

Electric cables — 600/1 000 V armoured fire-resistant cables having thermosetting insulation and low emission of smoke and corrosive gases when affected by fire

ICS 29.060.20

Committees responsible for this British Standard

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- British Approvals Service for Cables
- British Cables Association
- British Plastics Federation
- ERA Technology Ltd.
- Electricity Association
- London Underground Ltd.
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Foreword

This British Standard has been prepared by Technical Committee GEL/20/2. It constitutes a major revision of the 1996 edition which is withdrawn.

The start and finish of text introduced by amendment No. 1 is indicated in the text by tags **A1** **A1**. Tags indicating changes to text carry the number of the amendment. For example, text altered by amendment No. 1 is indicated by **A1** **A1**.

This new edition, which makes changes to the scope so as to reflect those cable types in common use in the construction and industrial sector:

- introduces the new fire resistance categories F2 and F3, as described in the scope;
- introduces 5-core cables;
- extends 4-core cables up to 400 mm²;
- extends the auxiliary cables up to 48-core types;
- revises and updates the general technical content in line with BS 6724:1997, and aligns editorially with that publication where appropriate.

The opportunity has also been taken to refer to BS EN 50268, BS EN 50267-2-1, BS EN 60811-1-3 and BS EN 50265-2-1 for details of methods and requirements for a smoke emission test, corrosive and acid gas emission, shrinkage of insulation, and flame propagation on a single cable, respectively.

As with the previous edition, performance under fire conditions is assessed on the basis of tests which measure, under defined conditions, the flame propagation, emission of smoke and corrosive gases, and fire resistance.

Amendment No. 1:2004 implements the changes to the identification of cores by colours, in accordance with HD 308 S2. The principal identification colours are now:

Single phase — Green-and-yellow (Earth); blue (Neutral); brown (Live).

Three phase — Green-and-yellow (Earth); blue (Neutral); brown, black, grey (Live).

Users should ensure that any interconnection between cables with these new colours and those with the pre-existing ones is carried out safely. BS 7671, as amended in parallel with this standard, gives some guidance in this respect, but does not cover all installation conditions or cable uses.

The provisions introduced by amendment No. 1:2004 are effective from 1st April 2004. The original version of this standard remains current until 31st March 2006.

Annex D, Annex E, Annex F, Annex G, Annex H, Annex J, Annex K, Annex L and Annex M are normative. Annex A, Annex B, Annex C, Annex N, Annex P and Annex Q are informative. Annex I and Annex O are spare.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Warning. This British Standard calls for the use of 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. Users seeking assistance in identifying appropriate conformity assessment bodies or schemes may ask BSI to forward their enquiries to the relevant association.

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 to iv, pages 1 to 46, an inside back cover and a back cover.

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1 Scope

This British Standard specifies the requirements for construction and performance, and describes methods of test, for armoured fire-resistant cables with thermosetting insulation and of rated voltage 600/1 000 V and low emission of smoke and corrosive gases when affected by fire.

The circuit integrity performance under fire conditions is assessed on the basis of various tests which either separately measure resistance to fire, resistance to fire with water, and resistance to fire with mechanical shock (Categories F1 and F2), or in combination measure resistance to fire with mechanical shock and water (Category F3).

Cables specified in this standard are intended for use in fixed installations in industrial areas, buildings and similar applications, where maintenance of power supply during a fire is required for a defined period of time.

For the purposes of this standard, cables are designated by category according to their special performance characteristics. The following categories are included:

- Category F1 — resistance to fire alone when tested in accordance with **17.4.2**;
- Category F2 — resistance to fire, resistance to fire with water, resistance to fire with mechanical shock, assessed separately when tested in accordance with **17.4.3**;
- Category F3 — resistance to fire with mechanical shock and water assessed in combination when tested in accordance with **17.4.4**.

NOTE 1 Attention is drawn to the fact that the ability of a given cable to meet a particular category in this standard refers only to the test condition stated, and the level of performance achieved in a particular installation may be influenced by actual installation conditions.

Cables covered by this standard have limited evolution of smoke and corrosive gases when assessed under the fire conditions as specified in BS EN 50268 and BS EN 50267-2-1.

