

Components for smoke and heat control systems —

Part 6: Specifications for cable systems

ICS 13.220.20; 29.060.01

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee FSH/25, Smoke, heat control systems and components, to Subcommittee FSH/25/3, Fire performance cables, upon which the following bodies were represented:

- British Cables Association
- Electrical Contractors Association
- Engineering Industries Association
- London Fire and Emergency Planning Authority
- Ministry of Defence (UK Defence Standardization)
- Office of the Deputy Prime Minister (ODPM)
- Co-opted members

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 March 2005

© BSI 31 March 2005

Amendments issued since publication

Amd. No.	Date	Comments

The following BSI references relate to the work on this British Standard:
Committee reference FSH/25/3
Draft for comment 02/540530 DC

ISBN 0 580 45578 5

Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
Introduction	1
1 Scope	2
2 Normative references	2
3 Terms and definitions	2
4 Type of cable	2
5 Cable integrity under fire conditions	3
6 Installations	4
Annex A (informative) Additional information regarding building service cable systems other than SHEVS	5
Annex B (normative) Test method	6
Annex C (informative) Calculation of a fire-fighting jet to a test house jet	20
Bibliography	21
Figure B.1 — Schematic of test configuration	7
Figure B.2 — Plan view of fire test equipment	8
Figure B.3 — End elevation of fire test equipment	9
Figure B.4 — Rubber bush	10
Figure B.5 — Burner face	11
Figure B.6 — Position of water jet device	13
Figure B.7 — Temperature measuring arrangement	14
Figure B.8 — Example of mounting a sample for test	16
Figure B.9 — Detailed section of adjusted position of mounting of a sample for test	17
Figure B.10 — Basic circuit diagram	19
Table 1 — Building services incorporating circuits for cable systems	3
Table A.1 — Building services incorporating circuits for cable systems other than SHEVS	5

Foreword

This part of BS 7346 has been prepared by Subcommittee FSH/25/3, under the direction of Technical Committee FSH/25.

The other parts of BS 7346, *Components for smoke and heat control systems*, are as follows:

- *Part 1: Specifications for natural smoke and heat exhaust ventilators;*
- *Part 2: Specifications for powered smoke and heat exhaust ventilators;*
- *Part 3: Specification for smoke curtains;*
- *Part 4: Functional recommendations and calculation methods for smoke and heat exhaust ventilation systems, employing steady-state design fires — Code of practice;*
- *Part 5: Functional recommendations and calculation methods for smoke and heat exhaust ventilation systems, employing time dependent design fires — Code of practice.*

Parts 1, 2 and 3 of BS 7346 will eventually be replaced by the equivalent parts of BS EN 12101. The parts of BS EN 12101, *Smoke and heat control systems*, relevant to BS 7346-6 will include:

- *Part 1: Specification for smoke barriers — Requirements and test methods;*
- *Part 2: Specification for natural smoke and heat exhaust ventilators;*
- *Part 3: Specification for powered smoke and heat exhaust ventilators;*
- *Part 6: Specification for pressure differential systems¹⁾;*
- *Part 8: Specification for smoke control dampers¹⁾;*
- *Part 9: Control panels and emergency control panels¹⁾;*
- *Part 10: Power supplies¹⁾.*

This British Standard is a new specification for cable systems required to have resistance to fire and contains the basic performance requirements and test methods for electrical cables required to maintain their circuit integrity under fire conditions. These cables are required to be used in life safety and property protection systems, i.e. the operation of a smoke and heat exhaust ventilation system (SHEVS). This British Standard introduces new requirements that assess cable performance under conditions of fire, direct mechanical impact and water impact from fire-fighting jets as may be expected in an actual fire incident.

It is assumed in the drafting of a standard that the execution of its provisions is entrusted to appropriately qualified and competent people.

This British Standard calls for the use of substances and/or procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

Product certification/inspection/testing. Users of this British Standard are advised to consider the desirability of third-party certification/inspection/testing of product conformity with this British Standard. Appropriate conformity attestation arrangements are described in BS EN 9000. Users seeking assistance in identifying appropriate conformity assessment bodies or schemes may ask BSI to forward their enquiries to the relevant association.

This British Standard supports the requirements identified in the guidance to the regulations in the Approved Document B [1], with respect to fire engineering solutions.

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

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 21 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

¹⁾ In preparation.

