1S	5 ± 2	50 ± 2
A2S	5 ± 2	50 ± 2
BS	20 ± 2	65 ± 2
CS	35 ± 2	80 ± 2
DS	50 ± 2	95 ± 2
ES	65 ± 2	110 ± 2
FS	80 ± 2	125 ± 2
GS	95 ± 2	140 ± 2

6.1.2.2 Review of response time data

The response times of the specimens tested in tests 5.4 and 5.8 shall be reviewed.

6.1.3 Requirements

The specimen subjected to the plunge test, in accordance with 6.1.2.1, shall not produce an alarm or fault signal during the transfer period or during the 10 min exposure to the airflow, when tested in accordance with 6.1.2.1.

The response times of the specimens tested in 5.4 and 5.8 shall exceed the lower limits of response time for each applicable rate of temperature rise specified in Table 8.

Table 8 — Lower limit of response for class suffix S detectors

Rate of rise of air temperature	Lower limit of response time	
K min^{-1}	min	s
3	9	40
5	5	48
10	2	54
20	1	27
30		58

NOTE: These lower limits of response time correspond to a minimum rise of temperature of 29 K above the stabilization temperature.

6.2 Test for suffix R detectors

6.2.1 Object

To confirm that a suffix R detector maintains the response requirements of its class for high rates of rise of temperature starting from an initial temperature below the typical application temperature applicable to the class marked on the detector. This test is only applicable to suffix R detectors.

NOTE: Suffix R detectors may be particularly suitable for use in unheated buildings where the ambient temperature can vary considerably and high rates of temperature rise are not sustained for long periods.

6.2.2 Test procedure

The specimens shall be tested as described in 5.1.5 at rates of rise of air temperature of 10 K min^{-1}, 20 K min^{-1} and 30 K min^{-1}. One specimen shall be tested with the orientation which gave the minimum response time and the other at the orientation which gave the maximum response time in the test in 5.2. Before each test, the air stream and the specimen shall be stabilized to the temperature specified in Table 9 according to the class marked on the specimen. The response times of the specimens shall be recorded.

Table 9 — Initial conditioning temperature for suffix R detectors

Detector class	Initial conditioning temperature °C
A1R	5 ± 2
A2R	5 ± 2
BR	20 ± 2
CR	35 ± 2
DR	50 ± 2
ER	65 ± 2
FR	80 ± 2
GR	95 ± 2

6.2.3 Requirements

The response times of the detectors shall lie between the lower and upper response time limits specified in Table 4 for the appropriate detector class.

Annex A
(normative)

Heat tunnel for response time and response temperature measurements

The following 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 heat detectors. However, since it is not practical to specify and measure all parameters which may influence the measurements, the background information in annex B should be carefully considered and taken into account when a heat tunnel is designed and used to make measurements in accordance with this standard.

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

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 m s^{-1} of the nominal test conditions, respectively. Conformance of this requirement shall be regularly verified under both static and rate-of-rise conditions, by measurements at an adequate number of points distributed within and on the imaginary boundaries of the working volume. The working volume shall be large enough to fully enclose the detector(s) to be tested, the required amount of mounting board and the temperature measuring sensor.

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

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

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

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

The air temperature measuring system shall have an overall time constant of not greater than 2 s when measured in air with a mass flow equivalent to (0,8 ± 0,1) m s^{-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 B
(informative)

Information concerning the construction of the heat tunnel

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

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

There are two basic types of heat tunnel: recirculating and non-recirculating. All else being equal, a non-recirculating tunnel requires a higher power 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 power 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 shall 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 m s^{-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.