In this standard, the level of corrosive (and acid) gases is determined by measurement of hydrochloric acid (HCl) in accordance with BS EN 50267-2-1.

NOTE 2 This is an indirect assessment method, and reference should be made to IEC 60695-5-2:1994, **5.1.5** for additional guidance.

The insulation and other components are suitable to permit operation of the cables at a maximum sustained conductor temperature of 90 °C and for a maximum short circuit conductor temperature of 250 °C.

NOTE 3 Limitation on the temperature of the cables may be imposed in situations where they may be touched.

NOTE 4 Due to the relatively high conductor temperature, there is a risk of drying out the surrounding soil causing an increase in thermal resistivity which in turn would lead to the cable temperature rising to a higher value than anticipated. For cable laid directly in the ground, a suitable de-rating factor should be applied or a lower maximum sustained conductor operating temperature should be assumed to take into account the possible effects of soil drying out.

NOTE 5 In installations which include cable joints and terminations, the performance of these accessories should be taken into account in deciding the maximum operating temperature of the cable.

The cables specified in the standard are all wire armoured and oversheathed and are as follows:

- a) two-, three-, four- and five-core stranded copper conductor;
- b) multicore auxiliary stranded copper conductor.

Annex A gives recommendations for the selection and operation of cables while recommendations for the installation of cables are given in Annex B. Annex C lists the information that should be given with an enquiry or order.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this British Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references the latest edition of the publication referred to applies.

A1 Text deleted **A1**

BS 4727-2:Group 08, *Glossary of electrotechnical, power, telecommunication, electronics, lighting and colour terms — Part 2: Terms particular to power engineering — Group 08: Electric cables.*

BS 5099, *Specification for spark testing of electric cables.*

BS 6360, *Specification for conductors in insulated cables and cords.*

BS 6387:1994, *Specification for performance requirements for cables required to maintain circuit integrity under fire conditions.*

BS 6469-99.1:1992, *Insulating and sheathing materials of electric cables — Part 99: Test methods used in the United Kingdom but not specified in BS EN 60811 or other Parts of BS 6469 — Section 99.1: Non-electrical tests.*

BS 7655-1.2, *Specification for insulating and sheathing materials for cables — Part 1: Cross-linked elastomeric insulating compounds — Section 1.2: General 90 °C application.*

BS 7655-1.3, *Specification for insulating and sheathing materials for cables — Part 1: Cross-linked elastomeric insulating compounds — Section 1.3: XLPE.*

BS 7655-6.1, *Specification for insulating and sheathing materials for cables — Part 6: Thermoplastic sheathing compounds having low emission of corrosive gases, and suitable for use in cables having low emission of smoke when affected by fire — Section 6.1: General application thermoplastic types.*

A1 BS EN 10244-2, *Steel wire and wire products — Non-ferrous metallic coatings on steel wire — Part 2: Zinc or zinc alloy coatings on steel wire.* **A1**

BS EN 50265-2-1:1999, *Common test methods for cables under fire conditions — Test for resistance to vertical flame propagation for a single insulated conductor or cable — Part 2: Procedures — Section 2.1: 1 kW pre-mixed flame.*

A1 BS EN 50266-2-4, *Common test methods for cables under fire conditions — Test for vertical flame spread of vertically-mounted bunched wires or cables — Part 2-4: Procedures — Category C.* **A1**

BS EN 50267-2-1, *Common test methods for cables under fire conditions — Tests on gases evolved during combustion of materials from cables — Part 2: Procedures — Section 2.1: Determination of the amount of halogen acid gas.*

BS EN 50268-2, *Common test methods for cables under fire conditions — Measurement of smoke density of cables burning under defined conditions — Part 2: Procedure.*

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 60584-1, *Thermocouples — Part 1: Reference tables.*

BS EN 60811-1-1, *Insulating and sheathing materials of electric cables — Common test methods — Part 1: General application — Section 1.1: Measurement of thickness and overall dimensions — Tests for determining the mechanical properties.*

BS EN 60811-1-2:1995, *Insulating and sheathing materials of electric cables — Common test methods — Part 1: General application — Section 1.2: Thermal ageing methods.*

BS EN 60811-1-3, *Insulating and sheathing materials of electric cables — Common test methods — Part 1: General application — Section 1.3: Methods for determining the density — Water absorption tests — Shrinkage test.*

3 Terms and definitions

For the purposes of this British Standard the terms and definitions given in BS 4727-2:Group 08 and the following apply.