Introduction

One of the latest trends within the construction industry is the concept of Fire Safety Engineering. The importance of this relatively new discipline is increasing as developments in building design put more onerous demands on materials, as building projects are ever more ambitious in terms of size, height and complexity.

Fire Safety Engineering takes into account the interaction between the active and passive fire safety systems in addition to their use, process and management in a building. Building projects are assessed individually and it is no longer considered adequate to rely on the traditional prescriptive codes in the more complex designs. Active fire safety systems such as automatic fire detectors, fire alarms, sprinklers, smoke ventilation and pressure differential systems will be required to operate during a fire to ensure safe evacuation of occupants, and for subsequent fire-fighting operations.

Many active fire safety systems rely on an effective electrical supply, and are required to remain operational during a fire. Complex fire safety engineered buildings depend on the reliability of the installed fire safety systems. Components for SHEVS such as fans are required to remain operational for long periods and are tested as such. The integrity and continuity of the electrical supplies are, in such applications, fundamental to ensuring that the entire system functions effectively. The cables which power the systems are equally as important as the systems themselves and are required to have a suitable level of performance.

In complex multi-storey structures where there is a plethora of major power and control circuits, which form a backbone of the fire-safety-engineering infrastructure, greater emphasis needs to be given to the integrity of the electrical circuits, to maintain the functional safe working condition of the essential equipment/system.

The following are examples of protected circuits that are required to remain effectively operational when subjected to fire:

- atrium, basement, underground car park and shopping mall smoke ventilation systems;
- electrically operated fire shutters and smoke curtains (motor driven);
- fire-fighting lifts and associated intercom and emergency lighting systems;
- pressurization and depressurization fans (air supply and pressure release);
- smoke dampers motor driven open or closed;
- smoke relief dampers (pressurization systems) motor driven open;
- sprinkler and wet-riser pumps.

NOTE Different circuits (systems) could require different fire survival times.

The fire survival times of cables and building services to maintain the circuit integrity of systems under fire conditions are derived from applicable British Standards.

1 Scope

This British Standard defines the performance requirements for various types of cables and cable systems required to have resistance to fire. The cables (system) are used for circuits that have to maintain their circuit integrity for life safety, fire-fighting and property protection systems.

This British Standard is applicable to cables of rated voltage not exceeding 600/1 000 V.

Currently this British Standard does not cover the following cables:

- a) cables of rated voltage not exceeding 600/1 000 V with the overall outside diameter less than 20 mm which are not capable of being fitted into the test rig;
- b) wiring systems where the cables of rated voltage not exceeding 600/1 000 V are installed within metallic conduit;
- c) wiring systems used for fire alarm detection and sounder circuits as described in BS 5839.

NOTE The basic test apparatus (test ladder, continuity and voltage checking arrangement, source of heat, shock-producing device) used in the test method given in Annex B is taken from BS EN 50362. This standard states that the apparatus and test method are intended for cables with an overall diameter exceeding 20 mm.

This British Standard also defines the performance requirements for methods of cable fixing, clips and cable jointing.

The test within this British Standard includes:

- radiation via direct impingement;
- mechanical impact directly onto the cable; and
- a water jet sprayed directly onto the cable.

All the elements of the test are carried out on a single sample of cable.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN 50200:2000, Method of test for resistance to fire of unprotected small cables for use in emergency circuits.

BS EN 60269-3, Low-voltage fuses — Part 3: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar applications).

BS EN 60529, Specification for degrees of protection provided by enclosures (IP code).

BS EN 60584-1, Thermocouples — Part 1: Reference tables.

BS EN ISO 13943, Fire safety — Vocabulary.

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions in BS EN ISO 13943 apply.

4 Type of cable

Any cable that has been verified to meet the fire performance requirements laid down in this British Standard shall be considered acceptable for the purpose of supplying power to a SHEVS installed to achieve a viable life safety system in a building. The system in its entirety, including the associated cables, connections and fixings shall form part of the fire safety engineered solution put forward by the designer for the regulator to consider.

NOTE When designing a power circuit that is required to maintain circuit integrity when exposed to a fire hazard, it is important to consider the effects of the increase in cable resistance due to the higher operating temperature.

The cable manufacturer shall be required to provide the necessary support documentation to demonstrate the suitability of the cable for the building service as specified in Table 1.

