

LV and MV polymeric insulated cables for use by distribution and generation utilities —

Part 8: Specification for multicore and multipair cables for installation above and below ground —

Section 8.5: Single wire armoured and unarmoured multicore cables with copper conductors and non-halogenated sheath

(Implementation of part of HD 627)

ICS 29.060.20

Confirmed
October 2008

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee GEL/20, Cables, to Subcommittee GEL/20/16, Medium/high voltage cables, upon which the following bodies were represented:

- British Approval Service for Cables
- British Cables Association
- British Plastics Association
- Electricity Association
- ERA Technology
- Co-opted members

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 16 June 2003

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The following BSI references relate to the work on this British Standard:
Committee reference GEL/20/16
Draft for comment 99/244662 DC

ISBN 0 580 37571 4

Amendments issued since publication

Amd. No.	Date	Comments

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Foreword

This section of BS 7870 has been prepared by Subcommittee GEL/20/16, under the direction of Technical Committee GEL/20.

BS 7870 implements the nationally applicable parts of Harmonization Documents HD 603, HD 604, HD 605, HD 620, HD 622, HD 626 and HD 627 published by the European Committee for Electrotechnical Standardization (CENELEC) in accordance with the decision of the CENELEC Technical Board.

BS 7870 applies to cables for fixed installations having a rated voltage U_0/U up to and including 19/33 kV, and is published as a series of separate parts and sections, as listed in the table in the foreword of BS 7870-1.

BS 7870-8.5 implements HD 627:Part 7A1 and is to be read in conjunction with BS 7870-1 and BS 7870-2.

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 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.

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 23 and a back cover.

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1 Scope

This section of BS 7870 specifies requirements for the construction, dimensions and mechanical and physical properties of multicore cables with thermosetting insulation and non-halogenated sheaths, having reduced fire propagation performance, and low emission of smoke when affected by fire.

It specifies requirements for:

- a) steel wire armoured multicore cables (2-core to 48-core) having copper conductors;
- b) unarmoured multicore cables (2-core to 48-core) having copper conductors.

It specifies requirements for both Type 1 and Type 2 cables, which are defined as follows:

- Type 1: cable designed for the installation and operating conditions prevailing in a conventional fossil-fuelled power station or equivalent location;
- Type 2: cable designed for the installation and operating conditions prevailing in a PWR power station, but excluding location in or around the containment area.

The requirements specified in this section of BS 7870 are applicable to both Type 1 and Type 2 cables unless otherwise indicated.

This section of BS 7870 is applicable to cables for use in and around power stations and other installations having similar cable densities.

NOTE A “guide to use” is given in Annex A.

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

BS 7870-1, *LV and MV polymeric insulated cables for use by distribution and generation utilities — Part 1: General*.

BS 7870-2:1999, *LV and MV polymeric insulated cables for use by distribution and generation utilities — Part 2: Methods of test*.

BS 7870-6.3, *LV and MV polymeric insulated cables for use by distribution and generation utilities — Part 6: Specification for 0.6/1 kV and 1.9/3.3 kV power cables with special fire performance for use in power stations — Section 6.3: Cables with thermosetting insulation and non-halogenated sheath*.

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

BS EN 60811-1-3:1995, *Insulating and sheathing materials of electric cables — Common test methods — Part 1-3: General application — Methods for determining the density — Water absorption tests — Shrinkage test*.

BS EN 60811-1-4:1995, *Insulating and sheathing materials for electric cables — Common test methods — Part 1-4: General application — Test at low temperatures*.

BS EN 60811-2-1:1995, *Insulating and sheathing materials for electric cables — Common test methods — Part 2-1: Methods specific to elastomeric compounds — Ozone resistance, hot set and mineral oil immersion tests*.

BS EN 60811-3-1:1995, *Insulating and sheathing materials for electric cables — Common test methods — Part 3-1: Methods specific to PVC compounds — Pressure test at high temperature — Tests for resistance to cracking*.

BS EN ISO 4589-3, *Plastics — Determination of burning behaviour by oxygen index — Part 3: Elevated temperature test*.

ASTM D5964-96:2001, *Standard practice for rubber IRM 902 and IRM 903 replacement oils for ASTM No. 2 and ASTM No. 3 oils*.

