



BSI Standards Publication

**Electric cables –
Thermosetting insulated,
non-armoured cables with a
voltage of 600/1 000 V, for
fixed installations, and
having low emission of
smoke and corrosive gases
when affected by fire**

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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 October 2012. It was prepared by Subcommittee GEL/20/17, *Low voltage cables*, under the authority of Technical Committee GEL/20, *Electric cables*. A list of organizations represented on this committee can be obtained on request to its secretary.

Relationship with other publications

BS 8573 is related to, but not equivalent to, IEC 60502-1.

Information about this document

BS 8573 is a new standard, catering for important changes in the market. It is required for those sectors, especially buildings of high public occupancy and/or access, where it is necessary to restrict both the spread of flames and the release of smoke and harmful gases in the case of fire.

This British Standard reflects the revision of BS 7889 for matters not related to fire performance.

In the preparation of BS 8573, GEL/20/17 has requested that references to other standards for which the committee is responsible are undated, even if referring to a specific clause. It is the committee's intention not to amend the fundamentals (e.g. clause numbers, material type designation) in any of these standards and so the latest edition applies.

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.

Hazard warnings

WARNING. This British Standard calls for the use of substances and/or procedures that can 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.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

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 cannot confer immunity from legal obligations.

1 Scope

This British Standard specifies requirements and test methods for the construction and performance of non-armoured cables with thermosetting insulation of rated voltages 600/1 000 V which, when assessed by the specified tests, produce lower levels of smoke and corrosive products under exposure to fire compared with cables conforming to BS 7889.

NOTE 1 These tests are published in separate British Standards to which reference is made at the appropriate point in the text. The Scope clauses of these British Standards contain cautionary notes concerning the applicability of such tests, and these should be taken into account when assessing the suitability of cables specified in this British Standard for use in a particular application.

Cables specified in this British Standard are intended for use in fixed installations in industrial areas, buildings and similar applications but not for burial in the ground, either directly or in ducts.

The cables specified in this British Standard are all stranded copper conductor, thermosetting insulated, thermoplastic sheathed types. There are single-core types and multi-core types (2-, 3-, 4- and 5-core).

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 These are indirect assessment methods, and reference should be made to IEC/TS 60695-5-2:2002, 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 (for a maximum period of 5 s).

NOTE 3 Limitation on the temperature of the cables may be imposed in situations where they could be touched, or where they could touch other materials.

NOTE 4 In installations that include wiring accessories, junction boxes and consumer units etc., the performance of these accessories should be taken into account in deciding the maximum operating temperature of the cable.

NOTE 5 Annex A gives guidance on the use of these cables. Annex B gives the test for shrinkage of sheath on cable. Annex C gives the compatibility test. Annex D gives the abrasion test. Annex E contains notes on type tests, and Annex F gives green-and-yellow measurement for shaped conductors.

2 Normative references

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

BS 5099, *Electric cables – Voltage levels for spark testing*

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 of 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*

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

BS EN 50363-5, *Insulating, sheathing and covering materials for low voltage energy cables – Part 5: Halogen-free, cross-linked insulating compounds*

BS EN 50395, *Electrical test methods for low voltage energy cables*

BS EN 50396, *Non electrical test methods for low voltage energy cables*

BS EN 60228, *Conductors of insulated cables*

BS EN 60229, *Electric cables – Tests on extruded oversheaths with a special protective function*

BS EN 60332-1-2:2004, *Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single small insulated wire or cable – Procedure for 1 kW pre-mixed flame*

BS EN 60332-3-24:2009, *Tests on electric and optical fibre cables under fire conditions – Part 3-24: Test for vertical flame spread of vertically mounted bunched wires or cables – Category C*

BS EN 60811-401, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 401: Miscellaneous tests – Thermal ageing methods – Ageing in an air oven*

BS EN 60811-501, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 501: Mechanical tests – Tests for determining the mechanical properties of insulating and sheathing compounds*

BS EN 60811-502, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 502: Mechanical tests – Shrinkage test for insulations*

BS EN 60811-503, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 503: Mechanical tests – Shrinkage test for sheaths*

BS EN 61034-2, *Measurement of smoke density of cables burning under defined conditions – Part 2: Test procedure and requirements*

BS EN 62230, *Electric cables – Spark-test method*

IEC 60050-461, *International Electrotechnical Vocabulary – Part 461: Electric cables*

3 Terms and definitions

For the purposes of this British Standard, the terms and definitions given in IEC 60050-461 and the following apply.