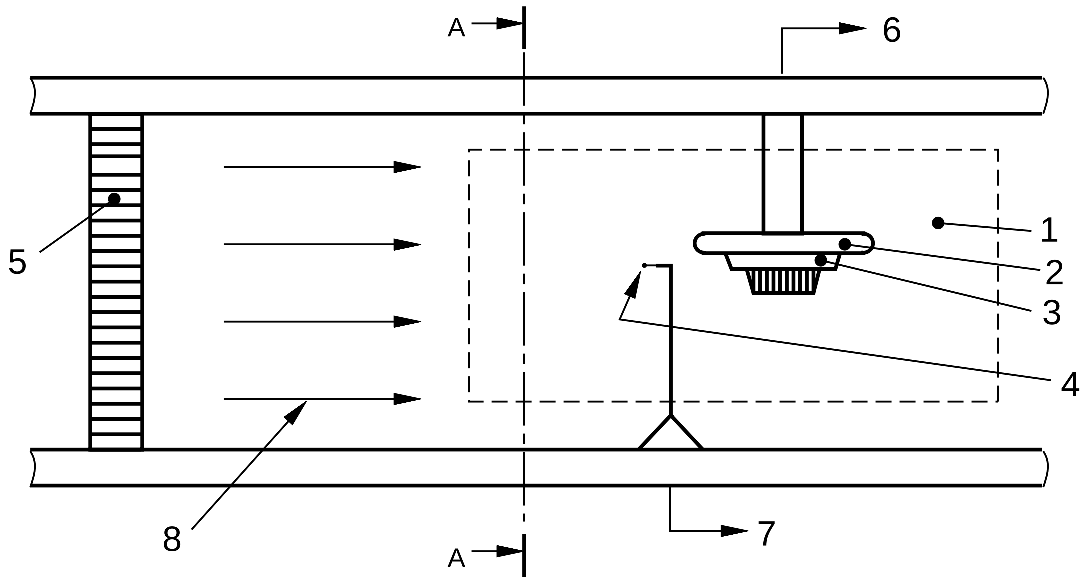
The important thing is that the specified temperature profiles are obtained with the required accuracy within the working section.

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 an appropriate correction is used 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 airflow created by a fan in the tunnel will be turbulent, and needs to pass through an air straightener to create a nearly laminar and uniform air flow in the working volume (see Figures B.1 and B.2). This can be facilitated by using a filter, honeycomb or both, in line with, and upstream of the working section of the tunnel. Care should be taken to ensure that the airflow from the heater is mixed to a uniform temperature before entering the flow straightener.

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 depth of this boundary layer and the temperature gradient across it can be reduced by constructing or lining the walls of the tunnel with a low thermal conductivity material.

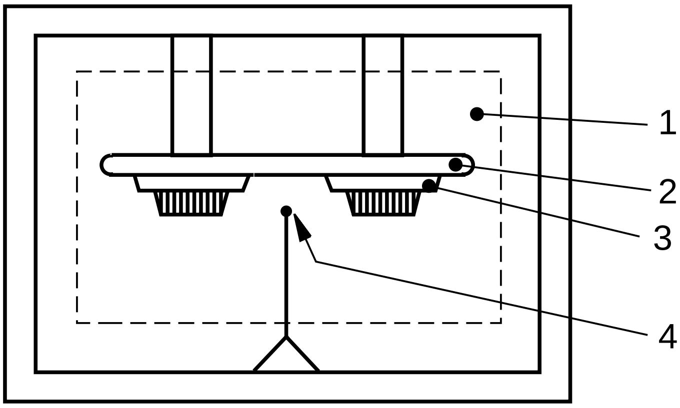
Special attention should be given to the temperature measuring system in the tunnel. The required overall time constant of not greater than 2 s in air, means that the temperature sensor should have a very small thermal mass. In practice only the fastest thermocouples and similar small sensors will be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



Key

1 working volume
2 mounting board
3 detector(s) under test
4 temperature sensor
5 flow straightener
6 to supply and monitoring equipment
7 to control and measuring equipment
8 air flow

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



Key

1 working volume
2 mounting board
3 detector(s) under test
4 temperature sensor

Figure B.2 — Example of mounting arrangement for simultaneously testing two detectors (section A — A, see Figure B.1).

Annex C
(informative)

Derivation of upper and lower limits of response times

The upper and lower limits of response times specified in this standard were derived using the same equations that were used to derive the limits specified in EN 54-5:1976 and EN 54-8:1982. However, in the interest of harmonization and in the light of experience, the value of some of the thermal constants used in the equations deviate slightly from their original value. For reference purposes the thermal constants and equations used for the derivation of the limits in this standard are set out below.

NOTE: It is noted for information that these equations were originally used to derive the limits specified in BS 3116-1:1970. Appendix G to BS 3116-1:1970 detailed the equations, the original thermal constants used and the minimum size of fires that can be detected by detectors with performances equivalent to the then specified upper response time limits, when mounted at a distance of 4.6 m (15 feet) horizontally from the fire on ceilings of various heights.

