BRITISH STANDARD

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Fire detection and alarm systems for buildings —

Part 4: Specification for control and indicating equipment

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Committees responsible for this British Standard

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British Fire Protection Systems Association Ltd.
British Fire Services' Association
British Telecommunications plc
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

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Contents

Foreword

This part of BS 5839 has been prepared under the direction of the Fire Standards Committee, and is a revision of BS 3116-4:1974, which is withdrawn. This edition may be revised, amended or superseded on the publication of EN 54-2, which deals with control and indicating equipment.

A simple single zone control unit suitable for small buildings is described in Appendix G of BS 5839-1:1998.

The tests specified herein are intended to assess the resistance of the equipment to the normal range of environmental conditions which may be encountered in buildings in temperate climates. Additional requirements may have to be met if the equipment is used in a flammable atmosphere (see BS 5345 and BS 5501) or outdoors.

The purpose of this part of BS 5839 is to ensure the satisfactory performance of the control and indicating equipment (and any associated power supply unit) used in a fire alarm system, but the overall performance of the system is dependent on its proper installation, etc. Guidance on these matters is given in BS 5839-1.

The purpose of a fire alarm system is to give warning of fire at the earliest practicable moment, in order that appropriate emergency measures may be taken. It is the primary function of the control and indicating equipment to raise an effective alarm in response to the operation of a trigger device by automatically switching on alarm sounders at the protected premises, by indicating where the operated trigger device is situated and, in certain cases, by transmitting a fire alarm signal to a remote manned centre.

Automatic indication of those faults directly affecting the primary function of the equipment is required. Other faults that do not affect the primary function need not be automatically indicated but should be recognizable by routine testing. Such routine testing is of the greatest importance in ensuring the continued effectiveness of the system, is necessary for systems installed in accordance with BS 5839-1 and, therefore, a test schedule and a recommended time interval between tests is required to highlight faults which may impair the effectiveness of the equipment. Specific requirements cannot be given for these test schedules since the testing routine will vary widely with the type of equipment or system.

This part of BS 5839 does not specify the facilities that have to be provided in the control and indicating equipment for a particular installation: these are determined by the plan for the action to be taken in the event of fire that should be prepared as part of the fire precautions of any building. Reference should be made to BS 5839-1 and BS 5588.

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.

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 to iv, 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 and tests for control and indicating equipment (including any associated power supply units) for fire detection and alarm systems for buildings installed for the safety of life, the protection of property, or both, with the exception of indicating equipment at remote manned centres.

NOTE 1 The requirements of this part of BS 5839 apply to the combination of the power supply unit, the control panel and the indicating panel, whether the power supply unit is integral with, partly integral with or separate from the control and indicating equipment, and whether the control panel and the indicating panel are in the same enclosure or not.

NOTE 2 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
access level

the accessibility of controls and visibility of indications, subclassified as follows:

a) *access level 1*: no restrictions;

b) *access level 2*: restricted to authorized operators and servicing personnel;

c) *access level 3*: restricted to authorized servicing personnel.

2.2
decision element

the element that differentiates between the fire and non-fire states

NOTE The decision element may be in the detector or the control equipment.

2.3
final voltage

the final voltage for standby batteries is 1.85 V/cell for lead acid cells, 1.1 V/cell for vented nickel cadmium cells and 1.0 V/cell for sealed nickel cadmium cells, at the 10 h (C_{10}) discharge rate

2.4
manufacturer's data

data supplied by the manufacturer or supplier

2.5
memory

provision for storage of software

2.6
alterable memory

memory whose contents can be altered as part of the operation of the control and indicating equipment without the use of any special programming device external to the system

2.7
non-volatile memory

memory that does not require the presence of any energy source for the retention of its contents (but see the note to **2.9**)

2.8
read-only memory

memory whose contents can only be programmed during manufacture or altered by a special external programming device

2.9
volatile memory

memory that requires the presence of an energy source for the retention of its contents

NOTE Some types of memory can retain their contents for a limited period without power. Unless the period for which the contents can be kept exceeds 6 months without the use of power external to the memory, for the purposes of this standard the memory is considered as volatile.

2.10
software

data required for the operation of a program-controlled system

2.11
operating system

data that controls the operations carried out within the system, and which is not dependent on the configuration of any particular installation

2.12
configuration data

data, other than the operating system (see **2.11**) that controls the configuration of a particular installation

2.13
running data

data that is either generated internally by the system (such as the readings of sensors) or is entered manually to initiate test or disablement functions

2.14
extra low voltage (elv)

a voltage that does not exceed 50 V between conductors, or between any conductor and earth

2.15
safety extra low voltage (selv)

an extra low voltage (see **2.14**) in a circuit that is isolated from the supply mains by means such as a safety transformer or converter with separate windings

Section 2. Requirements

3 Functional requirements

3.1 Alarm condition

3.1.1 *Alarm condition responses.* The transition of the decision element from a non-fire state to the fire state shall result in the following.

a) Outputs to external circuits for the energization of fire alarm devices (usually sounders) external to the control and indicating equipment, so arranged that at least one fire alarm device can continue to operate with a single open circuit or short circuit at any point on the external wiring.

NOTE 1 This requirement could be met either by the provision of two independent outputs or by a single output to a ring circuit which includes protection against both open circuit and short circuit faults. See also **6.6.5** of BS 5839-1:1988.

NOTE 2 A fire alarm evacuation signal should be given by the continuous operation of the fire alarm devices or continuous energization of the outputs. If the control equipment is arranged to provide alarms for phased evacuation, with differentiation between "evacuation" and "alert" signals, the evacuation signal should be continuous and the alert signal should be intermittent, 1.0 ± 0.5 s on and 1.0 ± 0.5 s off.

b) A visible indication of the fire alarm.

c) Operation of a control sounder adjacent to or within the control and indicating equipment.

NOTE 3 If two independent outputs are provided [see item a)] the control sounder may be energized from one of these outputs.

d) For equipment capable of multi-zone operation, a separate and continuous visible indication for each zone in which a detector or manual call point has operated.

NOTE 4 This indication may be given on the control panel or on a separate indicator panel connected to it.

NOTE 5 The indications described in items b) and d) may be combined.

e) Operation of such other functions as specified in the manufacturer's data, for example transmission of signals to fire protection equipment.

None of the responses specified in items a) to e) shall be prevented by the simultaneous operation of two detectors, or by the operation of any further detectors up to the maximum number of detectors per circuit specified by the manufacturer, at a rate not exceeding one detector every 2 s. If the control equipment is intended for use with flame detectors, then the responses shall not be prevented by the simultaneous operation of any number of flame detectors up to the maximum number of flame detectors per circuit specified by the manufacturer.

NOTE 6 Simultaneous operation (or operation in quick succession) of detectors might simulate a short circuit. The above paragraph is intended to ensure that simultaneous operation of detectors causes a fire alarm to be given and not a fault indication.