3 Voltage designation

Cables shall be designated by the voltages U_0 , U and U_m , expressed in the form $U_0/U (U_m)$.

The voltage designation of cables in this standard is 0.6/1 (1.2) kV.

4 Conductors

Conductors shall be 1.5 mm², 2.5 mm² or 4 mm², of circular stranded copper (class 2), conforming to the requirements of BS 6360.

Conformity shall be checked by visual examination as specified in **15.2**.

NOTE A separator tape may be applied over the conductor.

5 Insulation

The insulation for Type 1 cables shall be a single extruded layer of XLPE or HEPR. The insulation for Type 2 cables shall be either a single extruded layer of thermosetting TI Z material, or two bonded layers of extruded thermosetting material, as a composite layer, conforming to the requirements for TI Z specified in Table 11.

The insulation shall be applied so that it fits closely on the conductor and it shall be possible to remove it without damage to the insulation itself or to the conductor.

The insulation shall be applied by a suitable extrusion process, cross-linked where required, and shall form a compact and homogenous body.

Conformity shall be checked by the test methods specified in **15.3**.

6 Identification of cores

The cores shall be black or white with printed numbers in a contrasting colour.

The cores shall be numbered in sequence inside to outside from 1 to 48.

Cores shall be clearly identifiable and the printing shall be durable.

Conformity shall be checked by visual examination as specified in **15.4**.

7 Assembly of cores, fillers and binders

The direction of lay shall alternate for each successive layer. Up to seven cores shall be laid up with either a right- or left-hand direction of lay or an alternating right- and left-hand direction of lay.

Conformity shall be checked by visual examination as specified in **15.5**.

NOTE 1 Where necessary, fillers of suitable synthetic material may be used.

NOTE 2 At the discretion of the manufacturer, a synthetic binder tape may be applied over the laid-up cores.

8 Bedding layer (optional for unarmoured cables)

The bedding for Type 1 cables shall consist of a compound conforming to the requirements for ZB 1 as specified in Table 12. The bedding for Type 2 cables shall consist of a compound conforming to the requirements for ZB 2 as specified in Table 12.

NOTE 1 A bedding layer is optional for unarmoured cables.

NOTE 2 Tapes may be applied over the bedding.

9 Armouring

Armoured cables shall have a single layer of galvanized steel wires. The wires shall be applied with a direction of lay opposite to that of the outer layer of cores.

Joints in the steel wire armour shall be brazed or welded and any surface irregularity shall be removed. Any joint in any wire shall be not less than 1 m from the nearest joint in any other armour wire in the complete cable.

NOTE Tapes may be applied over the armour wires.

10 Oversheath

The oversheath for Type 1 cables shall consist of an extruded layer of compound conforming to the requirements for ZM 1 as specified in Table 12. The oversheath for Type 2 cables shall consist of an extruded layer of black compound conforming to the requirements for ZM 2 as specified in Table 12.

11 Marking

11.1 External marking

The external surface of the cable shall be legibly marked with the following elements:

Element	Example of marking
a) Electric cable	ELECTRIC CABLE
b) Voltage designation	600/1 000 V AUX
c) British Standard number ¹⁾ and cable type	BS 7870-8.5 Type 1 or BS 7870-8.5 Type 2
d) Manufacturer's identification	XYZ

The marking shall be by indenting or embossing on the oversheath.

For cables with tabulated²⁾ approximate overall diameters greater than 15 mm, elements a), b) and c) shall appear, in any sequence that is deemed neither to confuse nor to conflict, on two or more primary lines along the axis of the cable, approximately equally spaced around the circumference of the cable. Element d) shall appear upon at least one line, which may be one of the primary lines or a secondary line.

For cables with tabulated²⁾ approximate overall diameters of 15 mm or less, the elements shall be arranged as for cables of greater than 15 mm diameter, except that the marking for elements a), b) and c) shall appear on one or more primary lines.

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

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

Conformity shall be checked by visual examination and measurement as specified in 14.6.

11.2 Identification of year of manufacture

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

If the identification is internal, 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 external surface, the distance between the end of one element of marking and the beginning of the next identical element shall be not greater than 1 100 mm.