3.1 cable manufacturer

organization that has the capability to both produce and control the conformity of cable made to this British Standard

NOTE See 11.1a) for information on marking the cable with the cable manufacturer's name and identifier.

3.2 length of lay

axial length of one complete turn of the helix formed by one cable component

3.3 routine tests, R

tests made on all production cable lengths to demonstrate their integrity

3.4 sample tests, S

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

3.5 type tests, T

tests made before supplying, on a general commercial basis, a type of cable covered by this British Standard, 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.

3.6 values**3.6.1 approximate value**

value which is only indicative

NOTE Values described as "approximate" do not constitute requirements to be checked by measurement.

3.6.2 nominal value

value by which a quantity is designated

NOTE Nominal values usually give rise to values to be checked by measurements taking into account specified tolerances.

3.7 voltage**3.7.1 maximum voltage, U_m**

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

3.7.2 rated voltage, U_0

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

3.7.3 rated voltage, U

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

4 Rated voltage

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 shall be 600/1 000 V.

The maximum designated voltage (U_m) for the purposes of this standard for 600/1 000 V cable shall be 1 200 V.

In an alternating current system, the rated voltage of a cable shall be at least equal to the nominal voltage of the system for which it is intended.

NOTE Guidance on the selection of cables of appropriate voltage designations for particular systems is given in A.4.

5 Conductors

The conductors shall be annealed copper as given in Table 2 to Table 6 inclusive, and shall conform to the requirements of BS EN 60228, Class 2.

NOTE The category of test for this requirement, and for all others in this standard, is shown in Table 1, "Schedule of tests".

6 Insulation

6.1 Type of insulation

The insulation shall be type GP 8 conforming to BS 7655-1.3, or type GP 6 conforming to BS 7655-1.2, or type EI 5 conforming to BS EN 50363-5. For the assessment of halogens on the insulation taken from a completed cable, only 6.4 shall apply.

NOTE Other tests for assessment of halogens, for instance to BS EN 50267-2-2 and BS EN 60684-2, are not required.

6.2 Application

The insulation shall be applied by an extrusion process and cross-linked to form a compact and homogeneous layer.

NOTE 1 The insulation can be applied in a single layer, or in a number of cohesive layers.

Where more than one layer is used, the complete insulation shall be tested as though it were a single layer.

NOTE 2 Insulation applied in more than one layer does not conform to the definition of "double insulation" given, for instance, in BS 7671.

The manufacturer shall have the option to apply a tape or tapes over the conductor or insulation. These tapes shall not be included as part of the insulation.

It shall be possible to remove the insulation easily without damage to the insulation itself or to the conductor.

6.3 Thickness of insulation

The mean value of the radial thickness of the insulation, when measured in accordance with BS EN 50396, 4.1, shall be not less than the value given in Table 2 to Table 6. The smallest value measured, t_m , shall not fall below 90% of the value given in Table 2 to Table 6 by more than 0.1 mm, i.e.:

$$t_m \geq 0.9t_n - 0.1$$

where:

t_m is the smallest value measured, in millimetres (mm);

t_n is the tabulated radial thickness, in millimetres (mm).

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 by colour. Colour coding shall be in accordance with the following sequence.

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

NOTE Depending on their intended use, the cables might be subject to the core colour requirements specified in BS 7671 or other standards, or in statutory requirements.