3.1.2 *Delays in alarm condition responses.* Any delay in the giving of the responses listed in **3.1.1** shall be limited as follows.

a) Where the response is to a detector, the time taken by scanning, interrogation, decision or other signal processing, either within the control equipment, or controlled by it, shall not delay the responses by more than 10 s beyond the point where operation is required by the appropriate part of BS 5445 or BS 5839.

b) Where the response is to the operation of a manual call point, the delay shall not exceed 3 s.

c) If the manufacturer's data allows the use of call points which allow the call to be cancelled after breaking the frangible element (for example by pushing the "button" back into the call point), any operator actions at the call point more than 1 s after the breaking of the frangible element shall not inhibit or delay the giving of the alarm responses.

d) Any control provided to override transmission delays shall be accessible at access level 1. The operation of any such control shall also result in the energization of the fire alarm device (sounder) circuit(s).

3.1.3 *Silencing of fire alarm devices (sounders) and the control sounder.* Switches shall be provided to silence the alarm condition responses specified in items a) and c) of **3.1.1**. The switches shall be manually operated biased switches or other devices fulfilling the same function. The alarm condition responses specified in items a) and c) of **3.1.1** shall continue until silenced by the manual operation of either the appropriate silencing switch or the reset switch (see **3.1.5**); they shall not be automatically silenced. In the event of further alarms from a zone or zones not already in the fire condition, the alarm condition responses specified in items a) and c) of **3.1.1** shall restart.

NOTE 1 In practice it is recommended that the reset switch is not operated until the source of the alarm is identified. It is therefore desirable that it is not possible to reset the equipment until the alarm sounders have been silenced.

NOTE 2 The silencing switches may be combined into a single control as long as access is restricted to access level 2.

Operation of either or both of the silencing switches shall not cancel the alarm condition responses specified in items b), d) and e) of **3.1.1**. While the alarm devices are silenced an audible signal shall be given at the control and indicating equipment, until the fire alarm system is reset. This audible signal, which may be the same as the fault warning, shall give a sound different and distinctive from any fire alarm sounder. If intermittent, this signal shall sound for a minimum of 0.5 s at least once every 15 s.

3.1.4 *Manual starting or restarting of fire alarm devices.* A clearly labelled facility shall be provided for starting or restarting the evacuation signal. Operation of this facility shall not depend on the state of any silencing switch and shall not reset the system.

NOTE Provision for starting or restarting an alert signal (see note 2 to **3.1.1**) is not precluded.

3.1.5 *Resetting from the alarm condition.* The fire alarm responses specified in items b), d) and e) of **3.1.1**, once given, and the audible signal indicating that the alarms have been silenced (see **3.1.3**), shall all persist until the system is manually reset. Resetting shall be accomplished only by the operation of a biased switch or other device fulfilling the same function. It shall not be possible for the reset switch to remain in the "reset" position without a continuing manual action.

3.2 Fault warning condition

3.2.1 *Fault warning condition responses.* Fault warnings shall be given by at least the following.

a) An audible warning from a sounder situated at the control and indicating equipment and preferably within it. The sound level shall be not less than 50 dB(A) at every point less than 1 m from the control equipment enclosure, when measured with an instrument complying with BS 5969, type 2 with slow response and A frequency weighting.

NOTE 1 BS 5839-1 recommends that the sound level produced by the sounder should not be less than the ambient sound level. A sound level of 50 dB(A) might not be adequate for control equipment installed in noisy environments; in such situations an (additional) external sounder might be required.

b) A visible indication on the indicating equipment.

c) For equipment capable of multi-zone operation, a visible indication of the zone or location concerned in the event of faults specified in items d) and e) of **3.2.2**.

d) A signal for transmission to a remote manned centre where provision for such a link is made.

NOTE 2 The indications described in items b) and c) may be combined.

The fire alarm condition responses shall not be inhibited by any fault warning unless the fault itself prevents the giving of such a response.

NOTE 3 Fault indications may be suppressed during an alarm condition, but in this case any faults remaining after the alarm condition has been reset should cause the fault indication to be restored.

If additional facilities are provided for giving a fault warning on the control and indicating equipment in the event of a failure or disconnection of both main and standby power supplies, they shall be capable of providing both visible and audible signals for at least 24 h.

3.2.2 *Fault monitoring.* The fault warning condition responses as specified in **3.2.1** shall be given within 100 s of the occurrence of any one of the following.

a) Short-circuit or disconnection of the connection to any normal power supply associated with the giving of an alarm of fire, or other total loss of power from such a normal power supply.

b) Short-circuit or disconnection of any standby power supply (other than the back-up energy source specified in item b) 1) of **3.8.4.2**) associated with the giving of an alarm of fire.

c) Short-circuit or disconnection of any battery charging equipment associated with the giving of an alarm of fire.

d) Short-circuit or disconnection of the leads to one or more detectors and/or call points if the fault would disable one or more detectors and/or call points.

e) Removal of any detector or call point of the plug-in type or disconnection from its transmitter or power supply.

f) Short-circuit or disconnection of any leads to fire alarm devices (sounders) external to the control and indicating equipment.

g) Cessation of any scanning or interrogating process within the control equipment.

h) Rupture of any fuse or operation of any protective device such as to prevent a fire alarm being given as indicated in **3.1**. If fuses or protective devices are provided on auxiliary circuits, any circuit for which warning of failure is not provided shall be indicated in the manufacturer's data.

i) Failure of a processor to correctly execute its software [see item c) of **3.8.1**].

j) Detection of any error in the memory checking procedures specified in **3.8.4.1** and **3.8.4.2**.

3.2.3 *Fault warning sounder.* The audible warning specified in item a) of **3.2.1** shall be distinctive and of a different character from any fire alarm sounder. This signal shall sound for a minimum of 0.5 s at least every 5 s.

3.2.4 *Silencing of the fault warning sounder.* If provision is made for manually silencing the fault warning sounder, the fault warning sounder shall resound in the event of the detection of a further fault from a different source.

NOTE It is not considered necessary to resound the sounder for different faults from the same source (e.g. in the same zone or the same sounder circuit). It is also recognized that some of the faults listed in **3.2.2** (e.g. failure of a processor) may prevent the detection of other faults.

3.2.5 *Resetting from the fault warning condition.* Resetting from the fault warning condition shall either be automatic when all faults have been removed (non-latching fault warnings), or shall be by a manual control (latching fault warnings). If the fault warning condition can be cancelled by resetting when the fault(s) still exist, then the fault warning condition responses specified in **3.2.1** shall be restored within 100 s.

NOTE It is permissible for the fault warnings to latch for some types of faults and not for others.

3.3 Disablement

NOTE A facility may be provided for disabling ancillary services.

3.3.1 *Accessibility.* Controls which disable any part of the system other than fire alarm devices shall be accessible only at access level 2. A manual control for disabling the fire alarm devices (sounders) shall only be accessible at access level 3.

3.3.2 *Indication.* The operation of any facility for disabling any part of the fire alarm system shall be indicated visually and audibly. The method of indication shall be such that the disabled condition(s) can be differentiated from the fault condition.