Conformity shall be checked by visual examination and measurement as specified in 14.6.

¹⁾ Marking BS 7870-8.5:2003 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 the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third-party certification of conformity

²⁾ See Table 1 to Table 8.

11.3 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 as an identification thread or by marking on the external surface of the cable, as specified by the approval organization.

If the mark is on the external surface of the cable, it shall be in the form of the symbol(s) specified by the approval organization, and the distance between the end of one element of marking and the beginning of the next identical element shall be not greater than 1 100 mm.

Conformity shall be checked by visual examination and measurement as specified in **14.6**.

11.4 Additional marking

Where additional marking is made, it shall be throughout the length of the cable, and 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. If the additional marking is applied to the external surface of the cable, it shall not render illegible the marking specified in **11.1**, **11.2** and **11.3**.

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

Conformity shall be checked by visual examination and measurement as specified in **14.6**.

12 Dimensions

The dimensions of the component layers shall be as specified in Table 1 to Table 8.

Table 1 — Construction of 1.5 mm² multicore XLPE or HEPR insulated armoured cables (Type 1 only)

Cable type	Conductor size mm ²	Mean thickness of insulation mm	Mean thickness of bedding mm	Approximate diameter over bedding mm	Armour wire diameter mm	Mean thickness of oversheath mm	Approximate overall diameter mm
2-core	1.5	0.6	0.8	7.6	0.9	1.4	12.3
3-core	1.5	0.6	0.8	8.1	0.9	1.4	12.8
4-core	1.5	0.6	0.8	8.8	0.9	1.4	13.5
7-core	1.5	0.6	0.8	10.6	0.9	1.4	15.2
12-core	1.5	0.6	0.8	13.8	1.25	1.5	19.4
19-core	1.5	0.6	0.8	16.3	1.25	1.6	22.2
27-core	1.5	0.6	1.0	19.9	1.6	1.7	26.7
37-core	1.5	0.6	1.0	22.4	1.6	1.8	29.2
48-core	1.5	0.6	1.0	25.7	1.6	1.9	32.9

Table 2 — Construction of 2.5 mm² multicore XLPE or HEPR insulated armoured cable (Type 1 only)

Cable type	Conductor size mm ²	Mean thickness of insulation mm	Mean thickness of bedding mm	Approximate diameter over bedding mm	Armour wire diameter mm	Mean thickness of oversheath mm	Approximate overall diameter mm
2-core	2.5	0.7	0.8	8.9	0.9	1.4	13.6
3-core	2.5	0.7	0.8	9.4	0.9	1.4	14.1
4-core	2.5	0.7	0.8	10.3	0.9	1.4	15.0
7-core	2.5	0.7	0.8	12.4	0.9	1.4	17.1
12-core	2.5	0.7	0.8	16.5	1.25	1.6	22.4
19-core	2.5	0.7	1.0	19.8	1.6	1.7	26.6
27-core	2.5	0.7	1.0	23.9	1.6	1.8	30.7
37-core	2.5	0.7	1.0	26.8	1.6	1.8	33.8
48-core	2.5	0.7	1.2	31.3	2.0	2.0	39.3

Table 3 — Construction of 4 mm² multicore XLPE or HEPR insulated armoured cable (Type 1 only)

Cable type	Conductor size mm ²	Mean thickness of insulation mm	Mean thickness of bedding mm	Approximate diameter over bedding mm	Armour wire diameter mm	Mean thickness of oversheath mm	Approximate overall diameter mm
2-core	4	0.7	0.8	10.0	0.9	1.4	14.7
3-core	4	0.7	0.8	10.7	0.9	1.4	15.3
4-core	4	0.7	0.8	11.7	0.9	1.4	16.4
7-core	4	0.7	0.8	14.1	1.25	1.5	19.7
12-core	4	0.7	1.0	19.1	1.6	1.6	25.7
19-core	4	0.7	1.0	22.7	1.6	1.7	29.3
27-core	4	0.7	1.0	27.2	1.6	1.9	34.4
37-core	4	0.7	1.2	31.2	2.0	2.0	39.2
48-core	4	0.7	1.2	35.7	2.0	2.1	44.1