BRITISH STANDARD

BS 5839-5: 1988

Fire detection and alarm systems for buildings —

Part 5: Specification for optical beam smoke detectors

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Fire Standards Committee (FSM/-) to Technical Committee FSM/12, upon which the following bodies were represented:

British Fire Protection Systems Association Ltd.
British Fire Services Association
British Telecom
Chartered Institution of Building Services Engineers
Chief and Assistant Chief Fire Officers' Association
Department of Health and Social Security
Department of the Environment (Building Research Establishment, Fire Research Station)
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Department of Transport — Marine Directorate
Electrical Contractors' Association
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The following body was also represented in the drafting of the standard, through subcommittees and panels:

Electricity Supply Industry in England and Wales

This British Standard, having been prepared under the direction of the Fire Standards Committee, was published under the authority of the Board of BSI and comes into effect on 31 March 1988.

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Foreword

This part of BS 5839 has been prepared under the direction of the Fire Standards Committee, and is based on a draft prepared by the British Fire Protection Systems Association.

Optical beam smoke detectors detect the obscuration of an optical beam transmitted between the two parts of the detector; either a transmitter and a receiver, or a combined transmitter/receiver and a reflector. Beam detectors are commonly used for the protection of large areas, or areas with high ceilings, where the greatest risk is from materials which smoulder or burn slowly, producing visible smoke.

Beam detectors may include thermal turbulence detection elements for the detection of fires that do not produce smoke particles. However, requirements for the thermal turbulence detection element are not included in this standard.

Beam detectors are subjected to basic tests and fire sensitivity tests. In the basic tests, detectors are tested in various ways to determine whether they are capable of withstanding certain ambient conditions which may occur in practice. The tests are undertaken to determine whether the beam detector would remain functional for a sufficiently long period of practical use, or at least for the period between two services or inspections of the installed fire detection system. Furthermore, the basic tests verify the constancy of the response threshold of beam detectors relative to one another.

In the fire sensitivity test, detectors are subjected to various test fires in a fire test room. In this way the response behaviour of detectors to real fires can be verified and the sensitivity of detectors to various defined fires can be determined.

The tests are type tests and are not intended as manufacturers' tests to maintain uniformity of quality in production, which is dealt with in BS 5750. While the tests are intended to assess the most important features of the design and construction of the equipment, they cannot remove the necessity for regular inspection and maintenance, which is essential for reliable operation.

Product certification. Users of this part of BS 5839 are advised to consider the desirability of third party certification of product conformity with this British Standard based on testing and continuing surveillance, which may be coupled with assessment of a supplier's quality systems against the appropriate part of BS 5750.

Enquiries as to the availability of third party certification schemes will be forwarded by BSI to the Association of Certification Bodies. If a third party certification scheme does not already exist, users should consider approaching an appropriate body from the list of Association members.

WARNING. An evaluation should be made of the possible hazards to personnel from optical radiation arising from and associated with a particular beam detector. This evaluation should take into account the nature of the beam source(s) (i.e. whether continuous or pulsed) and its output power, the beam diameter and its wavelength(s), and the duration to which personnel would be exposed to the beam. Guidance on the evaluation of hazards to personnel arising from semiconductor emitters is in preparation.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 18, an inside back cover and a back cover.

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Section 1. General

1 Scope

This part of BS 5839 specifies requirements, test methods and performance criteria for fire detectors utilizing attenuation of an optical beam for the detection of smoke aerosols.

NOTE 1 The term "optical" is used to describe that part of the electromagnetic spectrum produced by the transmitter to which the receiver is responsive; this is not restricted to visible wavelengths.

An optical beam detector may or may not include an external reflector but is distinct from a point detector in that there is no integral mechanical connection to define or adjust the optical path length. This specification covers beam detectors with separations between the opposed components of 1 m to 100 m and minimum separations not exceeding 10 m.

Beam detectors with a minimum separation between the components defining the optical path in excess of 10 m are not covered by this standard because the dimensions of the fire test room described in BS 5445-9 preclude subjecting such detectors to the fire sensitivity test.

NOTE 2 It will not be possible to test beam detectors with a minimum separation exceeding 8 m in fire test rooms of the minimum length specified in BS 5445-9.

Detectors that detect thermal turbulence within the optical beam as an adjunct to the detection of attenuation of an optical beam are covered although the thermal turbulence detection is not tested beyond ensuring that performance as an optical beam detector is not impaired.

NOTE 3 The titles of the publications referred to in this part of BS 5839 are listed on the inside back cover.

2 Definitions

For the purposes of this part of BS 5839 the definitions given in BS 5839-1 apply together with the following.

2.1
beam detector

the components, including any reflectors, necessary for the detection of smoke by the attenuation of an optical beam

2.2
opposed components

those components of the beam detector whose positions determine the optical path

2.3
optical path length

the total distance traversed by the wavefront between the transmitter and receiver

2.4
receiver

the components receiving the optical beam

2.5
separation

the physical distance between the opposed components

2.6
transmitter

the components from which the optical beam emanates

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Section 2. Requirements

3 Requirements

3.1 Indication of operation

Each detector shall be so designed that, when used in accordance with the manufacturer's instructions (see clause **4**), the detector that is raising or has raised an alarm can be individually identified.

3.2 Indication of response threshold

Detectors having adjustable response thresholds shall provide a simple easily accessible means of indicating the actual value to which the response threshold is set.

3.3 Cable monitoring

Facilities shall be provided for monitoring connections to, or interconnections between, components of the detector such that a fault indication can be given at the control and indicating equipment in the event of any cable fault which could prevent the giving of an alarm.

3.4 Reproducibility

When tested in accordance with clause **6**, the response threshold value of each of the eight test specimens shall be not less than 0.5 dB, and the ratio between the largest and smallest response threshold values recorded shall not exceed 1.6.

3.5 Thermal turbulence

The detector shall either be insensitive to thermal turbulence or means shall be provided to enable the detector to be insensitive to thermal turbulence; the detector shall be deemed to satisfy this requirement if, when subjected to the test described in clause **7**, it satisfies the criterion for compliance specified in that clause.

Detectors incorporating thermal turbulence detection shall provide means of distinguishing between alarms generated as a result of beam obscuration and as a result of thermal turbulence.

3.6 Repeatability

The response threshold of the detector shall not vary unduly over time; the detector shall be deemed to satisfy this requirement if, when subjected to the test described in clause **8**, it satisfies the criteria for compliance specified in that clause.

3.7 Rapid changes in obscuration

The detector shall detect fires that produce a plume of thick smoke sufficient to obscure the optical path in a very short period of time; the detector shall be deemed to satisfy this requirement if, when subjected to the test described in clause **9**, it satisfies the criterion for compliance specified in that clause.

3.8 Slow changes in obscuration

The detector shall detect a slowly developing fire, despite the provision of any circuits for compensation for the effects of contamination of optical components; the detector shall be deemed to satisfy this requirement if, when subjected to the test described in clause **10**, it satisfies the criterion for compliance specified in **10.3.1**.

Detectors provided with compensation for the effects of contamination of optical components shall emit a signal (that shall not be an alarm signal) indicating that the limit of compensation has been reached and that the detector will continue to function as a non-compensating detector. The detector shall be deemed to satisfy this requirement if, when subjected to the test described in clause **10**, it satisfies the criteria for compliance specified in **10.3.2** and **10.3.3**.