Upper limits

Upper limits of response times are derived from the theoretical response times of idealized detectors containing only a static element (fixed temperature detector). Assuming no heat losses from the sensing element, the response time of such a detector under constant conditions of air mass flow and rate of rise in air temperature depends on two design properties. The first is the 'time constant' T of the sensing element as expressed by the equation:

$$T = \frac{C}{H\,A}$$

where:

C is the thermal capacity of the heat sensitive element;

H is the coefficient of convective heat transfer to the element;

A is the surface area of the element.

The second property is the temperature at which the detector will give an alarm when subjected to an infinitely slow rate of rise of air temperature, its fixed temperature setting, which is normally set by an adjustment of a gap between contacts, electrical resistance, etc.

A decrease in either of these properties will result in a decrease in the response time of the detector at any given rate of rise of air temperature. Hence a detector having a high response time (low sensitivity) will have a high temperature setting or a long time constant or both, while a detector having a low response time (high sensitivity) will have lower values of either or both.

Assuming no heat losses, the temperature rise θ of the heat sensitive element at any time t, when subject to a constant mass flow with linearly increasing temperature α, is given by the equation:

$$T\frac{d\theta}{d t} + \theta = \alpha\, t$$

The solution of this equation is:

$$\theta = \alpha\,(t - T\,(1 - e^{-\frac{t}{T}}))$$

If θ_0 is the operating temperature rise of the sensitive element (the difference between the alarm and the stabilization temperatures) then the response time is given by the root of the above equation with θ set to θ_0. The two sets of upper response time limits given in Table 4 were calculated using the values shown in Table C.1.

Table C.1 — Thermal constants used to derive upper limits in Table 4.

Detector class	Thermal constants for upper limits	
	θ_0	T
A1	40 K	20 s
All others	45 K	60 s

The time constants shown in Table A.1 are referenced to an airflow of 0,8 m s^{-1} and should not be confused with the "response time index" (*RTI* in $m^{½}\,s^{½}$) commonly used in other heat detector standards. *RTI* referenced to 1 m s^{-1} is related to the time constant T_u at an airflow u by the following equation:

$$RTI = T_u \sqrt{u}$$

A time constant referenced to 1 m s^{-1} has the same numerical value as the *RTI* referenced to 1 m s^{-1}.

Lower limits

The purpose of imposing lower limits on the response times of detectors is to minimize the incidence of false alarms due to changes in air temperature which occur under non-fire conditions.

An analysis of the performance of rate of rise detectors made by many manufacturers has shown that, with the exception of detectors that have a performance equivalent to Class A1, they alarm at substantially the same temperature at rates of rise of between 1 K min^{-1} and 30 K min^{-1}. In the light of this finding and the wide range of application conditions in which these detectors may be installed, the minimum increase in temperature necessary to cause an alarm for detectors other than Class A1 has been set at 20 K for rates of rise of 10 K min^{-1} and above, starting from an initial temperature at or below the typical application temperature. For class A1 detectors the minimum rise in temperature to cause an alarm has been set at 10 K for rates of rise of 10 K min^{-1} and above, because it is envisaged that Class A1 detectors will be installed in environments that are not subject to large, rapid changes in temperature.

The lower limits of response times specified in Table 4 for rates of rise up to 5 K min^{-1} for class A1 and up to 30 K min^{-1} for other classes were derived from the calculated performance of a rate of rise detector consisting of two heat sensitive elements, one with a zero time constant and the other with a time constant of 34 min, and having a 19,51 K initial temperature 'setting' between the elements. These values were selected because they produce a smooth curve yielding an operating temperature rise of 29 K for 1 K min^{-1} and 20 K for 10 K min^{-1} and above. For this detector, assuming no heat losses, the response time t is given by the following equation:

$$t = T \ln\left(1 - \frac{\theta}{\alpha T}\right)$$

where:

T is the time constant of the second element;

θ is the temperature setting between the elements;

α is the rate of rise of air temperature.

Change after environmental tests

For a single measurement, the response time of a detector can be measured to a high degree of accuracy, but the response temperature is usually subject to a proportionately greater uncertainty because the temperature is changing with time, and may deviate from the required temperature at any instant by 2 K. For this reason, response time measurements have been specified in this standard for tests in which the detector is subject to rates of rise of 1 K min^{-1} and above.