NOTE Unless otherwise specified in this part of BS 5839, the audible warning may be the same as the fault warning specified in **3.2.3**, and the audible warning may be silenced as specified in **3.2.4**.

3.3.3 *Disablement of detectors or call points.* If detectors or call points use the same wiring as alarm sounders, then neither the operation of the sounders nor the monitoring of the sounder circuit wiring shall be affected by any provision for disablement of the response to detectors or call points.

3.3.4 *Disablement of fire alarm devices (sounders).* It shall not be possible to cancel the visual and audible indication of disablement until the circuit is restored.

3.3.5 *Disablement of the connection to a remote manned centre.* If a facility is provided for manually disabling the connection to a remote manned centre, disabling shall be indicated visually and audibly. The audible warning may be the same as the fault warning but it shall not be possible to silence this warning until the connection is restored. If intermittent, this signal shall sound for a minimum of 0.5 s at least once every 15 s.

3.4 External circuits

An open- or short-circuit in any cable or wiring of an individual circuit external to the housing(s) of the control and indicating equipment (other than in a cable providing power to the equipment) shall not prevent the correct operation of other circuits.

3.5 Repeat indicators and secondary indicators

Any provision for repeat or secondary indicators shall be so protected that short- or open-circuit faults on the lines to repeat or secondary indicators, or excessive power demands by repeat or secondary indicators, shall not jeopardize the performance of the fire alarm system. Fire alarm responses shall be given at any repeat indicating equipment within 5 s of the outputs specified in item a) of **3.1.1** being given.

3.6 Ancillary services

If provision is made for the initiation of ancillary services in the event of a fire, any such provision shall be so protected that short- or open-circuit faults on the lines to ancillary devices, or excessive power demands by ancillary devices, shall not jeopardize the performance of the fire alarm system.

NOTE BS 5839-1 recommends that ancillary services which take power (other than for indicators) in the non-fire state should not be operated from the fire alarm supply.

3.7 Routine testing

If facilities are provided to assist in testing, these facilities shall not prevent the responses specified in **3.1.1** being given on operation of any detector or call point not included in the group under test, nor prevent the manual starting of the fire alarm devices (see **3.1.4**). The operation of such test facilities shall be indicated visually. Test facilities shall be accessible only at access level 2.

Any automatic testing routine initiated by the control equipment shall not prevent the giving of the responses specified in **3.1.1**.

3.8 Software controlled equipment

3.8.1 *Program monitoring.* The correct execution of the software by any processor shall be monitored by internal self-checking procedures and by a monitoring circuit (watchdog circuit) complying with the following.

a) The monitoring circuit and its associated indication and signalling circuits shall not be prevented from determining and signalling a fault condition by the failure of a processor or its associated clock circuits.

b) The monitoring circuit shall monitor the operation of routines associated with the main functions of the program controlled element (i.e. it shall not be solely associated with "waiting" or other "housekeeping" routines).

c) In the event of a failure by a processor to correctly execute its software the monitoring circuit shall (in addition to initiating an audible and visual fault warning [see **3.2.1**)] perform as follows.

1) Reinitialize the processor and attempt to restart the program at a suitable point within 10 s of the occurrence of the failure. The reinitialization procedure shall check all memory check-sums, both program and data.

2) Either:

i) record that a failure has occurred (see **3.8.2**) and automatically reset the equipment; or

ii) automatically reset the equipment and give both a visual and an audible warning that an automatic reset has occurred (see **3.8.3**).

3.8.2 *Recording of failure by a processor to correctly execute software* [see **3.8.1** c) 2)]. The failure shall be automatically recorded by a provision capable of recording a minimum of 99 failures and resettable only by a manual operation at access level 3.

NOTE Recording may be by means of a counter.

3.8.3 *Warning of automatic resetting following failure by a processor to correctly execute software* [see **3.8.1** c) 2)]

3.8.3.1 The visual indication shall not be used for any other purpose.

3.8.3.2 The audible signal shall sound for a minimum of 0.5 s at least every 15 s.

3.8.3.3 It shall not be possible to reset the visual and audible warnings of **3.8.3.1** and **3.8.3.2** other than by means of a manual operation at access level 2.

3.8.4 ***Storage of software***

3.8.4.1 *General*. All software (i.e. programs and data) necessary for the functions required by this part of BS 5839 shall be held in solid-state memories. In particular software shall not be held on storage media requiring mechanical moving parts such as magnetic tape or disks.

With the exceptions specified in **3.8.4.2** and **3.8.4.3**, all the software used by the control and indicating equipment shall be held in non-volatile read-only memories.

Each non-volatile read-only memory device shall be marked with a designation that can be uniquely cross-referenced with documentation indicating the precise contents of the memory (e.g. program version, data details).

Provision shall be made for the regular checking of memory contents (other than configuration data stored in alterable memory [see item a) 3) of **3.8.4.2**] and running data [see **3.8.4.3**)] at intervals not exceeding 7 days.

NOTE These checking routines, for example a "check-sum" procedure, may be performed automatically or may be initiated manually as part of the routine maintenance procedure.

3.8.4.2 *Configuration data.* Configuration data held in memory other than non-volatile read-only memory shall be as follows.

a) If stored in alterable memory, configuration data shall be protected against unauthorized or accidental alteration or corruption by at least the following.

1) Configuration data shall be modified only at access level 3.

2) The "write-enable" input to the memory shall be normally held in the disabled state so that no action elsewhere in the processor can cause corruption of the memory. A manual operation shall be required before the memory contents can be changed. It shall not be possible for the system to be operated in its normal mode when "write-enabled".

3) The contents of the memory shall be automatically monitored (e.g. by a "check-sum" procedure) at regular intervals not exceeding 24 h.

4) It shall be possible to make a clear and unambiguous check of the data held in memory against the documentation to reveal any unauthorized or undocumented changes.

b) If stored in volatile memory, configuration data shall be protected against power failure as follows.

1) It shall be provided with a back-up energy source permanently fixed to the same printed circuit board as the memory. This energy source shall have an expected life of at least 10 years and shall be capable of retaining the contents of the memory for at least 6 months.

2) A fault indication shall be given in the event of a loss of the memory contents, and the equipment shall still be capable of signalling a fire alarm in accordance with items a), b), c) and e) of **3.1.1**.

c) If stored in memory that is both alterable and volatile, the memory shall comply with items a) and b).

3.8.4.3 *Running data*. If data generated internally by the system during its operation or data entered from manual controls to initiate the test or disablement functions is stored in alterable memory (which may be volatile memory without a back-up energy source), the equipment shall restart in a safe condition (i.e. without any test mode selected or any parts of the system disabled) after a failure of the power supply to the memory.

Any memory contents associated with the selection of test modes or the disablement of parts of the system shall be monitored to ensure that the correct indications are given by the control and indicating equipment.

3.8.5 *Software design and documentation.* The software used in the control equipment shall be designed in a modular structure appropriate to its function. Adequate documentation of the software shall be available to allow compliance with **3.8.1** and **3.8.4** to be properly assessed.