3.9 Variation of supply voltage

The response threshold of the detector shall not vary unduly when subjected to specified variations in the supply voltage; the detector shall be deemed to comply with this requirement if, when subjected to the test described in clause **11**, it satisfies the criteria for compliance specified in that clause.

3.10 Optical path length dependence

The response threshold of the detector shall not vary unduly over the range of optical path lengths specified by the manufacturer; the detector shall be deemed to comply with this requirement if, when subjected to the test described in clause **12**, it satisfies the criteria for compliance specified in that clause.

3.11 Tolerance to beam misalignment

Small inaccuracies in alignment shall not affect the operation of the detector; the detector shall be deemed to satisfy this requirement if, when subjected to the test described in clause **13**, it satisfies the criterion for compliance specified in that clause.

3.12 Environmental conditions

The detector shall be capable of performing all its functions in the environmental conditions expected in buildings; the detector shall be deemed to satisfy this requirement if, when subjected to the tests described in clauses **14**, **15**, **16**, **17**, **18**, **22**, **23** and **24**, it satisfies the criteria for compliance specified in those clauses.

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3.13 Electro-derived interference

Detectors shall be protected against electrostatic and electromagnetic interference and mains and line-borne transients; the detector shall be deemed to satisfy this requirement if, when subjected to the tests described in clauses **19**, **20** and **21**, it satisfies the criteria for compliance specified in those clauses.

3.14 Fire sensitivity

The detector shall be capable of detecting a broad range of types of fire; the detector shall be deemed to comply with this requirement if, when tested in accordance with clause **25**, it satisfies the criterion for compliance specified in that clause.

4 Marking and data

4.1 Each part of the beam detector shall be marked with the following information:

a) the number and date of this British Standard, i.e. BS 5839-5:1988[1)];

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

c) the designation or type number of the beam detector.

4.2 Each beam detector shall be marked or supplied with the following data:

a) *for detectors with an internal power supply,* the maximum and minimum, and/or nominal, operating voltages, and the maximum and minimum voltages supplied by any standby battery;

for detectors with an external power supply, the maximum and minimum operating voltages;

b) the maximum and minimum separation and maximum and minimum optical path length;

c) the response threshold value of the detector in decibels. If the response threshold value is variable, the value shall be stated in decibels for the extremes of the adjustment;

d) the maximum angular misalignment.

4.3 Where the performance of the detector is influenced by the control and indicating equipment, full details of this dependence shall be marked on or supplied with the detector (see **5.3**).

4.4 Full alignment, calibration, operating and test instructions shall be marked on or supplied with each beam detector. This information shall include operating current, temperature range, minimum stabilization time after switch-on, spectral range of the receiver, and other information necessary for the successful operation of the beam detector.

4.5 Beam detectors intended for installation in unspecified systems shall be supplied with sufficient operational data to ensure compliance with clause **3**.

[1)] Marking BS 5839-5:1988 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

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Section 3. Tests

5 Testing

NOTE These tests are type tests, and the existence of a satisfactory test certificate cannot of itself be taken as an indication of compliance with this part of BS 5839 of products subsequently produced, as this will depend on the manufacturer's quality systems. It may be necessary for some or all of the tests to be repeated whenever materials or the manufacturing process are modified, dependent on an evaluation of the effect of the alterations on the validity of the original test certificate. This evaluation should be carried out either by the issuer of the test certificate or by another equally competent body.

5.1 Test specimens

Eight specimens shall be provided for use in the tests described in clauses **6** to **25**. Each specimen shall consist of all components of the beam detector including any separate reflector utilized within the optical path. The test specimens shall be representative of the product being tested.

5.2 Test schedule

The tests on each specimen indicated in Table 1 shall be carried out in the order in which they are listed.

5.3 Associated equipment

During the tests the specimens shall be connected to monitoring equipment capable of monitoring all the functions of the beam detector, and to supply equipment capable of supplying voltages complying with **5.4**.

If the monitoring equipment used is control and indicating equipment which affects the response behaviour of the beam detector (for example by introducing a time delay or by remotely setting the response threshold) then full details of the effects shall be marked on or supplied with the detector (see **4.3**).

5.4 Test voltages

Voltages applied to a specimen shall, except where a particular value is specified in a method of test, be at the nominal voltage specified by the manufacturer [see **4.2** a)] or, if a nominal voltage is not specified, at the arithmetic mean of the maximum and minimum voltages specified by the manufacturer.

Table 1 — Test schedule

Test	Clause	Specimen number[a]							
		1	2	3	4	5	6	7	8
Reproducibility	**6**	×	×	×	×	×	×	×	×
Thermal turbulence	**7**	×							
Repeatability	**8**		×						
Rapid change in obscuration	**9**	×							
Slow changes in obscuration	**10**	×							
Variation of supply voltage	**11**	×							
Optical path length dependence	**12**	×						×	
Tolerance to beam misalignment	**13**	×							
Dry heat	**14**			×					
Cold	**15**			×					
Vibration	**16**	×							
Shock	**17**		×						
Damp heat (steady state) and insulation resistance	**18**			×					
Electromagnetic fields	**19**				×				
Electrostatic discharge	**20**				×				
Electrical transients	**21**				×				
Stray light	**22**					×			
Impact	**23**					×			
SO_2 corrosion	**24**						×		
Fire sensitivity	**25**							×	×

[a] Specimen numbers are allocated as part of the reproducibility test (see clause **6**).

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5.5 Standard atmospheric conditions for testing

Unless particular values are specified in a method of test, measurements and visual observations before, during and after each test shall be carried out in the standard atmospheric conditions for testing described in BS 2011-1.1, i.e.:

a) temperature: 15 °C to 35 °C;

b) relative humidity: 45 % to 75 %;

c) barometric pressure: 86 kPa to 106 kPa.

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

5.6 Tolerances

If a specific tolerance or limit is not specified in a method of test a tolerance of ±5 % shall be applied.

5.7 Beam detectors incorporating thermal turbulence detection

Detectors which incorporate thermal turbulence detection shall be adjusted, if adjustment is provided, to give maximum sensitivity to thermal turbulence except during the test described in clause **7**.

6 Reproducibility

6.1 Object of the test

The purpose of this test is to:

a) ensure the response threshold value is not too low;

b) ensure the spread of the response threshold values of the batch of beam detectors is within certain limits;

c) rank the beam detectors for the purpose of scheduling further tests.

6.2 Detectors with a fixed response threshold value

6.2.1 *Test procedure.* Determine the response threshold A of each specimen as described in appendix A.

NOTE These individual specimen response threshold values are also used in clauses **10** and **11**.

6.2.2 *Designation of A_{min} and A_{max}.* Designate as $A_{\min}$ the lowest value recorded for A and as $A_{\max}$ the highest value recorded for A.

6.2.3 *Criteria for compliance*

6.2.3.1 The ratio $A_{\max} : A_{\min}$ shall not exceed 1.6.

6.2.3.2 The value of $A_{\min}$ shall not be less than 0.5 dB.

6.2.4 *Specimen numbering.* The specimens shall be numbered relative to their response threshold values with the specimens numbered 8 and 7 being the specimens with the highest and next highest values of A respectively, and the remaining six specimens numbered 1 to 6 arbitrarily.