3.1

rated voltage U_0

nominal power-frequency voltage between conductor(s) and armour or earth, for which the cable is suitable

3.2

rated voltage U

nominal power-frequency voltage between phase conductors for which the cable is suitable

3.3

maximum voltage U_m

maximum sustained power-frequency voltage between phase conductors for which the cable is suitable

3.4

nominal value

value by which a quantity is designated and which is often used in tables

NOTE In this standard, nominal values usually give rise to values to be checked by measurements taking into account specified tolerances.

3.5

approximate value

value which is only indicative

NOTE In this standard, values described as approximate do not constitute requirements to be checked by measurement.

3.6

fire resistance

ability of a cable to maintain circuit integrity for a stated period of time and under conditions as defined in a standard test

NOTE The designation “fire resistant” given to a cable implies that it conforms to the requirements specified in 17.4.2, 17.4.3 or 17.4.4 when subjected to the relevant standard fire resistance test.

3.7

type tests (symbol T)

tests required to be made before supplying a type of cable specified in this standard, on a general commercial basis in order to demonstrate satisfactory performance characteristics to meet the intended application

NOTE These tests are of such a nature that, after they have been made, they need not be repeated unless changes are made in the cable materials, design or type of manufacturing process which might change the performance characteristics

3.8

sample tests (symbol S)

tests made on samples of completed cable, or components taken from a completed cable adequate to verify that the finished product meets the design specifications

3.9

routine tests (symbol R)

tests made on all production lengths to demonstrate their integrity

3.10

tests after installation

tests intended to demonstrate the integrity of the cable and its accessories as installed

4 Voltage designation

The cables shall be designated by the rated voltages U_0 and U , expressed in the form U_0/U .

The rated voltage recognized for the purposes of this standard is 600/1 000 V.

The maximum designated voltage (U_m) for the purposes of this standard for 600/1 000 V cables is recognized as 1 200 V.

NOTE Guidance on the selection of cables for particular systems is given in A.2.

5 Conductors

The conductors shall be annealed copper as given in Table 4 to Table 8 inclusive, and shall conform to the requirements detailed in Table 2 and to BS 6360. Where the manufacturer deems it necessary to use tinned copper conductors, they shall conform to the requirements of BS 6360 for metal coated conductors.

The conductors shall be circular, circular compacted or shaped stranded (class 2), as specified in Table 4 to Table 8 inclusive.

6 Insulation

6.1 General

A1 The insulation shall be GP 8 conforming to BS 7655:Section 1.3, or GP 6 conforming to BS 7655:Section 1.2, or EI 5 conforming to BS 7655:Section 5.1. **A1** The insulation shall be applied by the extrusion process and cross-linked to form a compact and homogeneous layer.

The manufacturer shall, where necessary to meet the performance requirements of this standard, apply suitable tape(s) either under or over the insulation. These tapes shall not be included as part of the insulation thickness.

6.2 Thickness of insulation

The thickness of insulation, when determined by taking the average of a number of measurements in accordance with Annex D, shall be not less than the value given in Table 4 to Table 8, as appropriate, and the smallest of the measured values shall not fall below the value given in Table 4 to Table 8, as appropriate, by more than (10 % + 0.1 mm).

6.3 Spark testing of insulation

The core insulation shall conform to the requirements for spark testing given in BS 5099 when tested in accordance with the a.c. or d.c. test methods specified in that standard.

6.4 Corrosive and acid gas emission of insulation and tape(s)

When tested in accordance with BS EN 50267-2-1, the level of HCl shall be not greater than 0.5 %.

7 Identification of cores

7.1 General

The cores of all cables shall be identified either by colour or by numbers. Numbers shall be marked sequentially starting with the number 1. Colour coding shall be in accordance with the following sequence.