To improve reliability, a methodical and formal approach to software design shall be followed, based on the following:

a) stated objectives and a formal specification;

b) structured and well documented programs;

c) use of a computer language suited both to the processor and to the application;

d) definition of test procedures to enable verification of the correct operation of the software from individual modules to complete system integration.

3.9 Event logging

NOTE 1 It is desirable that a method is provided by which events occurring on the system may be automatically logged. Where no such provision is made, an event counter may be provided to allow the display of the accumulated number of alarm events that have occurred.

If an event counter is provided, the counter shall be capable of displaying a minimum of 999 events before automatically resetting to zero.

NOTE 2 The display may be continuous or may be activated by the use of a manual control.

3.10 Indication of energization

It shall be possible to distinguish between normal operation (i.e. neither fire nor fault indications) and total power failure. Under normal conditions a green indicator shall be shown on the front panel; in the event of total power failure this indication shall be extinguished.

NOTE When the system is operating on standby supplies the state of this indicator is not defined, as in the event of failure of the normal supply and operation on standby supplies a fault indication will be given (see **3.2**) which will show energization.

4 Construction requirements

4.1 Enclosure

The control and indicating equipment shall be housed in an enclosure or enclosures providing a degree of protection, as specified in BS 5490, with a classification of at least IP 2X. This degree of protection shall be maintained at all times while access is restricted to access levels 1 and 2. To prevent dust deposition inside the equipment, the top of the enclosure shall be imperforate except for cable entries which shall be provided with dustproof seals.

NOTE In some applications the equipment may need to have protection against water spray or splashing. In such cases higher IP classifications may be necessary.

4.2 Manual controls

All manual controls shall be robust, positive in operation, and so designed and positioned as to restrict the likelihood of accidental operation. All manual controls shall be clearly labelled to indicate their function.

Controls whose operation does not result in sensory feed back (tactile, visual or audible) from the control panels shall be deemed not to be positive in operation.

4.3 Control accessibility and indicator visibility

4.3.1 *Accessibility*. Accessibility levels for controls and indicators shall comply with Table 1.

4.3.2 *Access level 1.* Controls required to be accessible at access level 1 shall have no restriction on access. Indicators required to be visible at access level 1 shall be visible from the front of the panel with any doors closed.

4.3.3 *Access level 2.* Access to controls required to be accessible at access level 2 or to indicators required to be visible at access level 2 shall be restricted by means of a key or code-operated switch or lock. Keys or codes restricted to access at level 2 shall not provide access at level 3.

4.3.4 *Access level 3.* Access to controls required to be accessible at access level 3 or to indicators required to be visible at access level 3 shall be restricted by means of a key or code operated switch or lock.

NOTE Keys or codes providing access at level 3 may provide access at level 2.

Table 1 — Accessibility levels for controls and indications

Control or indication	Clause reference	Accessibility[a] at access level		
		1	2	3
a) *Mandatory manual controls*				
1) Silence fire alarm devices[b]	**3.1.3**	P	M	M
2) Silence control sounder[b]	**3.1.3**	O[b]	M	M
3) Manual start or restart alarm devices	**3.1.4**	O	M	M
4) Reset system	**3.1.5**	P	M	M
b) *Mandatory indications*				
1) Fire alarm[c]	**3.1.1**b)	M	M	M
2) Zone of fire (multi-zone equipment only)[c]	**3.1.1**d)	M	M	M
3) Fault[d]	**3.2.1**b)	M	M	M
4) Zone of fault (multi-zone equipment only)[d]	**3.2.1**c)	M	M	M
5) System energized	**3.10**	M	M	M
c) *Optional manual controls (if provided)*				
1) Override transmission delay	**3.1.2**d)	M	M	M
2) Silence fault warning sounder	**3.2.4**	P	M	M
3) Disable detection function	**3.3.3**	P	M	M
4) Disable fire alarm devices	**3.3.4**	P	P	M
5) Disable link to remote centre	**3.3.5**	P	M	M
6) Disable ancillary services	**3.3**	P	M	M
7) Test system	**3.7**	P	M	M
8) Reset software execution failure recorder [see d)5)]	**3.8.2**	P	P	M
9) Reset automatic reset warning [see d)6)]	**3.8.3**	P	M	M
10) Change configuration data	**3.8.4.2**	P	P	M
d) *Mandatory indications if corresponding optional controls are provided*				
1) Detectors or call points disabled [see c)3)]	**3.3.3**	M	M	M
2) Fire alarm devices disabled [see c)4)]	**3.3.4**	M	M	M
3) Link to remote centre disabled [see c)5)]	**3.3.5**	M	M	M
4) Ancillary services disabled [see c)6)]	**3.3**	M	M	M
5) Software execution failure counter	**3.8.2**	O	O	M
6) Automatic reset warning	**3.8.3**	M	M	M
7) Test condition selected [see c)7)]	**3.7**	M	M	M
e) *Optional indications*				
1) Power supply failure	**3.2.1**	M	M	M
2) Specific indicators for **3.2.2**	**3.2.2**	O	O	M
3) Event counter	**3.9**	O	O	M

NOTE Although the provision of a control or indication may be optional, if provided it should comply with the relevant accessibility requirements.

[a] Key: M Mandatory
O Optional
P Prohibited

[b] Controls a)1) and a)2) may be combined, in which case access to silence the control sounder is prohibited (P) at access level 1.

[c] Indications b)1) and b)2) may be combined.

[d] Indications b)3) and b)4) may be combined.

4.4 Primary visual indicators

4.4.1 *Identification*. Primary visual indicators shall be those specified in clause **3**, with the exception of the indicators specified in **3.2.1**c).

4.4.2 *Colour*. The colours of primary visual indicators shall be as follows.

a) Fire alarm indicators and other indicators shown only during a fire condition shall be red.

b) Indicators of fault shall be yellow.

c) The indicator of energization (see **3.10**) shall be green.

d) Indicators of other functions within the fire alarm system shall not be red or green.

e) Where there are British or international standards covering the use of ancillary equipment, the colours of indicators used to show the state of the equipment shall be those required by the relevant standard. If the colours used are likely to conflict with the indications of the fire alarm system, the indicators of the ancillary equipment shall be so positioned as to prevent any confusion.

NOTE The presence of a red light on the indicating panel is intended to be an unambiguous indication of the existence of a fire alarm. The presence of a yellow light is intended to indicate a deviation from normal operation, either deliberately (e.g. by disablement) or because of a fault. The presence of a green light is intended to show energization of the fire alarm system.

4.4.3 *Flashing rates*. Indications shall be given either by steady lights or by flashing lights. Where flashing lights are used, the "on" and "off" periods shall each be not less than 0.25 s. The rates of flashing shall be as follows:

a) for indicators of fire, not less than 1.0 Hz;

b) for indicators of fault, not less than 0.2 Hz.