NOTE Further information relating to building service systems can be found in Annex A.

Table 1 — Building services incorporating circuits for cable systems

Building service	Category (LS or FF)	Fire survival time
Mechanical smoke control fire-fighting	FF	2 h
Mechanical smoke control phased evacuation	LS	1 h
Mechanical smoke control single stage evacuation	LS	30 min
Pressurization/depressurization/relief dampers	FF	2 h
	LS	30 min
Fire shutters smoke and fire barriers motor driven	FF	2 h
	LS	1 h
Smoke control dampers	FF	2 h
	LS	1 h

LS = Life safety system

The application of the smoke and heat control system in its fire operational condition for the period of time required (30 min or 60 min) for the occupants of the premise to be alerted, and to be able to exit the premise, with the smoke and heat control system assisting in the protection of the means of escape. The cables for these systems would include fire protection systems, control systems for smoke ventilation and pressure differential systems.

FF = Fire-fighting system

Fire-fighting systems are required to maintain functionality for a period of 120 min. The cables for these systems would serve active systems to protect and aid fire-fighters in carrying out their role and include pressure differential systems for fire-fighting, smoke and heat exhaust ventilation systems (SHEVS), sprinkler systems and fire-fighting lifts.

5 Cable integrity under fire conditions

5.1 Point of failure

Failure of either one of the following criteria shall be sufficient to show the point of failure for that cable:

- the voltage is not maintained during the test duration as indicated by fuse failure or by interruption of the circuit breaker;
- a conductor ruptures during the test duration as indicated by the lamp extinguishing.

5.2 Fire survival time

When tested as described in Annex B, electric circuits as listed in Table 1 shall be capable of maintaining a minimum fire survival time with respect to radiation (see 5.3) and direct mechanical impact (see 5.4) of:

- 30 min or 60 min for life safety systems;
- 120 min for fire-fighting systems;
- 30 min for property protection systems.

In addition to the radiation and direct impact, the cables shall be capable of withstanding a water jet impinging directly onto the cable during the final 5 min of the required test duration (see 5.5 and B.5.6).

The duration of fire survival measured in minutes shall be recorded in the test report (see B.6) for the cable under test, or recorded to the point of failure (see 5.1) where this occurs.

5.3 Temperature criteria (operating temperature)

The cables shall be capable of withstanding a constant temperature attack of 842 °C (see B.3 and Figure B.7). The temperatures taken shall be the same for a building protected by sprinklers as one without sprinkler protection.

The source of heat shall be in accordance with B.2.4 and the verification procedure for the source of heat shall be in accordance with B.3.

5.4 Direct mechanical impact criteria

The cable shall be capable of withstanding a direct impact from the shock-producing device (see **B.2.5**) of approximately 10 N.

The time interval between each cable impact shall be every 10 min throughout the test.

5.5 Water drenching criteria

The cable shall be capable of withstanding the direct impact of a water jet applied as one 5 s burst every minute during the final 5 min of the required fire survival time.

The mechanical impact of a fire-fighting jet on the cable shall be considered within the mechanical impact criteria (see **5.4** and Annex C).

5.6 Testing

For type approval testing, the test shall be carried out as specified in **B.1**, **B.2**, **B.3**, **B.4** and **B.5**.

For each test, a test report shall be prepared in accordance with **B.6**.

6 Installations

When installing cables that meet the requirements of this British Standard the fire resistance of the fixings, management systems, joints and terminations shall be at least equal to the survival time of the cable (see **5.2**). The following shall be taken into consideration.

- a) Where the fire performance cables require additional mechanical protection, they shall be enclosed in or carried upon cable management or containment systems, which will not impair the defined performance of the cable in the presence of the potential hazards. The supports shall be oversized to cater for the reduction in the tensile strength of steel when exposed to the effects of a fire.
- b) Where the fire performance cables have by their method of construction adequate mechanical protection the cable shall be fixed directly to the building structure. The fixing materials shall not impair the defined performance or support of the cables in the presence of the potential hazards.
- c) Where cable connections are required, which have a defined performance in respect of fire, impact and water, the connector terminals that are not part of a manufactured accessory shall not impair the defined performance of the cable system in the presence of the potential hazards.
- d) Joints should be avoided where possible, and minimized in their use, but where conditions require joints to be used they shall be of a type and nature that does not compromise the original performance of the cable.