A1 Number of cores	Identification
Two-core	Brown, blue
Three-core	Brown, black, grey
Four-core	Blue, brown, black, grey
Five-core	Green-and-yellow, blue, brown, black, grey A1

The colour shall be applied either throughout the insulation or on its external surface.
 Numbers on each core shall be printed in a colour contrasting with that of the insulation.
 The height of each individual number shall be not less than 1.5 mm.
 The spacing shall be such that each number is repeated at intervals not greater than 70 mm.
 Conformity shall be checked by visual examination and measurement.

7.2 Bi-colour combination

On the core marked with the bi-colour combination green-and-yellow, the distribution of the colours shall be such that for every 15 mm length of core, one of these colours shall cover at least 30 % and at most 70 % of the surface of the core, while the other colour covers the remainder of the surface.

NOTE 1 In cases of dispute and where appropriate to the method of colour marking of the insulation, a suitable test for checking conformity is given in BS 6469-99.1:1992, Clause 8.

NOTE 2 It is understood that the colours green and yellow when they are combined as specified above are recognized as identifying exclusively the core intended for use as an earth connection or similar protection.

7.3 Clarity and durability

The colour or the number used for core identification shall be clearly identifiable, and durable such that it cannot be removed when rubbed 10 times with a piece of cotton wool or cloth soaked in water.

8 Laying-up

8.1 General

The cores of cables having two, three, four or five cores shall be laid-up with a right-hand or right-and-left-hand alternating direction of lay. For multicore auxiliary cables the direction of lay shall alternate for each successive layer. Auxiliary cables having up to and including seven cores may be laid-up with a right-hand or left-hand or with a right-and-left-hand alternating direction of lay. Cores shall be laid up in the sequence given in 7.1.

Conformity shall be checked by visual examination.

The manufacturer shall, where necessary to meet the performance requirements of this standard, apply suitable tape(s).

If necessary, the formation of a compact and reasonably circular cable shall be achieved either by the bedding (see 9.1), or by the application of synthetic fillers and binder tape.

It shall be possible to strip the fillers, if any, from the cable without damaging the insulation of the cores.

8.2 Corrosive and acid gas emission of tape(s) and fillers

When tested in accordance with BS EN 50267-2-1, the level of HCl of filler and binder tape(s) shall be not greater than 0.5 %.

9 Bedding

9.1 General

The bedding shall consist of an extruded layer of polymeric material compatible with the operating temperature of the cable. When tested in accordance with BS EN 60811-1-1, it shall have a tensile strength of not less than 4 N/mm² and elongation at break not less than 50 %.

It shall be possible to remove the bedding without damaging the insulation of the core(s).

The manufacturer shall, where necessary to meet the performance requirements of this standard, apply suitable tape(s). These tapes shall not be included as part of the bedding thickness.

9.2 Thickness of bedding

The minimum thickness of extruded bedding, measured in accordance with Annex D, shall not fall below the value given in Table 4 to Table 8, as appropriate, by an amount more than $(20 \% + 0.2 \text{ mm})$.

9.3 Corrosive and acid gas emission of bedding and tape(s)

When tested in accordance with BS EN 50267-2-1, the level of HCl shall be not greater than 0.5 %.

10 Armour

10.1 General

The armour shall consist of a single layer of wires having nominal dimensions as given in Table 4 to Table 8, as appropriate. The armour shall be applied helically with a left-hand lay for cables having up to and including five cores. For multicore auxiliary cables the armour shall be applied helically with a direction of lay opposite to that of the final layer of cores, except that for cables which have been laid-up with alternating right-and-left-hand lay the armour may be applied with either a right-hand or a left-hand lay.

The manufacturer shall, where necessary to meet the performance requirements of this standard, apply suitable tape(s) over the armour.

No protective compounds, e.g. bitumen, shall be applied over the armour.

10.2 Corrosive and acid gas emission of tape(s)

When tested in accordance with BS EN 50267-2-1, the level of HCl shall be not greater than 0.5 %.

10.3 Wire armour

Wire armour shall consist of a single layer of galvanized steel wires.

The armour wire shall conform to the following.

- When determined in accordance with **G.1**, the diameter of the round armour wires, shall fall within the minimum and the maximum wire diameters given in Table 1.
- When determined in accordance with **G.2**, the mass of zinc coating of galvanized steel armour wire shall be not less than the value given Table 1.
- When tested in accordance with **G.3**, the mechanical characteristics of galvanized armour wires shall be such that none of the wires shall break.