4.4.4 *Labelling*. The visible indication for alarm of fire shall be clearly labelled with the word "FIRE". The function of each other visible indicator shall be clearly identified on the control panel.

4.4.5 *Duplication*. If light-emitting indicators are used to comply with item b) of **3.1.1**, their arrangement shall be such that, in the event of a fire, a red indication shall be given by at least two separate devices. Failure of one of these devices shall not prevent operation of the second, nor lead to its early failure. It shall be possible during routine testing to ensure that both devices operate.

NOTE 1 Illumination of two red devices, one of which shows the affected zone whilst the other is common to all zones, is acceptable [see items b) and d) of **3.1.1**].

NOTE 2 Single visual indicators consisting of multiple incandescent filaments within a single envelope are not considered to comply with **4.4.5** since failure of one filament can lead to the early failure of the other.

4.4.6 *Circuits*. The arrangement of the indicator circuits and the design of the equipment shall not prevent the proper and separate operation of other indicators or of any sounders or sounder circuits.

4.4.7 *Visibility*. Primary visual indications shall be clearly visible under the following conditions without requiring any operator actions:

a) from any distance up to 3 m;

b) for common primary visual indications, over a horizontal angle of at least ±45° to the normal to the panel;

c) for all other primary visual indications, over a horizontal angle of at least ±30° to the normal to the panel;

d) over a vertical angle of at least ±30° to the normal to the panel;

e) in illumination levels up to 200 lx perpendicular to, and measured at, the face of the control and indicating equipment.

4.5 Secondary visual indicators

If secondary visual indicators are provided to support or highlight information given by primary visual indicators they shall be as follows.

a) Red secondary indicators visible at access level 1 shall be used only for indications of fire or for indicators shown only during a fire situation; the colours of secondary indicators visible at access level 1 shall be chosen so that the meaning of such secondary indicators does not conflict with the meanings of the primary indicators.

b) Red secondary indicators visible at access level 2 shall only be used for indications of fire, for indications shown only during a fire situation, or as a result of a continuing manual operation accessible only at access level 2 (such as continued pressure on a test button). Other secondary indicators visible only at access level 2 shall be of any colour other than red.

NOTE Secondary indications visible only at access level 3 may be of any colour, including red.

4.6 Selection of components and circuit design

Components of good commercial quality shall be used, e.g. components of assessed quality complying with BS 9000. If components with expected lives of less than 15 years are used, their replacement intervals shall be specified by the manufacturer.

NOTE Control and indicating equipment should be so designed as to function reliably in the intervals between servicing recommended in the manufacturer's data. Equipment should be designed to have an expected life of at least 15 years.

Data-containing devices shall be protected against alteration caused by environmental conditions, e.g. ultraviolet radiation, and shall be labelled with the version of the data contained.

The manufacturer of the equipment shall certify that all components are suitable for their purpose and are operated within their ratings.

4.7 Environmental conditions

The equipment shall be capable of performing all its functions in the environmental conditions expected in buildings; the equipment shall be deemed to satisfy this requirement if, when subjected to the tests described in clauses **8**, **9**, **10**, **11** and **12**, it satisfies the criteria for compliance specified in those clauses.

4.8 Electro-derived interference

Equipment shall be protected against electrostatic and electromagnetic interference and mains and line-borne transients; the equipment shall be deemed to satisfy this requirement, if when subjected to the tests described in clauses **13**, **14** and **15**, it satisfies the criteria for compliance specified in those clauses.

5 Electrical requirements

5.1 Electrical safety

Equipment shall comply with the following clauses of BS 3955:1986:

a) clause **8** with the exception of **8.6**;

NOTE 1 Marking of covers is not necessary where these covers protect elv battery terminals and need to be removed during maintenance to top up the battery.

b) clauses **9**, **10** and **20**.

Double-insulated equipment shall be class II equipment as described in BS 2754.

NOTE 2 The damp heat steady state test described in clause **10** of this part of BS 5839 includes measurement of insulation resistance and verification of the dielectric strength.

5.2 Supply of power

NOTE Power supply units may be integral with, partially integral with or separate from the control and indicating equipment. The required capacity of the power supply unit will depend upon the particular supply recommendations detailed in clause **16** of BS 5839-1:1988. The tests described in this part of BS 5839 are therefore related to the power supply capacity data supplied by the manufacturer.

5.2.1 *General*. The control and indicating equipment shall derive its power from a normally continuous and reliable source such as the mains electricity supply. A standby power supply consisting of a secondary battery with provision for automatic charging shall also be provided to be immediately available in the event of a failure of the main supply. The main and standby power supplies shall each be capable of supplying the maximum load specified by the manufacturer under normal, fault and fire conditions, irrespective of the state of the other power supplies, and with a variation of +10, –15 % of the stated nominal supply voltage(s) in the mains power supply.

The equipment shall be deemed to satisfy this requirement if, when subjected to the tests described in clause **16**, it satisfies the criteria for compliance specified in that clause. If a range of power supply units is supplied to meet different system requirements, each of the power supply units shall satisfy the criteria for compliance specified in clause **16** when used in accordance with the manufacturer's data.

5.2.2 *Standby battery charging*. An appropriate means of automatic charging shall be provided for any secondary battery. The facility provided to recharge the standby battery shall be capable of recharging the battery to 85 % of its rated capacity in 24 h; the facility shall be deemed to satisfy this requirement if, when subjected to the test described in clause **17**, it satisfies the criterion for compliance specified in clause **17**.

NOTE Tests of the batteries themselves are not included but information should be obtained from the battery manufacturer indicating that the expected battery life exceeds 4 years under the conditions of use experienced in the fire alarm system. The capacities of secondary batteries used for standby supplies will depend upon the particular system loads and the standby periods required.

5.2.3 *Transitions between power supplies*. Transitions between the main and standby supplies (and vice versa), or reduction of mains voltage to a level outside its normal range, shall not cause any change in any indications, warnings or outputs being given by the control and indicating equipment, other than those relating to the power supplies.

5.2.4 *Recovery from total power failure*. Irrespective of the capacity of the standby power supply, occasions will arise when both mains and standby supplies (other than the back-up energy source specified in item b) of **3.8.2.2**) fail. The system shall automatically restore its normal working condition (other than any need for manual resetting of fault warning) within 10 min of the restoration of the main power supply following such a total power failure.

5.3 Segregation of conductors

Where conductors carrying signals or power at other than extra low voltage enter or leave the control and indicating equipment, provision shall be made for their entries or exits to be separated from entries or exits for extra low voltage conductors, and the segregation between conductors shall be maintained within the equipment.

6 Marking and data

6.1 The front face of the equipment shall be clearly marked with the following information:

a) the number and date of this British Standard, i.e. BS 5839-4:1988[1)];

b) the name of the manufacturer or supplier;

c) the type number or other designation.

The equipment shall be clearly marked with any information or warnings necessary for the safety of the operator or of any person servicing the equipment.