Some heat detectors, particularly fixed temperature detectors with a very short thermal time constant, can produce a spread of response times from repeated measurements which reflect the temperature control limitations of the test apparatus rather than changes in the detector. This is because the response time of the detector can be more closely related to the temperature of the airflow than to the time it is subjected to a rate of rise of temperature. Conversely the response time of other detectors can be more dependant on the initial stabilization temperature than the instantaneous temperature at the moment of response. These possibilities were considered in determining the maximum change in response time between measurements made before and after the environmental tests.

The maximum allowable change at 3 K min^{-1} of 2 min 40 s equates to an 8 K change in response temperature, 4 K attributable to the measuring apparatus and 4 K to the detector. Similarly the maximum allowable change of 30 s at 20 K min^{-1} also equates to 8 K plus a further 2 K attributable to twice the rounded up, allowable uncertainty of 1 s in the measurement of response time.

Annex D
(informative)

Apparatus for impact test

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

The striker is of dimensions 76 mm wide, 50 mm high and 94 mm long (overall dimensions) and is manufactured from aluminium alloy (Al Cu_4 Si Mg to ISO 209-1:1989), solution treated and precipitation treated condition. It has a plane impact face chamfered at (60 ± 1)° to the long axis of the head. The tubular steel shaft has an outside diameter of (25 ± 0,1) mm with walls (1,6 ± 0,1) mm thick.

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

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

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

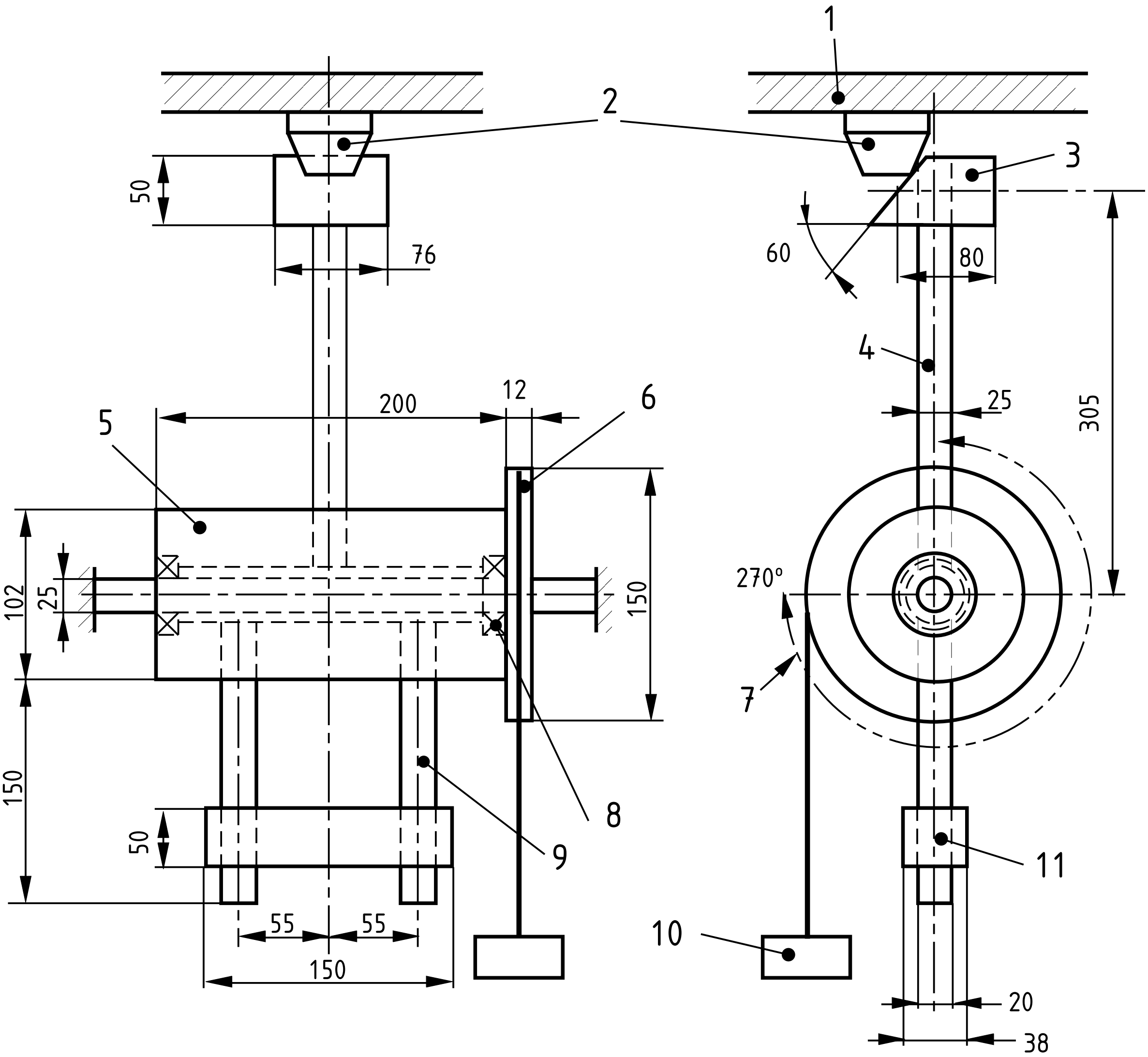
To operate the apparatus the position of the specimen and the mounting board is first adjusted as shown in Figure D.1 and the mounting board is then secured rigidly to the frame. The hammer assembly is then balanced carefully by adjustment of the counterbalance weight with the operating weight removed.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