Table 1 — Diameter of armour wire and mass of zinc coating

Nominal wire diameter mm	Wire diameter		Minimum mass of zinc coating g/m ²
	Minimum mm	Maximum mm	
0.9	0.85	0.95	112
1.25	1.18	1.32	150
1.6	1.51	1.69	172
2.0	1.90	2.10	180
2.5	2.37	2.63	195
3.15	2.99	3.31	206

10.4 Joints

Joints in steel wire armour shall be brazed or welded and any surface irregularity shall be removed.

A joint in any wire shall be not less than 1 m from the nearest joint in any other armour wire in the complete cable.

10.5 Armour resistance

When measured and corrected to 20 °C in accordance with **G.4**, the d.c. resistance of the armour of the completed cable shall not exceed the appropriate value given in Table H.1 or Table H.2.

11 Oversheath

11.1 General

The oversheath shall be an extruded layer of polymeric material conforming to the requirements for LTS 1 specified in BS 7655-6.1.

NOTE Oversheaths are normally black, but colours other than black may be provided by agreement between the manufacturer and the purchaser, subject to their suitability for the particular exposure conditions under which the cables are to be used.

11.2 Thickness of oversheath

The minimum thickness of the oversheath, when measured in accordance with Annex D, shall not fall below the value given in Table 4 to Table 8, as appropriate, by an amount exceeding (20 % + 0.2 mm).

11.3 Spark testing of oversheath

The oversheath shall conform to the requirements for spark testing specified in BS 5099 when tested in accordance with the a.c. or d.c. test methods specified in that standard.

11.4 Corrosive and acid gas emission of oversheath

When tested in accordance with BS EN 50267-2-1, the level of HCl shall be not greater than 0.5 %.

12 Cable marking

12.1 End marking

The ends of each factory length of cable having three or more cores of conductor size 25 mm² and above shall be marked red or green. The end at which the sequence of core colours, as specified in Clause 7, is clockwise shall be marked red and the other end shall be marked green.

12.2 External marking

The external surface of all cables conforming to this British Standard shall be legibly marked with the following elements.

Element	Example of marking
a) Electric cable	ELECTRIC CABLE
b) Voltage designation	600/1 000 V 600/1 000 V AUX
c) British Standard number and cable category	BS 7846-F1
d) Manufacturer's identification	XYZ
e) Number of cores and nominal area of conductor	4 × 50

NOTE 1 4 × 50 indicates a four-core cable with 50 mm² conductors.

The marking of the items a) to d) shall be by embossing or indenting on the oversheath.

For cables with tabulated approximate overall diameters above 15 mm, items a), b) and c) shall appear, in any sequence that is deemed neither to confuse nor conflict, on two or more primary lines along the axis of the cable, approximately equally spaced around the circumference of the cable.

Items d) and e) shall appear on either one of the primary lines, or on a secondary line or lines, in any sequence that is deemed neither to confuse nor conflict.

NOTE 2 Items d) and e) need not both appear on the same line.

For cables with tabulated approximate overall diameters up to 15 mm, the elements of the marking shall be disposed as for cables of greater than 15 mm diameter except that the marking for items a), b) and c) shall appear on one or more primary lines.

The letters and figures shall consist of upright block characters with a minimum height of 3 mm.

The distance between the end of one element of marking and the beginning of the next identical element of marking shall be not greater than 550 mm for items a), b) and c) and not greater than 1 100 mm for items d) and e).

Conformity shall be checked by visual examination and measurement.

12.3 Identification of year of manufacture

A means of identifying the year of manufacture shall be provided throughout the length of cable, either by marking or by an identification thread.

If the identification is by internal marking, the distance between the end of one mark and the beginning of the next mark shall be not greater than 550 mm.

If the identification is by marking on the surface, the maximum distance between marks shall be not greater than 1 100 mm.

12.4 The mark of an approval organization

If the mark of an approval organization is used it shall be provided throughout the length of the cable, either on the surface or as an identification thread.

If the mark is applied to the surface of the cable, it shall be in the form of symbol(s) specified by the approval organization, and the maximum distance between marks shall be not greater than 1 100 mm.