6.2 Data supplied with the equipment shall include the following:

a) operating supply voltage range;

b) sufficient information to allow the quiescent and alarm load current consumption to be calculated under both normal and mains-failed supply conditions, including the maximum capacity of the battery which the charging facility is capable of recharging;

c) voltage, voltage tolerances, and allowable currents for any output (such as sounder or detector supplies) available from the equipment;

d) any other data to ensure compatibility with other components in the fire alarm system;

e) details of any facilities for delaying the transmission of an alarm to a remote manned centre (see **3.1.2**);

f) electrical or other connections;

g) the smallest and largest conductors that the terminals can accept;

h) instructions for operation;

i) instructions to allow routine testing to be carried out as recommended in clause **29** of BS 5839-1:1988;

j) recommended replacement periods of components.

[1)] Marking BS 5839-4:1988 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 such a 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

7 General details of tests

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.

7.1 Standard atmospheric conditions for testing

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 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 environmental test where the standard atmospheric conditions are applied.

7.2 Mounting and orientation

Unless otherwise stated in a test procedure, the specimen shall be mounted in its normal orientation by the normal means of mounting indicated by the manufacturer.

7.3 Electrical connections

If a test procedure requires the specimen to be operating, it shall be connected to an appropriate power supply and, unless otherwise specified in a test procedure, all inputs and outputs shall be connected to appropriate equipment or to dummy loads corresponding to the maximum load specified by the manufacturer.

NOTE Address modules or other data transmission modules associated with sensors or detectors should not be tested in accordance with this part of BS 5839 unless their only possible location is adjacent to the control equipment; such equipment should be tested using the environmental tests appropriate to its location.

Means shall be provided for the simulation of the fire and fault conditions described in appendix A, and for examining the status of the indicators and outputs of the specimen.

Unless otherwise stated in a test procedure, the specimen shall be energized at the nominal operating voltage.

7.4 Order of testing

The tests described in clauses **8** to **17** shall be carried out in the order in which they appear, except that, as the tests described in clauses **11** and **12** both require the specimen to be mounted on a vibration generator in each of three perpendicular axes, it is permissible to interleave these tests, so that operational and endurance tests on one axis are both carried out before moving the specimen to the next axis.

8 Dry heat

8.1 Object of the test

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

8.2 Test procedure

8.2.1 *General*. Carry out the test procedure as described in test Bd of BS 2011-2.1B.

8.2.2 *Initial examination.* Before conditioning, inspect the specimen to ensure that it is functioning satisfactorily.

8.2.3 *State of the specimen during conditioning.* Mount the specimen as specified in **7.2** and connect it to suitable supply, monitoring and loading equipment (see **7.3**).

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

a) temperature: 40 ± 2 °C;

b) duration: 16 h.

8.2.5 *Measurements during conditioning.* Monitor the specimen during the conditioning period to detect any spurious alarm or fault signals. During the last hour of the conditioning period, subject the specimen to the functional test described in appendix A.

8.2.6 *Final measurements.* After the recovery period, subject the specimen to the functional test described in appendix A and inspect it visually for mechanical damage both externally and internally.

8.3 Criteria for compliance

8.3.1 The specimen shall remain in the normal condition during the conditioning period, except where being subjected to a functional test.

8.3.2 The specimen shall respond correctly (see **3.1.1** and **3.2.1**) during each functional test.

8.3.3 No damage due to the conditioning shall be visible during the final examination.

9 Cold

9.1 Object of the test

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

9.2 Test procedure

9.2.1 *General.* Carry out the test procedure as described in test Ad of BS 2011-2.1A.

9.2.2 *Initial examination.* Before conditioning, inspect the specimen to ensure that it is functioning satisfactorily.

9.2.3 *State of the specimen during conditioning.* Mount the specimen as specified in **7.2** and connect it to suitable supply, monitoring and loading equipment (see **7.3**).

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

a) temperature: –10 ± 3 °C;

b) duration: 16 h.

9.2.5 *Measurements during conditioning.* Monitor the specimen during the conditioning period to detect any spurious alarm or fault signals. During the last hour of the conditioning period, subject the specimen to the functional test described in appendix A.

9.2.6 *Final measurements.* After the recovery period, subject the specimen to the functional test described in appendix A and inspect it visually for mechanical damage both externally and internally.

9.3 Criteria for compliance

9.3.1 The specimen shall remain in the normal condition during the conditioning period, except when being subjected to a functional test.

9.3.2 The specimen shall respond correctly (see **3.1.1** and **3.2.1**) during each functional test.

9.3.3 No damage due to the conditioning shall be visible during the final examination.

10 Damp heat (steady state), insulation resistance and dielectric strength

10.1 Object of the test

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

Tests of the insulation resistance and dielectric strength are included to ensure that acceptable levels of insulation resistance and dielectric strength can be maintained under humid conditions.

10.2 Test procedure

10.2.1 *General.* Carry out the test procedure as described in BS 2011-2.1Ca.

10.2.2 *Initial examination.* Before conditioning, inspect the specimen to ensure that it is functioning satisfactorily.

10.2.3 *Preconditioning.* Precondition the specimen at the conditioning temperature (40 ± 2 °C) until temperature stability has been reached, to prevent the formation of water droplets on the specimen.

10.2.4 *State of the specimen during conditioning.* Mount the specimen as specified in **7.2** and connect it to suitable supply, monitoring and loading equipment (see **7.3**).

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

a) temperature: 40 ± 2 °C;

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

c) duration: 16 h.

10.2.6 *Measurements during conditioning.* Monitor the specimen during the conditioning period to detect any spurious alarm or fault signals. During the last hour of the conditioning period, subject the specimen to the functional test described in appendix A.

10.2.7 *Final measurements.* Immediately after the recovery period, disconnect the specimen from its power supplies, and apply the following insulation resistance and dielectric strength tests. Complete these tests within 30 min.

Disconnect any components connected between the circuitry and earth (such as earth monitoring or suppression components).

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

Combine the power terminals into the following groups:

a) all earth terminals;

b) all selv input and selv output terminals;

c) all other terminals.

Measure the insulation resistance with 500 ± 50 V d.c. applied between the terminals of group a) and the terminals of group b). Make this measurement after the voltage has been applied for 60 ± 5 s.

Combine the terminals of groups a) and b). Measure the insulation resistance with 500 ± 50 V d.c. applied between the terminals of group c) and the terminals of groups a) and b). Make this measurement after the voltage has been applied for 60 ± 5 s.

Test the dielectric strength by applying the appropriate test voltage in accordance with Table 2 between the earth terminal and the power input terminals connected together. Ensure that this test voltage is of substantially sine-wave form with a frequency of 50 ± 10 Hz. Apply it at a rate of 300 ± 200 V/s (r.m.s.) and maintain it at its maximum value for 60 ± 5 s.

After the tests, reconnect the specimen to its power supplies. Subject it to the functional test described in appendix A and inspect it visually for mechanical damage both externally and internally.

10.3 Criteria for compliance

10.3.1 The specimen shall remain in the normal condition during the conditioning period, except when being subjected to a functional test.