6.3 Detectors with a variable response threshold value

6.3.1 *Test procedure*

6.3.1.1 Set the response threshold of each of the eight specimens to its maximum value, and determine the response threshold $A(1)$ of each specimen as described in appendix A.

NOTE These individual specimen response threshold values are also used in clauses **10** and **11**.

6.3.1.2 Set the response threshold of each specimen to its minimum value, and determine the response threshold $A(2)$ of each specimen as described in appendix A.

6.3.2 *Designation of A_{min} and A_{max}.* Designate as $A_{\min}(1)$ the lowest value recorded for $A(1)$ and as $A_{\max}(1)$ the highest value recorded for $A(1)$. Designate as $A_{\min}(2)$ the lowest value recorded for $A(2)$ and as $A_{\max}(2)$ the highest value recorded for $A(2)$.

6.3.3 *Criteria for compliance*

6.3.3.1 The ratios $A_{\max}(1) : A_{\min}(1)$ and $A_{\max}(2) : A_{\min}(2)$ shall not exceed 1.6.

6.3.3.2 The values of $A_{\min}(1)$ and $A_{\min}(2)$ shall not be less than 0.5 dB.

6.3.4 *Specimen numbering.* The specimens shall be numbered relative to their response threshold values with the specimens numbered 8 and 7 being the specimens with the highest and next highest values of $A(1)$ respectively, and the remaining six specimens numbered 1 to 6 arbitrarily.

6.3.5 *Response threshold setting.* Specimens 1 to 6 shall be set to the minimum response threshold, and specimens 7 and 8 shall be set to the maximum response threshold, as specified by the manufacturer [see **4.2** c)].

7 Thermal turbulence

7.1 Object of the test

It is known that all optical beam detectors show some sensitivity to thermal turbulence even if they do not incorporate special circuits to detect this phenomenon. The purpose of this test is to ensure that all detectors are, or can be made, insensitive to levels of thermal turbulence encountered in normal conditions.

7.2 Apparatus

The apparatus shall be capable of subjecting the optical path to a periodic variation of +0, –0.7 dB peak to peak at the following frequencies: 5 ± 1 Hz, 10 ± 1 Hz, 20 ± 2 Hz, 50 ± 5 Hz.

7.3 Test procedure

NOTE This test is intended to simulate thermal turbulence, an intrinsically random phenomenon. If the detector under test is known to sample at a certain frequency, the frequencies used in the test, whilst still within the frequency ranges specified, should not be integer multiples of the sampling frequency.

Adjust detectors that incorporate thermal turbulence detection, if adjustment is provided, to give minimum sensitivity to thermal turbulence.

Mount, stabilize, align and calibrate the specimen as described in **A.2.1**, **A.2.2** and **A.2.3**.

Vary the transmission of the optical path by a periodic variation of +0, –0.7 dB peak to peak for a period of 1 min at each of the following frequencies: 5 ± 1 Hz, 10 ± 1 Hz, 20 ± 2 Hz, 50 ± 5 Hz, monitoring the specimen to detect any fault signal or alarm signal.

7.4 Criterion for compliance

The specimen shall not emit a fault signal nor an alarm signal whilst the optical path is subjected to the periodic variation described in **7.3**.

8 Repeatability

8.1 Object of the test

To ensure that the response threshold does not change significantly when subjected to repeated testing over both short and extended periods.

8.2 Test procedure

8.2.1 Determine the response threshold A of the specimen as described in appendix A three times. The period between successive determinations shall be not less than 10 min nor greater than 1 h. Do not disconnect the specimen from its power supply after the final determination.

8.2.2 After the final determination of **8.2.1**, energize the specimen, without interruption, for 7 days, then determine the response threshold of the specimen as described in **A.2.4** three times. The period between successive determinations shall be not less than 10 min nor greater than 1 h.

8.3 Designation of A_{min} and A_{max}

Designate as A_{min} the lowest of the six values recorded for A, and as A_{max} the highest of the six values recorded for A.

8.4 Criteria for compliance

8.4.1 The ratio $A_{max} : A_{min}$ shall not exceed 1.6.

8.4.2 The value of A_{min} shall not be less than 0.5 dB.

9 Rapid change in obscuration

9.1 Object of the test

To ensure that the detector will produce an alarm signal, within an acceptable time, after a sudden large sustained increase in beam obscuration.

9.2 Apparatus

9.2.1 *Optical filter,* with an obscuration of 11.5 ± 1.5 dB over the spectral range of the specimen (see **4.4**).

9.3 Test procedure

Mount, stabilize, align and calibrate the specimen as described in **A.2.1**, **A.2.2** and **A.2.3**.

Place the filter (**9.2.1**) in the optical path as close as possible to the receiver and in such a way that the maximum obscuration is reached in less than 1 s, monitoring the specimen to detect any alarm signal.

9.4 Criterion for compliance

The specimen shall emit an alarm signal not less than 5 s nor more than 60 s after the introduction of the obscuring filter between the opposed components.

NOTE The detector may emit a fault signal prior to emitting an alarm signal.

10 Slow changes in obscuration

10.1 Object of the test

To ensure that the detector can detect a slowly developing fire, despite the provision of any circuits for compensation for the effects of contamination of optical components.

10.2 Test procedure

Determine the effect of slow changes in obscuration on the response threshold of the detector, either by circuit analysis, or by conducting a physical test (e.g. by using a detector modified in such a way that its power output may be varied).

10.3 Criteria for compliance

10.3.1 For each and every possible rate of change of obscuration R which is not less than 0.7 dB/h, the time to alarm shall not exceed $1.6 \times A/R$ by more than 30 s, where the value of A is that determined in **6.2.1** or **6.3.1.1** as appropriate.

10.3.2 At the limit of compensation a signal, that may be a fault signal, indicating that the limit of compensation has been reached, shall be or shall have been emitted.

10.3.3 At the limit of compensation an increase in obscuration of $1.6 \times A$ dB shall result in the emission of an alarm signal, where the value of A is that determined in **6.2.1** or **6.3.1.1** as appropriate.

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Table 2 — Voltage conditions for specimens with internal power supplies

Test	Mains power source voltage[a]		Standby battery voltage[a]	
	Transmitter	Receiver	Transmitter	Receiver
1	0	0	Maximum	Maximum
2	0	0	Minimum	Minimum
3	Maximum or nominal +10 %, whichever is the greater	Maximum or nominal +10 %, whichever is the greater	Maximum	Maximum
4	Minimum or nominal –15 %, whichever is the lesser	Minimum or nominal –15 %, whichever is the lesser	Minimum	Minimum
5	0	0	Maximum	Minimum
6	0	0	Minimum	Maximum
7	Maximum or nominal +10 %, whichever is the greater	Minimum or nominal –15 %, whichever is the lesser	Maximum	Minimum
8	Minimum or nominal –15 %, whichever is the lesser	Maximum or nominal +10 %, whichever is the lesser	Minimum	Maximum

[a] As stated by the manufacturer [see **4.2**a)].

11 Variation of supply voltage

11.1 Object of the test

To ensure that the response threshold of the detector does not change significantly with changes in supply voltage.

11.2 Apparatus

11.2.1 *Stabilized power supplies,* capable of providing the voltages given in Table 2 and Table 3.

11.3 Test procedure

Mount, stabilize, align and calibrate the specimen as described in **A.2.1**, **A.2.2** and **A.2.3**.