The colour shall be applied throughout either the insulation or the outer cohesive layer, and shall be applied as part of the extrusion process.

The insulation of the coloured cores, irrespective of the method of colouring, shall be tested as a complete single layer (see 6.2).

Conformity shall be checked by visual examination.

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 not less than 30% and at most 70% of the surface of the core, while the other colour shall cover the remainder of the surface. Conformity shall be checked by measurement.

NOTE 1 In the case of shaped cores one colour may be applied as one or more stripes, provided that both colours remain readily visible.

NOTE 2 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 EN 50396, 5.2, for circular cores, and in Annex F of this standard for shaped cores.

7.3 Clarity and durability

The colour used for core identification shall be clearly identifiable and durable such that it cannot be removed in accordance with the test method stated in BS EN 50396, 5.1.

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-hand-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 maximum length of lay for core with circular conductors shall not exceed 65 times the diameter of the laid-up cores, and the maximum length of lay for core with shaped conductors shall not exceed 80 times the diameter of the laid-up cores.

Conformity shall be checked by the test method given in **15.5**.

If necessary, the formation of a compact and reasonably circular cable shall be achieved by one of the following methods.

- a) The application of synthetic fillers or binder tape(s).
- b) The optional inner covering (see **9.1**).
- c) The sheath (see Clause **10**) provided it effectively fills the interstices.
- d) Any combination of the above.

It shall be possible to strip the fillers and/or tape(s), if any, from the cable without damaging the insulation of the cores.

Conformity shall be checked visually.

8.2 Corrosive and acid gas emission of binder 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 Extruded optional inner covering

9.1 General

NOTE 1 The manufacturer has the option to include or not include an inner covering.

The optional inner covering, where used, shall consist of an extruded layer of synthetic polymeric material compatible with the operating temperature of the cable. It shall surround the single core and the laid-up two, three, four or five cores, giving the assembly a practically circular shape. The inner covering shall not adhere to the cores.

NOTE 2 For information, an approximate value of thickness of the inner covering is given in Table 2 to Table 6.

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

NOTE 3 The manufacturer may apply a tape or tapes over the optional extruded inner covering.

9.2 Corrosive and acid gas emission of optional inner covering and tape(s)

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

10 Sheath

10.1 General

The sheath shall be an extruded layer of polymeric material conforming to the requirements for LTS 4 specified in BS 7655-6.1.

NOTE Sheaths are normally black and, when properly formulated and compounded, this provides good resistance to deterioration from outdoor exposure to light. Sheaths where the black is only in an outer cohesive layer, or sheaths with colours other than black, can be provided by agreement between the manufacturer and the purchaser but, unless such sheaths also include additives to protect the cable from UV, the cables are not suitable for all exposure conditions.

10.2 Application

The sheath shall be applied in a single layer:

- a) to the core of the single core cables and inner covering (if any);
- b) to the assembly of cores with inner covering;
- c) to the assembly of cores without inner covering.

The sheath shall be capable of being removed without damage to the core(s).

Conformity shall be checked visually.

10.3 Thickness of sheath

When measured in accordance with BS EN 50396, 4.2, the smallest value, t_m , of the radial thickness of the sheath shall not fall below 85% of the value given in Table 2 to Table 6 by more than 0.1 mm, i.e.:

$$t_m \geq 0.85t_n - 0.1$$

where:

t_m is the smallest value measured, in millimetres (mm);

t_n is the tabulated radial thickness, in millimetres (mm).

10.4 Corrosive and acid gas emission of sheath

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

11 Cable marking and additional information

11.1 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) Cable manufacturer	Manufacturer's name and their unique factory identifier

NOTE 1 A simplified version of the manufacturer's name, or a trading name of the manufacturer, may be used in place of the full name.

NOTE 2 Any suitable method may be used to unambiguously identify the manufacturer's factory.

NOTE 3 The manufacturer's own trademark or equivalent may be added but this cannot be used instead of the manufacturer's name or identifier.