If the mark is in the form of an identification thread, it shall be as specified by the approval organization.

12.5 Additional marking

Any additional marking shall be throughout the length of the cable, and shall be either on the external surface of the cable, or by means of a tape or thread within the cable, or by a combination of these methods.

Such marking, however made, shall be repeated at intervals not exceeding 1 100 mm.

If the additional marking is applied to the surface of the cable, it shall not be such as to render illegible the marking specified in 12.2, 12.3 and 12.4.

13 End sealing

Before dispatch, the manufacturer shall cap the ends of the cable in order to form a seal to prevent the ingress of water during transportation and storage.

14 Schedule of tests

The tests to be performed on cables specified in this standard shall be as scheduled in Table 2, which refers to the relevant clauses of the standard specifying the requirements and test methods as well as the category of each test which applies, i.e. T, S or R (as defined in Clause 3). Table 2 also indicates which tests relate to complete cable, and which relate to components.

Table 2 — Schedule of tests

Test	Requirement given in clause	Test method	Category
Tests on components			
Conductor construction	Clause 5	BS 6360	S
Insulation:			
material	6.1	Ⓐ BS 7655 -1.3 or -1.2 or -5.1 Ⓐ	T
thickness	6.2	Annex D	S
spark test	6.3	BS 5099	R
corrosive and acid gas	6.4	BS EN 50267-2-1	T
Core identification	Clause 7	Visual examination and measurement	S
Laying-up:			
direction and sequence of lay	8.1	Visual examination	S
fillers and binders	8.1	Visual examination	S
corrosive and acid gas	8.2	BS EN 50267-2-1	T
Bedding:			
physical properties	9.1	BS EN 60811-1-1	T
thickness	9.2	Annex D	S
corrosive and acid gas	9.3	BS EN 50267-2-1	S
Armour:			
wire armour diameter	10.3a)	G.1	S
mass of zinc coating	10.3b)	G.2	T
wrapping test	10.3c)	G.3	T
Tape over armour:			
corrosive and acid gas	10.2	BS EN 50267-2-1	T
Oversheath:			
physical properties	11.1	BS 7655-6.1	T
thickness	11.2	Annex D	S
spark test	11.3	BS 5099	R
corrosive and acid gas	11.4	BS EN 50267-2-1	S
Tests on completed cables			
Cable markings	Clause 12	Visual examination and measurement	R
Conductor resistance	16.2	BS 6360	R
Voltage test on completed cables	16.3	Annex K	R
Armour resistance test	10.5	G.4	S
Shrinkage of insulation	18.3	BS EN 60811-1-3	T
Abrasion	18.4	Annex E	T
Shrinkage of oversheath	18.6	Annex J	T
Insulation resistance constant of oversheath	18.7	Annex F	T
Tests under fire conditions:			
flame propagation on single cable	17.2	BS EN 50265-2-1	S
flame propagation on multiple cables	18.5	Ⓐ BS EN 50266-2-4 Ⓐ	T
smoke emission	17.3	BS EN 50268-2	S
test for resistance to fire — Category F1	17.4.2	BS 6387:1994, D.2	S
test for resistance to fire — Category F2	17.4.3	BS 6387:1994, D.2, D.3 and D.4; and L.1 of the present standard	S
test for resistance to fire — Category F3	17.4.4	L.2	S
Compatibility	18.2	Annex M and BS EN 60811-1-1 and -1-2	T

15 Test conditions

15.1 Ambient temperature

Tests shall be performed at an ambient temperature of $(20 \pm 15) ^\circ\text{C}$ unless otherwise specified in the details for the particular test.

15.2 Frequency and waveform of power frequency test voltages

Unless otherwise specified in the particular test, the frequency of the alternating test voltages shall be in the range of 49 Hz to 61 Hz. The waveform shall be substantially sinusoidal.

16 Routine tests

16.1 General

Routine tests shall be performed as indicated by the symbol R in Table 2.

NOTE Those requirements for which routine testing is specified, and which are not fully covered by earlier clauses, are detailed in 16.2 and 16.3.

16.2 Conductor resistance

The d.c. resistance of each conductor shall conform to BS 6360 when measured in accordance with that standard and corrected to $20 ^\circ\text{C}$.