Subject specimens with internal power supplies to each of the voltage combinations given in Table 2. Subject specimens with external power supplies to each of the voltage combinations given in Table 3.

Table 3 — Voltage conditions for specimens with external power supplies

Test	Power supply voltage[a]	
	Transmitter	Receiver
1	Maximum	Maximum
2	Minimum	Maximum
3	Maximum	Minimum
4	Minimum	Minimum

[a] As stated by the manufacturer [see **4.2**a)].

For each voltage combination, after subjecting the specimen to the voltage combination for at least 1 h, determine the response threshold A of the specimen as described in **A.2.4**.

11.4 Designation of A_{min} and A_{max}

Designate as A_{min} the lowest of the values recorded for A in **11.3** and in **6.2.1** or **6.3.1.1** as appropriate, and as A_{max} the highest of the values recorded for A in **11.3** and in **6.2.1** or **6.3.1.1** as appropriate.

11.5 Criteria for compliance

11.5.1 The ratio $A_{max} : A_{min}$ shall not exceed 1.6.

11.5.2 The value of A_{min} shall not be less than 0.5 dB.

12 Optical path length dependence

12.1 Object of the test

To ensure that the response threshold does not change significantly when tested over the maximum and minimum optical path lengths stated by the manufacturer [see **4.2**b)].

12.2 Test procedure

Subject the specimen to the following tests for each optical path length range stated by the manufacturer.

a) Mount, stabilize, align and calibrate the specimen as described in **A.2.1**, **A.2.2** and **A.2.3** at the minimum optical path length. Determine the response threshold A as described in **A.2.4**.

b) Align and calibrate the specimen as described in **A.2.3** at the maximum optical path length. Determine the response threshold A as described in **A.2.4**.

12.3 Designation of A_{min} and A_{max}

Designate as A_{min} the lowest value recorded for A and as A_{max} the highest value recorded for A.

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12.4 Criteria for compliance

12.4.1 The ratio $A_{max} : A_{min}$ shall not exceed 1.6.

12.4.2 The value of A_{min} shall not be less than 0.5 dB.

13 Tolerance to beam misalignment

13.1 Object of the test

To ensure that small angular inaccuracies in alignment (within the maximum stated by the manufacturer [see **4.2**d)], resulting from installation and/or movement in the structure of a building, do not affect the operation of the detector.

13.2 Test procedure

Mount, stabilize, align and calibrate the specimen as described in **A.2.1**, **A.2.2** and **A.2.3** at the maximum specified optical path length.

Subject each of the opposed components to the following procedures whilst holding the other component stationary.

a) Rotate the component in a clockwise direction about a vertical axis at a rate of 0.3 ± 0.05° /min. Record the smallest angle at which a fault or alarm signal is emitted. Return the rotated component to its original position, reset the detector and allow it to stabilize.

b) Repeat the procedure described in a) but rotate the component in a counter-clockwise direction.

c) Repeat the procedures described in a) and b) but rotate the component about a horizontal axis normal to the axis of the beam.

13.3 Criterion for compliance

The specimen shall not emit a fault signal nor an alarm signal whilst being rotated in the directions specified within the angular tolerances stated by the manufacturer [see **4.2**d)].

NOTE The emission of signals during the return of a component to its original position should be ignored.

14 Dry heat

14.1 Object of the test

To determine the suitability of the detector to operate under conditions of high ambient temperature.

14.2 Test procedure

14.2.1 *General.* Carry out the test procedure described in test Bb of BS 2011-2.1B.

14.2.2 *Initial measurements.* Determine the response threshold A of the specimen as described in appendix A.

14.2.3 *State of the specimen during conditioning.* Mount, stabilize, align and calibrate the specimen as described in **A.2.1**, **A.2.2** and **A.2.3**.

14.2.4 *Conditioning.* Apply the following severity of conditioning:

a) temperature: 55 ± 2 °C;

b) duration: 16 h.

14.2.5 *Measurements during conditioning.* Monitor the specimen during the conditioning period to detect any fault or alarm signal.

14.2.6 *Intermediate measurements.* At the end of the conditioning period, whilst the specimen is still in the conditioning atmosphere, determine the response threshold A of the specimen as described in **A.2.4**.

14.2.7 *Final measurements.* After the recovery period determine the response threshold A of the specimen as described in appendix A.

14.3 Designation of A_{min} and A_{max}

Designate as A_{min} the lowest value recorded for A and as A_{max} the highest value recorded for A.

14.4 Criteria for compliance

14.4.1 The ratio $A_{max} : A_{min}$ shall not exceed 1.6.

14.4.2 The value of A_{min} shall not be less than 0.5 dB.

14.4.3 The specimen shall not emit a fault signal nor an alarm signal during the conditioning period.

15 Cold

15.1 Object of the test

To determine the suitability of the detector to operate under conditions of low ambient temperature.

15.2 Method of test

15.2.1 *General.* Carry out the test procedure described in test Ab of BS 2011-2.1A.

15.2.2 *Initial measurements.* Determine the response threshold A of the specimen as described in appendix A.

15.2.3 *State of the specimen during conditioning.* Mount, stabilize, align and calibrate the specimen as described in **A.2.1**, **A.2.2** and **A.2.3**.

15.2.4 *Conditioning.* Apply the following severity of conditioning:

a) temperature: −10 ± 2 °C;

b) duration: 16 h.

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15.2.5 *Measurements during conditioning.* Monitor the specimen during the conditioning period to detect any fault or alarm signal.

15.2.6 *Intermediate measurements.* At the end of the conditioning period, whilst the specimen is still in the conditioning atmosphere, determine the response threshold A of the specimen as described in **A.2.4**.

15.2.7 *Final measurements.* After the recovery period determine the response threshold A of the specimen as described in appendix A.

15.3 Designation of A_{min} and A_{max}

Designate as A_{min} the lowest value recorded for A and as A_{max} the highest value recorded for A.

15.4 Criteria for compliance

15.4.1 The ratio $A_{max} : A_{min}$ shall not exceed 1.6.

15.4.2 The value of A_{min} shall not be less than 0.5 dB.

15.4.3 The specimen shall not emit a fault signal nor an alarm signal during the conditioning period.

16 Vibration

16.1 Object of the test

To determine the suitability of the detector to operate under conditions of vibration transmitted through its mountings.

16.2 Apparatus

16.2.1 *Vibration apparatus,* in accordance with clause **4** of BS 2011-2.1Fc:1983 and capable of producing the vibration frequencies and amplitudes given in **16.3.4**.

16.3 Test procedure

16.3.1 *General.* Carry out the test procedure described in BS 2011-2.1 Fc, applying the conditioning severities given in **16.3.4**.

Expose the specimen to the conditioning vibration in each of three mutually perpendicular planes in turn one of which is perpendicular to the plane of mounting of the test specimen.

16.3.2 *Initial measurements.* Determine the response threshold A of the specimen as described in appendix A.

16.3.3 *State of the specimen during conditioning.* Mount the specimen rigidly by its normal mounting means and so that the gravitational force acts in the same direction as it would in use unless the effect of gravitational force is not important, in which case the specimen may be mounted in any attitude. The specimen shall not be connected to the power supply.