10.3.2 The specimen shall respond correctly (see **3.1.1** and **3.2.1**) during each functional test.

10.3.3 The insulation resistance measured between the terminals of group a) and the terminals of group b) shall be not less than 2 MΩ, and the insulation resistance measured between the terminals of group c) and the terminals of groups a) and b) combined shall be not less than 10 MΩ (see **10.2.7**).

10.3.4 No breakdown or flashover shall be observed during the dielectric strength test.

10.3.5 No damage due to the conditioning shall be visible during the final examination.

Table 2 — Test voltages for dielectric strength

Nominal supply voltage	Type of equipment		
	Double insulated	Safety extra-low voltage	All others
V	V a.c.	V a.c.	V a.c.
up to and including 130	2 500	500	1 000
over 130 and up to and including 250	3 750	500	1 250
over 250 and up to and including 440	3 750	500	2 000
over 440	4 500	500	2 500

11 Vibration (operational)

11.1 Object of the test

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

11.2 Test procedure

11.2.1 *General.* Carry out the test procedure as described in BS 2011-2.1Fc, applying the conditioning severities given in **11.2.3**.

11.2.2 *Initial examination.* Before conditioning, inspect the specimen to ensure that it is functioning satisfactorily.

11.2.3 *State of the specimen during conditioning.* Mount the specimen in accordance with BS 2011-4.1. Subject the specimen to vibration in each of three mutually perpendicular axes in turn, one of which is perpendicular to the plane of mounting of the specimen.

Mount the specimen such that the gravitational force acts in the same direction as it would in use.

NOTE Where the effect of gravitational force is not important the specimen may be mounted in any attitude.

Connect the specimen to suitable supply, monitoring and loading equipment (see **7.3**).

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

a) frequency range: 10 Hz to 150 Hz;

b) acceleration amplitude: 0.981 $m \cdot s^{-2}$;

c) number of axes: 3;

d) number of sweep cycles[2)] per axis: 1 for each functional mode to the specimen whilst in each of the following functional modes:

1) normal condition;

2) alarm condition, initiated by operation of one trigger device;

3) fault condition, initiated by disconnection of the leads to a trigger device;

4) fault condition, initiated by total loss of power from the main power supply.

11.2.5 *Measurements during conditioning.* Monitor the specimen during the conditioning period to detect any spurious alarm or fault signals.

11.2.6 *Final measurements.* After conditioning, subject the specimen to the functional test described in appendix A and inspect it visually for mechanical damage both externally and internally.

[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.

11.3 Criteria for compliance

11.3.1 The specimen shall function correctly during the conditioning in each of the functional modes.

11.3.2 The specimen shall respond correctly (see **3.1.1** and **3.2.1**) during each functional test.

11.3.3 No damage due to the conditioning shall be visible during the final examination.

12 Vibration (endurance)

12.1 Object of the test

To determine the ability of the equipment to withstand prolonged exposure to vibration transmitted through its mountings. The test conditioning is accelerated in order to compress the duration of the test.

12.2 Test procedure

12.2.1 *General.* Carry out the test procedure as described in BS 2011-2.1Fc, applying the conditioning severities given in **12.2.4**.

12.2.2 *Initial examination.* Before conditioning, inspect the specimen to ensure that it is functioning satisfactorily.

12.2.3 *State of the specimen during conditioning.* Mount the specimen in accordance with BS 2011-4.1. Subject the specimen to vibration in each of three mutually perpendicular axes in turn, one of which is perpendicular to the plane of mounting of the specimen.

Mount the specimen such that gravitational force acts in the same direction as it would in use.

NOTE Where the effect of gravitational force is not important the specimen may be mounted in any attitude.

Do not energize the specimen.

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

a) frequency range: 10 Hz to 150 Hz;

b) acceleration amplitude: 4.9 $m \cdot s^{-2}$;

c) number of axes: 3;

d) number of sweep cycles[3)] per axis: 20.

12.2.5 *Final measurements.* After conditioning, subject the specimen to the functional test described in appendix A and inspect it visually for mechanical damage both externally and internally.

12.3 Criteria for compliance

12.3.1 The specimen shall respond correctly (see **3.1.1** and **3.2.1**) during the functional test.

12.3.2 No damage due to the conditioning shall be visible during the final examination.

13 Electrostatic discharges

13.1 Object of the test

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

13.2 Test procedure

13.2.1 *General.* Carry out the type test (laboratory) procedure as described in BS 6667-2.

13.2.2 *Initial examination.* Before conditioning, inspect the specimen to ensure that it is functioning satisfactorily.

13.2.3 *State of the specimen during conditioning.* Mount the specimen as specified in **7.2** and BS 6667-2. Connect it to suitable supply and monitoring equipment (see **7.3**).

Connect the specimen as specified in **7.3** and BS 6667-2, with at least one sample (chosen at random) of each type of input and each type of output connected to the appropriate equipment, or dummy load, situated at least 1 m from the specimen.

The specimen shall be operational during the conditioning.

13.2.4 *Conditioning.* Apply the severity of conditioning described as level 3 in clause **5** of BS 6667-2:1985 (i.e. 8 kV ± 10 %).

13.2.5 *Measurements during conditioning.* Monitor the specimen during the conditioning period to detect any spurious alarm or fault signals, other than those of a transitory nature.

13.2.6 *Final measurements.* Subject the specimen to the functional test described in appendix A and inspect it visually for mechanical damage both externally and internally.

13.3 Criteria for compliance

13.3.1 The specimen shall remain in the normal condition during the conditioning period, apart from alarm or fault signals of a purely transitory nature, except when being subjected to a functional test.

13.3.2 The specimen shall respond correctly (see **3.1.1** and **3.2.1**) during each functional test.

13.3.3 No damage due to the conditioning shall be visible during the final examination.

[3)] 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.

14 Electromagnetic interference

14.1 Object of the test

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

14.2 Test procedure

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

14.2.2 *Initial examination.* Before conditioning, inspect the specimen to ensure that it is functioning satisfactorily.

14.2.3 *State of the specimen during conditioning.* Mount the specimen as specified in **7.2** and BS 6667-3. Connect it to suitable supply and monitoring equipment (see **7.3**).

Connect the specimen as specified in **7.3** and BS 6667-3, with at least one sample (chosen at random) of each type of input and each type of output connected to the appropriate equipment, or dummy load, situated at least 1 m from the specimen.

The specimen shall be operational during the conditioning.

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

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

14.2.6 *Final measurements.* Subject the specimen to the functional test described in appendix A and inspect it visually for mechanical damage both externally and internally.

14.3 Criteria for compliance

14.3.1 The specimen shall remain in the normal condition during the conditioning period except when being subjected to a functional test.

14.3.2 The specimen shall respond correctly (see **3.1.1** and **3.2.1**) during each functional test.

14.3.3 No damage due to the conditioning shall be visible during the final examination.

15 Electrical fast transients

15.1 Object of the test

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

15.2 Test procedure

15.2.1 *General.* Carry out the type test (laboratory) procedure as described in IEC 801-4.