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

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

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

Dimensions in millimetres



Key

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

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

Figure D.1 — Impact apparatus

A1 Annex ZA
(informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU Directives

ZA.1 Scope and relevant clauses

This European Standard has been prepared under the mandate M/109 given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European Standard, shown in this annex, meet the requirements of the Mandate given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the construction product covered by this European Standard for its intended use according to clause 1 (Scope) of this standard.

WARNING: Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

NOTE 1 In addition to any specific clauses relating to dangerous substances contained in this standard, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). These requirements need also to be complied with, when and where they apply.

NOTE 2 An informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA (CREATE, accessed through http://europa.eu.int/comm/enterprise/construction/internal/hygiene.htm)

This annex ZA has the same scope, in relation to the products covered, as clause 1 of this standard. This annex establishes the conditions for the CE marking of point heat detectors intended for the use shown below and identifies the relevant clauses applicable. A1

A1⟩

Construction Product: **Heat detectors — Point detectors for fire detection and fire alarm systems for buildings.**

Intended use: **Fire Safety.**

Table ZA.1 — Relevant clauses

Essential characteristics	Clauses in this European Standard	Mandated level(s)	Notes
Nominal activation conditions/Sensitivity, Response delay (response time) and Performance under fire conditions	4.2, 4.3, 5.2 to 5.6, 5.8, 6.1[a], 6.2[b]		[a] Suffix S detectors only [b] Suffix R detectors only
Operational reliability	4.4 to 4.11		
Tolerance to supply voltage	5.7		
Durability of operational reliability and response delay; temperature resistance	5.9, 5.10	None	
Durability of operational reliability; vibration resistance	5.14 to 5.17		
Durability of operational reliability; humidity resistance	5.11, 5.12		
Durability of operational reliability; corrosion resistance	5.13		
Durability of operational reliability; electrical stability	5.18		

ZA.2 Procedures for the attestation of conformity of point heat detectors covered by this standard

ZA.2.1 System of attestation of conformity

The mandate requires that the attestation of conformity system to be applied shall be that shown in Table ZA.2.

Table ZA.2 — Attestation of conformity system

Product	Intended use	Levels or classes	Attestation of conformity system
Fire detection/Fire alarm: Heat detectors — Point detectors	Fire safety	None	1
System 1: See CPD Annex III.2.(i), without audit-testing of samples.			

⟨A1

A1

This requires:

a) Tasks to be provided by the manufacturer:

1) factory production control (see ZA.2.2b);

2) testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan;

b) Tasks to be undertaken under the authority of a Notified Product Certification Body[3]:

1) type testing of the product;

2) inspection of the factory and factory production control;

3) continuous/periodic surveillance, assessment and approval of the factory production control.

ZA.2.2 Evaluation of conformity

The evaluation of conformity of point heat detectors covered by this European Standard shall be by the following:

a) Type testing

Type testing of the product shall be carried out in accordance with the clauses shown in Table ZA.1. The products tested shall be representative of the manufacturer's normal production with regard to their construction, operation and calibration. Tests previously performed in accordance with the provisions of this standard may be taken into account providing that they were made to the same system of attestation of conformity on the same product or products of similar design, construction and functionality, such that the results may be considered applicable to the product in question. Wherever a change, for example in the product design, materials or supplier of the components or of the production process occurs, which could change significantly one or more of the characteristics, the type testing shall be repeated for the relevant product performance.

b) Factory production control

The manufacturer shall establish, document and maintain a permanent factory production control system to ensure that the products placed on the market conform with the stated performance characteristics. The factory production control system shall consist of procedures, regular inspections and tests and/or assessments and the use of the results to control incoming materials or components, equipment, the production process and the product.