16.3.4 *Conditioning.* Apply the following severity of conditioning:

a) frequency range:	10 Hz to 150 Hz;
b) acceleration amplitude:	9.81 $m \cdot s^{-2}$;
c) number of axes:	3;
d) number of sweep cycles[2] per axis:	20.

16.3.5 *Final measurements.* Determine the response threshold A of the specimen as described in appendix A.

16.4 Designation of A_{min} and A_{max}

Designate as A_{min} the lower value recorded for A and as A_{max} the higher value recorded for A.

16.5 Criteria for compliance

16.5.1 The ratio $A_{max} : A_{min}$ shall not exceed 1.6.

16.5.2 The value of A_{min} shall not be less than 0.5 dB.

17 Shock

17.1 Object of the test

To ensure that the response threshold of the detector does not change significantly when the structures to which it is attached are subjected to physical shock.

17.2 Apparatus

The apparatus is as illustrated in Figure 1 and consists of the following:

a) *beam,* consisting of European oak (*Quercus robur L.* or *Quercus petraea Liebl.*), rigidly bolted to two European oak supports of 300 mm length;

b) *cylindrical steel block,* with a base area of 18 cm^2 ± 10 % and a mass of 1 kg, and a vertical guide;

c) *concrete piers.*

NOTE If formed from blocks, concrete blocks complying with BS 6073 should be used.

[2] The sweep cycle consists of a traverse of the specified frequency range once in each direction, i.e. 10 Hz to 150 Hz to 10 Hz. The sweeping is continuous and the frequency changes exponentially with time with a sweep rate of 1 ± 0.1 octaves/min.

17.3 Test procedure

17.3.1 Mount one of the opposed components on the oak beam [**17.2**a)] such that the shock it receives is in the same plane as that which it would encounter in normal use. Mount the other component, and stabilize, align and calibrate the specimen as described in **A.2.1**, **A.2.2** and **A.2.3**. Determine the response threshold value A as described in **A.2.4**.

17.3.2 Drop a cylindrical steel block [**17.2**b)] onto the centre of the upper horizontal face of the beam from a height of 700 mm, guiding the block by suitable means so that it strikes the beam with its longitudinal axis vertical. Record whether a fault or alarm signal was emitted.

17.3.3 Determine the response threshold value A as described in **A.2.4**.

17.3.4 Repeat the procedures of **17.3.1**, **17.3.2** and **17.3.3** for the other opposed component.

17.4 Designation of A_{min} and A_{max}

Designate as A_{min} the lowest value recorded for A and as A_{max} the highest value recorded for A.

17.5 Criteria for compliance

17.5.1 The ratio $A_{max} : A_{min}$ shall not exceed 1.6.

17.5.2 The value of A_{min} shall not be less than 0.5 dB.

17.5.3 The specimen shall not emit a fault signal nor an alarm signal as a result of the dropping of the steel block [**17.2**b)].

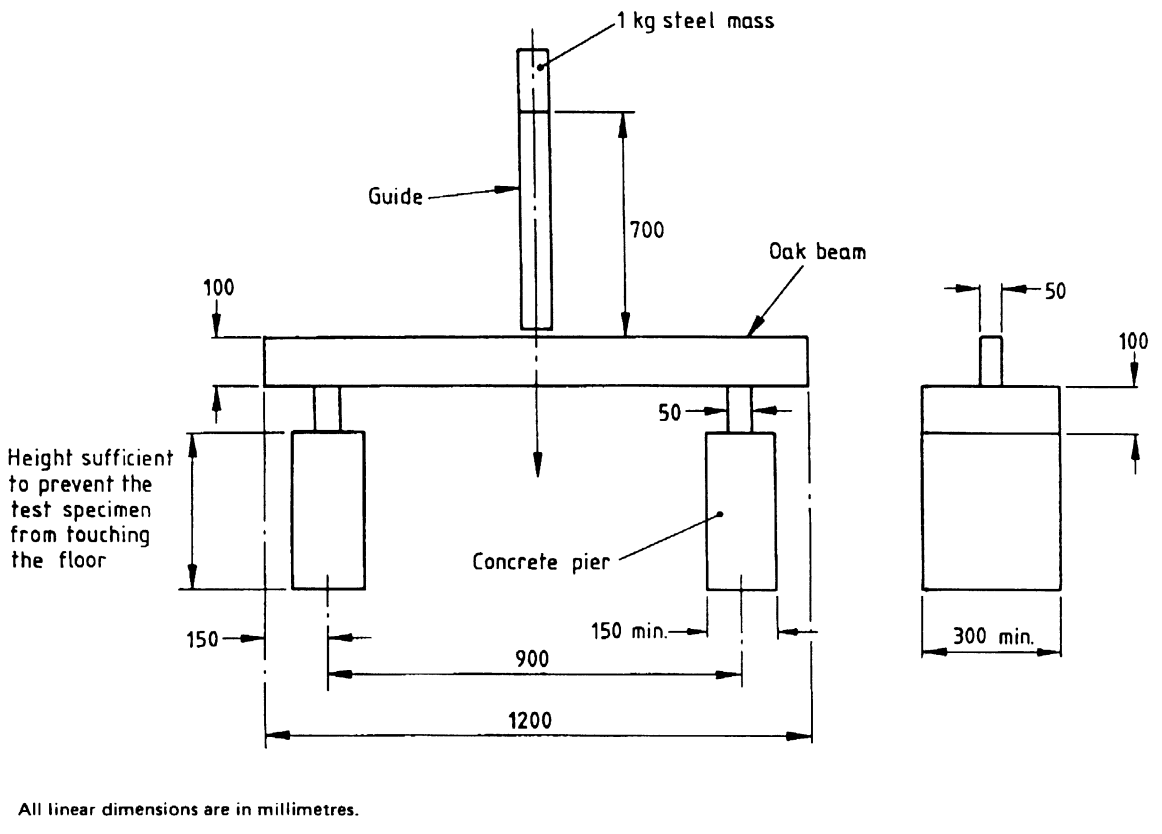

Figure 1 — Shock test apparatus

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18 Damp heat (steady state) and insulation resistance

18.1 Object of the test

To determine the suitability of the detector to withstand and operate under conditions of high relative humidity, where the absorption of humidity is mainly by diffusion.

A test of the insulation resistance is included to ensure that an acceptable level of insulation resistance can be maintained after being subjected to humid conditions.

18.2 Apparatus

18.2.1 *Testing chamber,* in accordance with clause **2** of BS 2011-2.1Ca:1977 and capable of producing the atmospheric conditions given in **18.3.4**.

18.3 Test procedure

18.3.1 *General.* Carry out the test procedure described in BS 2011-2.1Ca, applying the conditioning severities given in **18.3.4**.

18.3.2 *Initial measurements.* Determine the response threshold *A* of the specimen as described in appendix A.

18.3.3 *State of the specimen during conditioning.* Mount, stabilize, align and calibrate the specimen as described in **A.2.1**, **A.2.2** and **A.2.3**.

18.3.4 *Conditioning.* Apply the following severity of conditioning:

a) temperature: 30 ± 2 °C;

b) relative humidity: 93^{+2}_{-3} %;

c) duration: 16 h;

d) recovery period: 12 h.

18.3.5 *Measurements during conditioning.* Monitor the specimen during the conditioning period to detect any fault signal or alarm signal.

