

Fire detection and alarm systems for buildings —

Part 5: Specification for optical beam smoke detectors

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- 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)
- Department of the Environment (Property Services Agency)
- Department of Transport — Marine Directorate
- Electrical Contractors' Association
- Electrical Installation Equipment Manufacturers' Association (BEAMA Ltd.)
- Fire Insurers' Research and Testing Organization (FIRTO)
- Fire Offices Committee
- Fire Protection Association
- Home Office
- Institution of Electrical Engineers
- Institution of Fire Engineers
- Ministry of Defence
- National Inspection Council for Electrical Installation Contracting
- Royal Institute of British Architects
- Society of Fire Protection Engineers
- Trades Union Congress

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

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.

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 5839-5:1988¹⁾;
- 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.

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).