NOTE For convenience, maximum conductor resistance values are given in Table H.1 and Table H.2.

16.3 Voltage test on completed cables

When the completed cable is tested in accordance with Annex K, the insulation shall not break down.

17 Sample tests

17.1 General

Sample tests shall be performed as indicated by the symbol S in Table 2.

NOTE Those requirements for which sample testing is specified, and which are not fully covered by earlier clauses, are detailed in 17.2, 17.3 and 17.4.

17.2 Flame propagation on single cable

[A] Cables shall be tested in accordance with BS EN 50265-2-1. The test shall be carried out on a sample of completed cable. After the test, the cable shall conform to the performance recommendations given in BS EN 50265-2-1:1999, Annex A. **[A]**

17.3 Smoke emission

When a sample of the complete cable is tested in accordance with BS EN 50268-2, the values for the light transmittance shall not fall below 70 % at any time during the test.

The samples of cable shall be tested as a flat horizontal unit. The number of samples of cable shall be determined in accordance with BS EN 50268-2 using the values of approximate overall diameter given in Table 4 to Table 8.

17.4 Tests for resistance to fire

17.4.1 General

Cables shall be designated by category according to their special fire resistance characteristics as follows:

- Category F1: resistance to fire alone when tested in accordance with 17.4.2;
- Category F2: resistance to fire, resistance to fire with water, resistance to fire with mechanical shock, assessed separately, when tested in accordance with 17.4.3;
- Category F3: resistance to fire with mechanical shock and water assessed in combination when tested in accordance with 17.4.4.

The cable shall be tested in accordance with 17.4.2, 17.4.3 or 17.4.4, according to its special fire resistance category.

17.4.2 Category F1

The complete cable shall be tested in accordance with BS 6387:1994, **D.2** and shall withstand 950 °C for 3 h at a rated voltage of 600/1 000 V without rupture of the 3 A fuse or circuit breaker and with no loss of continuity.

NOTE This is equivalent to testing to category C of BS 6387 but at 600/1 000 V.

17.4.3 Category F2

The complete cable shall be tested in accordance with BS 6387:1994, **D.2** and shall withstand 950 °C for 3 h at a rated voltage of 600/1 000 V without rupture of the 3 A fuse or circuit breaker and with no loss of continuity.

Additionally, complete cables of a diameter not exceeding 20 mm, shall be tested in accordance with BS 6387:1994, **D.3** and **D.4** and shall conform to the requirements for category W and category Z at a rated voltage of 600/1 000 V. For complete cables of a diameter exceeding 20 mm the same requirements shall be met, subject to the additional provisions given in **L.1**.

17.4.4 Category F3

The complete cable shall be tested in accordance with **L.2** and shall withstand 30 min of fire with impact followed by 15 min water drenching at a rated voltage of 600/1 000 V without rupture of the 2 A fuse or circuit breaker and with no loss of continuity.

18 Type tests

18.1 General

Type tests shall be performed as indicated by the symbol T in Table 2 (see also Annex P).

NOTE Those requirements for which type testing is specified, and which are not fully covered by earlier clauses, are detailed in **18.2** to **18.8**.

18.2 Compatibility

When a sample of complete cable is aged in accordance with **M.2**, the insulation and oversheath shall conform to the requirements given in Table 3. In addition, at the end of the test period in the oven, the blotting paper shall be free of stains.



Table 3 — Compatibility requirements

Component	Test	Requirement			
		GP 8	GP 6	LTS 1	EI 5
Insulation	Minimum tensile strength (N/mm ²)	12.5	8.5	—	—
	Minimum percentage elongation at break	200	200	—	—
	Maximum percentage variation ^a of tensile strength	25	30	—	30
	Maximum percentage variation ^a of elongation at break	25	30	—	30
Oversheath	Minimum tensile strength (N/mm ²)	—	—	10	—
	Minimum percentage elongation at break	—	—	100	—
	Maximum percentage variation ^a of tensile strength	—	—	40	—
	Maximum percentage variation ^a of elongation at break	—	—	40	—

^a The variation is the difference between the respective values obtained prior to and after heat treatment, expressed as a percentage of the former.

(A1)