18.3.6 *Final measurements.* After the recovery period determine the response threshold *A* of the specimen as described in appendix A. Within 1 h of the determination of the response threshold value, disconnect the specimen and perform the following test.

a) Cover double insulated equipment with conductive foil and treat an electrical connection to the foil as the earth terminal.

b) Mount the specimen on a metal plate and connect the metal plate to the earth terminal(s) of the specimen.

c) Apply a test voltage between the metal plate and all the terminals for external conductors (excluding earth terminals) connected together. The test voltage shall be direct current and shall be equal to the highest of 50 V, twice the maximum voltage of the specimen, and 220 % of the nominal voltage of the specimen. After the voltage has been applied for 60 ± 5 s either:

1) record the insulation resistance between the metal plate and the connected together terminals; or

2) record the highest leakage current between the metal plate and the connected together terminals over a 5 s period.

18.4 Designation of A_{min} and A_{max}

Designate as A_{min} the lower value recorded for *A* and as A_{max} the higher value recorded for *A*.

18.5 Criteria for compliance

18.5.1 The ratio $A_{max} : A_{min}$ shall not exceed 1.6.

18.5.2 The value of A_{min} shall not be less than 0.5 dB.

18.5.3 The specimen shall not emit a fault signal nor an alarm signal during the conditioning.

18.5.4 Either

a) the leakage current shall not exceed 50 μa; or

b) the insulation resistance shall not be less than 9 MΩ.

19 Electromagnetic fields

19.1 Object of the test

To determine the suitability of the detector to withstand and operate when subjected to electromagnetic fields.

19.2 Test procedure

19.2.1 *General.* Carry out the test procedure described in BS 6667-3.

19.2.2 *Initial measurements.* Determine the response threshold *A* of the specimen as described in appendix A.

19.2.3 *State of the specimen during conditioning.* Mount, stabilize, align and calibrate the specimen as described in **A.2.1**, **A.2.2** and **A.2.3**.

19.2.4 *Conditioning.* Apply the severity of conditioning described as level 3 in clause **5** of BS 6667-3:1985 (i.e. 10 V/m).

19.2.5 *Measurements during conditioning.* Monitor the specimen during the conditioning to detect any fault signal or alarm signal.

19.2.6 *Final measurements.* Determine the response threshold *A* of the specimen in accordance with appendix A.

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19.3 Designation of A_{min} and A_{max}

Designate as A_{min} the lower value recorded for A and as A_{max} the higher value recorded for A.

19.4 Criteria for compliance

19.4.1 The ratio $A_{max} : A_{min}$ shall not exceed 1.6.

19.4.2 The value of A_{min} shall not be less than 0.5 dB.

19.4.3 The specimen shall not emit a fault signal nor an alarm signal during the conditioning.

20 Electrostatic discharge

20.1 Object of the test

To determine the suitability of the detector to withstand and operate when subjected to electrostatic discharges, including those which may occur between electrostatically charged objects brought together near to the detector.

20.2 Test procedure

20.2.1 *General.* Carry out the test procedure described in BS 6667-2.

20.2.2 *Initial measurements.* Determine the response threshold A of the specimen as described in appendix A.

20.2.3 *State of the specimen during conditioning.* Mount, stabilize, align and calibrate the specimen as described in **A.2.1**, **A.2.2** and **A.2.3**.

20.2.4 *Conditioning.* Apply the severity of conditioning described as level 3 in clause **5** of BS 6667-2:1985 (i.e. 8 kV), with a time interval between successive discharges of 5 s.

20.2.5 *Measurements during conditioning.* Monitor the specimen during the conditioning to detect any fault signal or alarm signal.

20.2.6 *Final measurements.* Determine the response threshold A of the specimen as described in appendix A.

20.3 Designation of A_{min} and A_{max}

Designate as A_{min} the lower value recorded for A and as A_{max} the higher value recorded for A.

20.4 Criteria for compliance

20.4.1 The ratio $A_{max} : A_{min}$ shall not exceed 1.6.

20.4.2 The value of A_{min} shall be not less than 0.5 dB.

20.4.3 The specimen shall not emit a fault signal nor an alarm signal during the conditioning.

21 Electrical transients

21.1 Object of the test

To determine the suitability of the detector to withstand and operate when subjected to the type of interference originating from switching transients.

21.2 Test procedure

21.2.1 *General.* The test procedure shall be as described in IEC 801-4.

21.2.2 *Initial measurements.* Determine the response threshold A of the specimen as described in appendix A.

21.2.3 *State of the specimen during conditioning.* Mount, stabilize, align and calibrate the specimen as described in **A.2.1**, **A.2.2** and **A.2.3**.

21.2.4 *Conditioning.* Apply the following severity of conditioning:

a) peak test voltage: 0.5 kV ± 10 %;

b) polarity: positive and negative;

c) test duration: 10^{+1}_{-0} s;

d) number of tests: 20 on each connecting line of the specimen.

21.2.5 *Measurements during conditioning.* Monitor the specimen during the conditioning to detect any fault signal or alarm signal.

21.2.6 *Final measurements.* Determine the response threshold A of the specimen as described in appendix A.

21.3 Designation of A_{min} and A_{max}

Designate as A_{min} the lower value recorded for A and as A_{max} the higher value recorded for A.

21.4 Criteria for compliance

21.4.1 The ratio $A_{max} : A_{min}$ shall not exceed 1.6.

21.4.2 The value of A_{min} shall not be less than 0.5 dB.

21.4.3 The specimen shall not emit a fault signal nor an alarm signal during the conditioning.

22 Stray light

22.1 Object of the test

To ensure that the response threshold does not change significantly as a result of exposure to stray light.

22.2 Apparatus

22.2.1 150 W *tungsten filament lamps,* complying with BS 161, arranged at 2 m centres along a line parallel to the optical path as shown in Figure 2. The lamps are aged for 1 h before use and discarded after 750 h of use.

22.2.2 *Tubular fluorescent lamps,* complying with data sheet 1853-04-01 of BS 1853-2:1979 (i.e. 2.4 m, 100 W, warm white), arranged along a line parallel to the optical path as shown in Figure 2. The lamps are aged for 100 h before use and discarded after 2 000 h of use.

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22.3 Test procedure

22.3.1 *Initial measurements.* Determine the response threshold A of the specimen as described in appendix A.

22.3.2 *State of the specimen during conditioning.* Mount the specimen as described in **A.2.1**, with the apparatus arranged as shown in Figure 2. Position the receiver as shown in Figure 2, with the distance between the opposed components not less than 10 m for specimens with a maximum separation of 10 m or more, and equal to the maximum separation where this is less than 10 m.

Neutral density filters shall not be inserted into the beam to reduce the distance between the opposed components.

Stabilize, align and calibrate the specimen as described in **A.2.2** and **A.2.3**.

22.3.3 *Conditioning.* Apply the following severity of conditioning.

a) Perform the following illumination cycle for all lamps together 10 times: 10 s on, 10 s off.

b) Switch on all lamps together for at least 60 min.

22.3.4 *Measurements during conditioning.* Monitor the specimen during the conditioning to detect any fault signal or alarm signal.

At the end of the conditioning, with the lamps still switched on, determine the response threshold A as described in appendix A.

22.4 Designation of A_{min} and A_{max}

Designate as A_{min} the lower value recorded for A and as A_{max} the higher value recorded for A.