15.2.2 *Initial examination.* Before conditioning, inspect the specimen to ensure that it is functioning satisfactorily.

15.2.3 *State of the specimen during conditioning.* Mount the specimen as specified in **7.2** and IEC 801-4. Connect it to suitable supply and monitoring equipment (see **7.3**).

Connect the specimen as specified in **7.3** and IEC 801-4 with at least one sample (chosen at random) of each type of input and each type of output connected to the appropriate equipment, or dummy load, situated at least 1 m from the specimen.

The specimen shall be operational during the conditioning.

15.2.4 *Conditioning.* Apply a test voltage of 1 kV by the direct coupling method to any selv power input cables, of 2 kV by the direct injection method to any other power input cables, and of 1 kV by the capacitive coupling method to all other cables connected to the specimen.

15.2.5 *Measurements during conditioning.* Monitor the specimen during the conditioning period to detect any spurious alarm or fault signals, other than those of a transitory nature.

15.2.6 *Final measurements.* Subject the specimen to the functional test described in appendix A and inspect it visually for mechanical damage both externally and internally.

15.3 Criteria for compliance

15.3.1 The specimen shall remain in the normal condition during the conditioning period, apart from alarm or fault signals of a purely transitory nature, except when being subjected to a functional test.

15.3.2 The specimen shall respond correctly (see **3.1.1** and **3.2.1**) during each functional test.

15.3.3 No damage due to the conditioning shall be visible during the final examination.

16 Variations in power supply

16.1 Object of the test

To determine the ability of the equipment and any associated power supply unit to function when subjected to variations in the power supply.

16.2 Test procedure

16.2.1 *Electrical connections.* Apart from the disconnections and changes in power supply levels required by this test, connect the specimen as specified in **7.3**. Allow the specimen to stabilize at the limit power supply and load conditions under which it will be expected to operate.

For tests 2 and 4 (see Table 3) the battery shall be simulated by a power supply which can be set to be the final voltage of the battery and which, at that voltage, can sink the charging current of the system.

16.2.2 *Voltage and load combinations.* Subject the specimen to each voltage and load combination given in Table 3 for the specified duration. At the end of each test period, whilst maintaining the test conditions, carry out the functional test described in appendix A but omitting step e) (involving failure of the power supplies) and wherever "normal condition" is specified substituting "normal condition (except for the power supply indications)".

16.2.3 *Total battery discharge condition.* For test 3 (see Table 3) use the largest capacity battery allowed by the manufacturer for that charger. For 48 h prior to the test connect a resistor across the output of the power supply unit such that a current C_{10} is drawn at nominal voltage, where C_{10} is the battery manufacturer's quoted 10 h rate. If the battery is protected against full discharge, then the protection circuit shall be allowed to operate normally.

16.2.4 *Final examination.* After applying all the voltage and load combinations given in Table 3, inspect the specimen visually for mechanical damage both externally and internally.

16.3 Criteria for compliance

16.3.1 The specimen shall respond correctly (see **3.1.1** and **3.2.1**) during each functional test.

16.3.2 No discharge current shall flow from the battery in tests 1, 3 and 4 of Table 3.

16.3.3 No damage due to the tests shall be visible during the final examination.

17 Battery charging

17.1 Object of the test

To determine whether the facility provided for recharging the standby battery is satisfactory.

17.2 Test procedure

Use the battery type having the maximum capacity which the manufacturer states is suitable for the recharging facility.

Charge the battery for 100 h using the recharging facility.

Discharge the battery to its final voltage at a discharge current

$$I_d = \frac{C_{10}}{4}$$

where

C_{10} is the battery manufacturer's quoted 10 h rate.

Charge the battery for 24 h using the recharging facility. During this period, ensure that the specimen supplies the maximum allowable equipment quiescent load, if applicable.

Discharge the battery to its final voltage at a discharge current $I_d = C_{10}$.

Record the discharge time.

17.3 Criterion for compliance

The C_{10} discharge time recorded shall exceed 8.5 h.

Table 3 — Voltage and load combinations

Test	Voltage of the main supply	Voltage of the standby battery	Control and indicating equipment load	Test duration
				h
1	Nominal +10 % or maximum, whichever is the greater	Standby battery disconnected	Minimum (i.e. quiescent)	2
2	Zero	Minimum[a] (i.e. final voltage)	Maximum (i.e. alarm)	1
3	Nominal –15 % or minimum, whichever is the lesser	Battery fully discharged (see **16.2.3**)	Maximum (i.e. alarm)	1
4	Nominal +10 % or maximum, whichever is greater	Minimum[a] (i.e. final voltage)	Maximum (i.e. alarm)	2

NOTE The nominal, maximum and minimum values are according to the specifications from the manufacturer of the test specimen (see clause **6**).

[a] If the battery is protected against fully discharging, the voltage used should be the cut-off voltage.

Appendix A Functional test

Carry out the following sequence of operations. At each step in the sequence, examine and record the status of the audible and visual indicators in the test specimen and the status of its outputs, and then reset the test specimen to the normal condition.

a) Check that the test specimen is in the normal condition.

b) Operate a trigger device or its electrical equivalent for each fire detection circuit for the period specified in **3.1.2**.

c) Simulate the fault condition in accordance with item d) of **3.2.2** for one fire detection circuit followed by the fire condition for another fire detection circuit.

d) Simulate faults at signal inputs in accordance with items d) and e) of **3.2.2** and outputs in accordance with item f) of **3.2.2**.

e) Simulate other faults in accordance with items a), b) and c) of **3.2.2** for which the control and indicating equipment has supervision.

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Publications referred to

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 2011-4.1, *Specification for mounting of components, equipment and other articles for dynamic tests.*

BS 2754, *Memorandum. Construction of electrical equipment for protection against electric shock.*

BS 3955, *Specification for electrical controls for household and similar general purposes.*

BS 5345, *Code of practice for the selection, installation and maintenance of electrical apparatus for use in potentially explosive atmospheres (other than mining applications or explosive processing and manufacture)*[4)].

BS 5445, *Components of automatic fire detection systems.*

BS 5445-1, *Introduction.*

BS 5445-5, *Heat sensitive detectors — point detectors containing a static element.*

BS 5445-7, *Specification for point-type smoke detectors using scattered light, transmitted light or ionization.*

BS 5445-8, *Specification for high temperature heat detectors.*

BS 5445-9, *Methods of test for sensitivity to fire.*

BS 5490, *Specification for classification of degrees of protection provided by enclosures.*

BS 5501[4)], *Electrical apparatus for potentially explosive atmospheres.*

BS 5588, *Fire precautions in the design and construction of buildings.*

BS 5750[4)], *Quality systems*

BS 5839, *Fire detection and alarm systems for buildings.*

BS 5839-1, *Code of practice for system design, installation and servicing.*

BS 5969, *Specification for sound level meters.*

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.*

BS 9000, *General requirements for a system for electronic components of assessed quality.*

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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