The production control procedure shall be adequately extensive and detailed so that the conformity of the products is made apparent to the manufacturer and so that irregularities can be detected at the earliest possible stage.

A factory production control system conforming with the requirements of EN ISO 9001, and made specific to the requirements of this standard, should be considered to satisfy the above requirements.

The production control procedure shall be recorded in a manual, which shall be made available for inspection.

3 A Notified Product Certification Body is an approved product certification body notified to the Commission by a member state, for this purpose, in accordance with article 18 of the Construction Products Directive (89/106/EEC) A1

A1⟩
The factory production control shall be recorded. These records shall be available for inspection and shall include at least the following:

1) identification of the product tested;
2) the dates of sampling;
3) the test methods applied;
4) the test and inspection results;
5) the date of tests;
6) the identification of the responsible authority within the factory;
7) calibration records;
8) actions taken.

ZA.3 CE Marking and labelling and accompanying documentation

The CE marking symbol (in accordance with Directive 93/68/EEC) shall be placed on the product and be accompanied by:

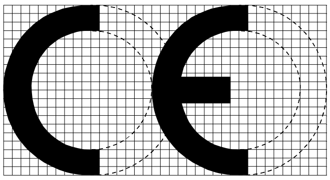
i) the identification number of the Notified Product Certification Body;
ii) the number of the EC certificate of conformity.

The CE marking symbol shall in addition be shown on the accompanying commercial documentation supplemented by

a) the identification number of the Notified Product Certification Body;
b) the name or identifying mark and registered address of the manufacturer;
c) the last two digits of the year in which the marking was affixed;
d) the number of the EC certificate of conformity;
e) the reference to this European Standard (EN 54-5);
f) the description of the construction product (e.g. Point type heat detector for fire detection and fire alarm systems for buildings);
g) the response class or classes, including any applicable suffixes (e.g. A2R);
h) the type/model designation of the product;
i) the data required by 4.10 or a reference to a document, which shall be uniquely identifiable and available from the manufacturer, containing these data.

Where the product exceeds the minimum performance levels stated in this standard, and where the manufacturer so desires, the CE marking may be accompanied by an indication of the parameter(s) concerned and the actual test result(s). ⟨A1

[A1⟩ Figure ZA.1 gives an example of the information to be given on the commercial documents.



0123

AnyCo Ltd, P.O. Box 21, B1050

01

0123 — CPD — 001

EN 54-5

Point type heat detector

Class A2R

ABC 123

Technical data: see Doc.123/2000 held by the manufacturer.

Figure ZA.1 — Example of CE marking information on the accompanying commercial documentation

ZA.4 EC certificate and declaration of conformity

The manufacturer, or his agent established in the EEA, shall prepare and retain a declaration of conformity, which authorizes the affixing of the CE marking. This declaration shall include:

— the name and address of the manufacturer, or his authorized representative established in the EEA, and the place of production;

— the description of the construction product (e.g. point heat detectors for fire detection and fire alarm systems for buildings);

— the type/model designation of the product;

— the provisions to which the product conforms (e.g. annex ZA of this EN);

— any particular conditions applicable to the use of the product (if necessary);

— the name and address (or identification number) of the Notified Product Certification Body;

— the name of and position held by the person empowered to sign the declaration on behalf of the manufacturer or of his authorized representative. ⟨A1]

The declaration shall contain a certificate of conformity with the following information:

- the name and address of the Notified Product Certification Body;
- the certificate number;
- the name and address of the manufacturer, or his authorized representative established in the EEA;
- the description of the construction product (e.g. point heat detectors for fire detection and fire alarm systems for buildings);
- the type/model designation of the product;
- the provisions to which the product conforms (e.g. annex ZA of this EN);
- any particular conditions applicable to the use of the product (if necessary);
- any conditions and period of validity of the certificate, where applicable;
- the name of and position held by the person empowered to sign the certificate.

The above mentioned declaration and certificate shall be presented (if requested) in the official language or languages of the Member State in which the product is to be used.

Bibliography

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

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