22.5 Criteria for compliance

22.5.1 The ratio $A_{max} : A_{min}$ shall not exceed 1.6.

22.5.2 The value of A_{min} shall not be less than 0.5 dB.

22.5.3 The specimen shall not emit a fault signal nor an alarm signal during the conditioning period.

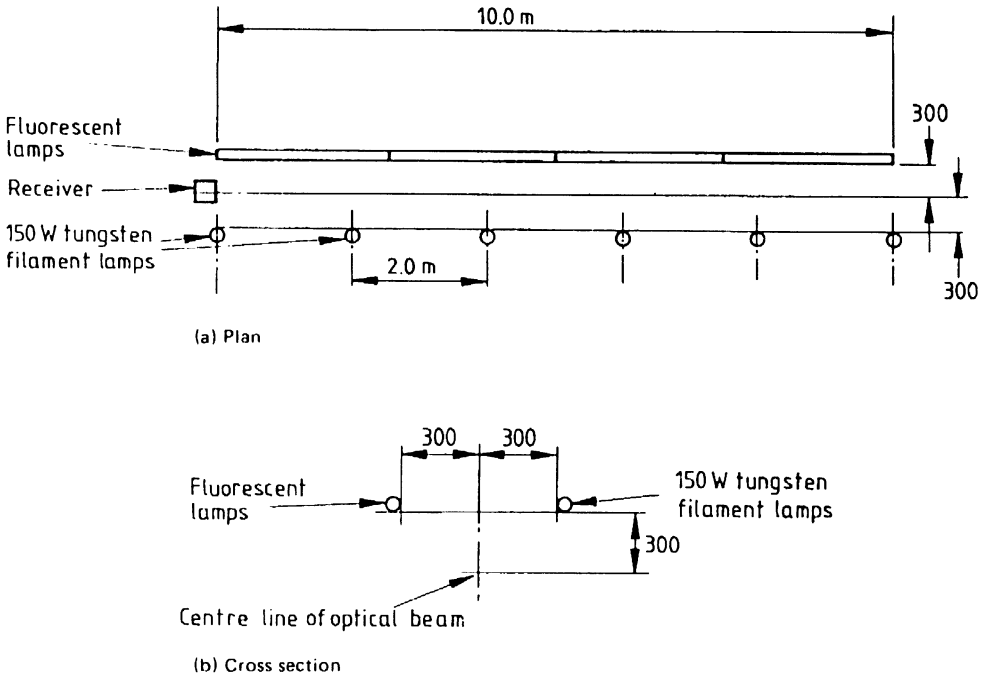

Figure 2 — Stray light apparatus

23 Impact

23.1 Object of the test

To ensure that the response threshold does not change significantly when subjected to mechanical impact.

23.2 Apparatus

23.2.1 *Spring-operated impact-test apparatus,* in accordance with **18.2.1** of BS 3955:1986 and which shall produce a blow with energy at the moment of impact of 0.5 ± 0.04 N·m.

23.3 Test procedure

23.3.1 *Initial measurements.* Determine the response threshold *A* of the specimen as described in appendix A.

23.3.2 *State of the specimen during the test.* Mount[3], stabilize, align and calibrate each specimen as described in **A.2.1**, **A.2.2** and **A.2.3**.

23.3.3 *Method of test.* For each of the opposed components in turn, apply a single impact to each point on the component which is deemed to be susceptible to mechanical damage that would impair the correct operation of the detector, up to a maximum of 20 points on each component. (For example, lenses, windows and devices used for adjusting alignment may be deemed susceptible to damage.) No two points at which impacts are applied shall be less than 10 mm apart.

Components deemed to have less than 20 such susceptible points shall have the balance of the 20 impacts distributed arbitrarily over the remainder of the surface of the component.

23.3.4 *Measurements during the test.* Where the application of the impact apparatus will not obscure the optical beam, monitor the specimen to detect any fault signal or alarm signal.

23.3.5 *Final measurements.* Determine the response threshold *A* of the specimen as described in **A.2.4**.

23.4 Designation of A_{min} and A_{max}

Designate as A_{min} the lower value recorded for *A* and as A_{max} the higher value recorded for *A*.

23.5 Criteria for compliance

23.5.1 The ratio $A_{max} : A_{min}$ shall not exceed 1.6.

23.5.2 The specimen shall not emit a fault signal nor an alarm signal as a result of the application of the impact apparatus.

24 SO_2 corrosion

24.1 Object of the test

To determine the suitability of the detector for use and storage in an atmosphere combining high relative humidity and a high sulphur dioxide content.

24.2 Apparatus

24.2.1 *Test chamber,* in accordance with clause **3** of BS 2011-2.1Kc:1977 and capable of producing the atmospheric conditions given in **24.3.3**.

24.3 Test procedure

24.3.1 *General.* Carry out the test procedure described in BS 2011-2.1Kc, applying the conditioning severity given in **24.3.3**.

24.3.2 *Initial measurements.* Determine the response threshold *A* of the specimen as described in appendix A.

24.3.3 *Conditioning.* Apply the following severity of conditioning:

a) temperature: 25 ± 2 °C;

b) relative humidity: 93^{+2}_{-3} %;

c) SO_2 concentration: 25 ± 5 p.p.m. (*V*/*V*);

d) exposure period: 21 days;

e) recovery period: 7 days.

24.3.4 *Final measurements.* Determine the response threshold *A* of the specimen as described in appendix A.

24.4 Designation of A_{min} and A_{max}

Designate as A_{min} the lower value recorded for *A* and as A_{max} the higher value recorded for *A*.

24.5 Criteria for compliance

24.5.1 The ratio $A_{max} : A_{min}$ shall not exceed 1.6.

24.5.2 The value of A_{min} shall not be less than 0.5 dB.

25 Fire sensitivity

25.1 Object of the test

To verify that the detectors will respond to real fires.

25.2 Apparatus

25.2.1 *Test room,* in accordance with clause **5** of BS 5445-9:1984, and any necessary apparatus for carrying out test fires TF 1, TF 2, TF 3, TF 4, and TF 5 as described in BS 5445-9:1984.

[3] See note 1 to **A.2.1**.

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25.2.2 *Optical density meter,* in accordance with appendix C of BS 5446-1:1977 positioned so that the obscuration over a path 8 m long and 250 mm below the ceiling of the test room is measured (see Figure 3).

25.3 Test procedure

25.3.1 *General.* Carry out the test procedure described in BS 5445-9, positioning the specimens as described in **25.3.2**, with an additional measurement of smoke density made using an optical density meter (**25.2.2**).

25.3.2 *Mounting of specimens.* Mount each specimen in the test room (**25.2.1**) in the position shown in Figure 3, for each distance between the opposed components given in Table 4, in such a way that the mechanical stability of the specimens during the test is ensured; the opposed components should be equidistant from the centre of the test room. The optical paths should be parallel to the longer walls of the test room, and 250 mm below the ceiling of the test room unless this is not permitted by the physical dimensions of the opposed components, in which case the beam should be as close as possible to the ceiling.

25.3.3 *Preparation of specimens for testing.* Adjust specimens which include thermal turbulence detection, if adjustment is provided, to give minimum sensitivity to thermal turbulence.

Connect each specimen to suitable supply and monitoring equipment (see **5.3**). Stabilize, align and calibrate the specimens as described in **A.2.2** and **A.2.3** before each test fire for each of the combinations of response threshold value and distance between the opposed components given in Table 4.

