

Specification for 600/1 000 V single-phase split concentric electric cables —

**Part 3: 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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- Association of Consulting Engineers
- British Approvals Service for Cables
- British Cables Association
- British Plastics Federation
- Electricity Association
- ERA Technology Ltd.
- London Underground Ltd.
- UK Steel Association

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Foreword

This British Standard has been prepared by Subcommittee GEL/20/2. It is one of three parts of a full technical revision of BS 4553:1992, which is withdrawn.

The start and finish of text introduced or altered by amendment 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]**.

BS 4553-3 specifies the range of split concentric cables which have thermosetting insulation and non-halogenated sheaths and a low emission of smoke and acid gas when affected by fire. In addition, the standard contains the option of solid aluminium conductors or stranded copper conductors, as well as the option of using a separate extruded bedding to build up the core to a diameter suitable for applying the split concentric layer.

BS 4553-1 specifies the range of split concentric cables but which have PVC insulation and sheath.

BS 4553-2 specifies a similar range of split concentric cables, but which have thermosetting insulation and sheath.

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 cables 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.

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.

WARNING. This 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.

Annex D, Annex E and Annex G are normative. Annex A, Annex B, Annex C, Annex H and Annex J are informative.

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 17 and a back cover.

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1 Scope

This British Standard specifies requirements for construction and describes methods of test for XLPE-insulated single-phase split concentric cables for operation on an earthed neutral system at nominal voltages up to and including 1 000 V between phases and 600 V to earth and which, when assessed by the specified tests, produce lower levels of smoke and corrosive products under exposure to fire, compared with corresponding cables conforming to BS 4553-1 and BS 4553-2.

In this standard, the level of corrosive (and acid) gases is determined by measurement of hydrochloric acid (HCl) in accordance with [A1](#) BS EN 50267-2-1 [A1](#).

The cables specified in this part of BS 4553 have a central phase conductor insulated with XLPE and a concentric layer comprising bare copper wires (earth continuity conductor) and copper wires covered with extruded polymer (neutral conductor). The cables are intended for use in fixed installations in industrial areas, buildings and similar applications. They are suitable for use in situations where the combination of ambient temperature and temperature rise due to loading current results in a conductor temperature not exceeding 90 °C and for a maximum short-circuit conductor temperature of 250 °C.

NOTE 1 Limitation on the temperature of the cables may be imposed in situations where they may be touched.

NOTE 2 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 3 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.

Guidance concerning selection, installation and usage is given in Annex A, Annex B and Annex J respectively.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part 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 4066-3, *Tests on electric cables under fire conditions — Part 1: Tests on bunched wires or cables.*

BS 4727-2-08, *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 6425-1, *Tests on gases evolved during the combustion of materials from cables — Part 1: Method for determination of amount of halogen acid gas evolved during combustion of polymeric materials taken from cables.*

BS 7622-2, *Measurement of smoke density of electric cables burning under defined conditions — Part 2: Test procedure and requirements.*

BS 7655-1.3, *Specification for insulating and sheathing materials for cables — Part 1: Elastomeric insulating compounds — Section 1-3: XLPE PVC sheathing compounds.*

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

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](#)

[A] BS EN 50267-2-1, *Common test methods for cables under fire conditions — Tests on gases evolved during combustion of material from cables — Part 2-1 — Procedures — 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.* **[A]**

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 Definitions

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

3.1

rated voltage U_0

nominal power-frequency voltage between phase conductor and 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

type tests (symbol T)

tests required to be made before supplying, on a general commercial basis, a type of cable covered by this 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 material, design or type of manufacturing process which might change the performance characteristics.

3.7

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

3.8

routine tests (symbol R)

tests made on all production lengths to demonstrate their integrity

3.9

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 is 1 200 V.

NOTE Guidance on the selection and operation of cables is given in Annex A.

5 Phase conductor

The phase conductor shall be either annealed copper or solid aluminium, as given in Table 3 or Table 4, and shall conform to the requirements detailed in Table 1 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 phase conductor shall be either circular or circular compacted stranded copper (class 2), or circular solid aluminium (class 1) as specified in Table 3 or Table 4.

6 Insulation

6.1 General

The insulation shall be cross-linked polyethylene compound GP 8 conforming to BS 7655-1.3. The insulation shall be applied by the extrusion process to form a compact and homogeneous layer.

The manufacturer shall, where necessary to meet the compatibility requirements specified in 18.2, apply a protective barrier between the conductor and the insulation and/or over the insulation.

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 3 or Table 4, as appropriate, and the smallest of the measured values shall not fall below the value given in Table 3 or Table 4, as appropriate, by more than 10 % + 0.1 mm. Any optional protective barrier shall not be included in this measurement.

6.3 Spark testing of insulation

The core insulation 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. The voltage levels shall be determined by reference to the value of insulation thickness given in Table 3 or Table 4.

6.4 Corrosive and acid gas emission of insulation and protective barrier

When tested in accordance with A_1 BS EN 50267-2-1 A_1 , the level of HCl shall be not greater than 0.5 %.

7 Identification of phase core

7.1 General

A_1 The phase core shall be identified by the colour brown either throughout the insulation or on its external surface. A_1

Conformity shall be checked by visual examination.

7.2 Clarity and durability

The colour 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.