25.3.4 *Fire sensitivity testing.* Subject the specimens to test fires TF 1, TF 2, TF 3, TF 4, and TF 5 as described in BS 5445-9:1984 in that sequence for each of the combinations of response threshold value and distance between the opposed components given in Table 4. Position each test fire in the centre of the test room floor.

For each test fire record the optical density at which each specimen emits an alarm signal.

25.4 Criterion for compliance

The optical densities recorded for each of the two specimens for the combinations of response threshold value and distance between the opposed components given in Table 4 for each of the five test fires shall be not less than 0.5 dB nor more than 6.0 dB.

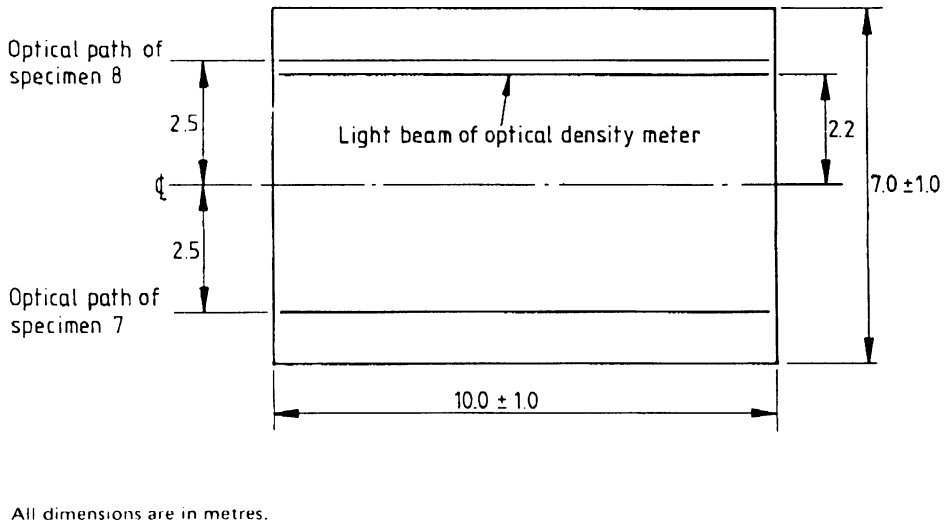

Figure 3 — Fire sensitivity test room plan

Table 4 — Response threshold values and distances between opposed components for fire sensitivity testing

	Specimen number	Response threshold value	Distance between the opposed components
Detectors with a fixed response threshold value			
Minimum separation less than 8 m	8	Fixed	Minimum separation
	7	Fixed	8 m or maximum separation, whichever is the lesser
Minimum separation 8 m or more	7 and 8	Fixed	Minimum separation
Detectors with a variable response threshold value			
Minimum separation less than 8 m	8	Minimum	Minimum separation
	7	Maximum	8 m or maximum separation, whichever is the lesser
Minimum separation 8 m or more	7 and 8	Maximum	Minimum separation

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Appendix A Determination of the response threshold value

A.1 Apparatus

A.1.1 *Set of filters,* neutral over the spectral range of the receiver (see **4.4**), capable of use individually or in combination to give a resolution as given in Table 5.

Table 5 — Minimum resolutions for optical density filters

Filter obscuration	Minimum resolution
dB	dB
less than 1.0	0.1
1.0 to 1.9	0.2
2.0 to 3.9	0.3
4.0 to 6.0	0.4
more than 6.0	1.0

NOTE The obscuration value A (in dB) of a filter or group of filters can be calculated as follows:

$$A = 10 \log_{10} (l_o/l)$$

where

l_o is the received intensity without filters;

l is the received intensity reduced by filters.

A.2 Test procedure

A.2.1 Mounting procedure

Mount the specimen with the distance between the opposed components within the range stated by the manufacturer.

NOTE 1 It is essential for the impact test (see **23.3**) that the specimen is mounted in such a way as to simulate mounting on a solid wall, e.g. by mounting on a concrete block with a mass of not less than 15 kg.

NOTE 2 The physical constraints imposed by some test apparatus may make it impossible for the separation to be within the normal working range of the detector. In such cases it is permissible to use a smaller separation than the minimum stated by the manufacturer if neutral density filters complying with **A.1** are inserted in the beam so as to reduce the received signal level to a value within the normal working range of the detector. However, this technique may not be used in the test procedure for the stray light test (see **22.3**).

Connect the specimen to a suitable power source and to the monitoring equipment (see **5.3**), or, if already mounted and connected, reset the specimen.

A.2.2 Stabilization

Allow the specimen to stabilize for a period not less than that stated by the manufacturer (see **4.4**).

A.2.3 Alignment and calibration

Align and calibrate the specimen according to the manufacturer's instructions (see **4.4**).

A.2.4 Determination of the minimum level of obscuration

A.2.4.1 Place filters with an obscuration of 0.4 dB in the optical path and as close as possible to the receiver (to minimize the effects of scatter within the filters). If an alarm is signalled within 30 s, record the obscuration level as less than 0.5 dB and terminate the test.

A.2.4.2 Determine the minimum level of obscuration at which the specimen, having been allowed to stabilize (see **A.2.2**), signals an alarm within 30 s of filters representing that level of obscuration being placed in the optical path as close as possible to the receiver.

NOTE Cognizance should be given to any compensation techniques employed in the detector and steps should be taken to ensure that such compensation does not affect the determination.

A.2.4.3 If the detector fails to signal an alarm at an obscuration of 10 dB, record an obscuration level of more than 10.0 dB and terminate the test.

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Publications referred to

BS 161, *Specification for tungsten filament lamps for general service (batch testing).*
BS 1853, *Tubular fluorescent lamps for general lighting service.*
BS 1853-2, *Specification for lamps used in the United Kingdom not included in Part 1.*
BS 2011, *Basic environmental testing procedures.*
BS 2011-1.1, *General and guidance.*
BS 2011-2.1A, *Tests A. Cold.*
BS 2011-2.1B, *Tests B. Dry heat.*
BS 2011-2.1Ca, *Test Ca. Damp heat, steady state.*
BS 2011-2.1Fc, *Test Fc. Vibration (sinusoidal).*
BS 2011-2.1Kc, *Test Kc. Sulfur dioxide test for contacts and connections.*
BS 3955, *Specification for electrical controls for household and similar general purposes.*
BS 4803, *Radiation safety of laser products and systems*[4)].
BS 5445, *Components of automatic fire detection systems.*
BS 5445-9, *Methods of test of sensitivity to fire.*
BS 5446, *Specification for components of automatic fire alarm systems for residential premises.*
BS 5446-1, *Point-type smoke detectors.*
BS 5750, *Quality systems*[4)].
BS 5839, *Fire detection and alarm systems for buildings.*
BS 5839-1, *Code of practice for system design, installation and servicing.*
BS 6073, *Precast concrete masonry units.*
BS 6667, *Electromagnetic compatibility for industrial-process measurement and control equipment.*
BS 6667-2, *Method of evaluating susceptibility to electrostatic discharge.*
BS 6667-3, *Method of evaluating susceptibility to radiated electromagnetic energy.*
IEC 801, *Electromagnetic compatibility for industrial-process measurement and control equipment.*
IEC 801-4, *Electrical fast transient requirements.*

[4)] Referred to in the foreword only.

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