

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

**Part 4: Specification for distribution
cables with extruded insulation for
rated voltages of 11 kV and 33 kV —**

**Section 4.13: Single core 33 kV copper
wire/foil sheath cables**

ICS 29.060.20

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee GEL/20, Electric cables, to Subcommittee GEL/20/2, Mains cables, 1 kV and above, upon which the following bodies were represented:

- 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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13519 Corrigendum	15 November 2001	In Table 1 corrections to approximate number of wires for copper wire screen (35 mm ²) and to short circuit rating text. Corrections to earth fault rating text in Annex G

The following BSI references relate to the work on this British Standard:

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Foreword

This section of BS 7870 has been prepared by Subcommittee GEL/20/2.

BS 7870 implements the nationally applicable parts of Harmonization Documents HD 603, 604, 605, 620, 622, 626 and 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 of 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 7870-4.13 specifies a range of 19/33 kV extruded insulation cables having radial and longitudinal water barriers. This range of cables is to be proposed, under the CENELEC TC20 maintenance procedure, as part of a future amendment No. 2 to HD 620-50 and HD 620-70. BS 7870-4.13 is to be read in conjunction with BS 7870-1 and BS 7870-2:1999.

A “Guide to use” for these types of cable is under consideration.

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

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 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.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their 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.

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1 Scope

This section of BS 7870 specifies requirements for the construction, dimensions and mechanical and physical properties of 19/33(36) kV single core cables having stranded copper conductors, cross-linked polyethylene (XLPE) or ethylene propylene rubber (EPR) extruded insulation, copper wire screen, water blocking tape(s), copper foil sheath and medium density polyethylene (MDPE) oversheath.

NOTE 1 The copper foil sheath may consist of either plain, corrugated or laminated copper.

It is applicable to cables that are intended to be suitable for laying direct in the ground, in ducts or in air, supplied either single core or in triplex formation.

NOTE 2 A long term test has been included to assess performance in wet conditions.

It is applicable to cables intended for operation at a continuous maximum conductor temperature of 90 °C and at a maximum conductor short circuit temperature of 250 °C.

NOTE 3 Guidance on selection of cables is given in Annex A. Guidance on type tests is given in Annex B.

2 Normative references

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

BS 6360:1991, *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 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: General application — Methods for determining the density — Water absorption tests — Shrinkage test*.

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*.

3 Voltage designation

Cables are 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 19/33 (36) kV.

4 Construction and dimensions

4.1 Conductors

Conductors shall be stranded copper, conforming to BS 6360 (class 2) in the following sizes: 150 mm², 185 mm², 240 mm², 300 mm², 400 mm², 500 mm², 630 mm² and 800 mm².

NOTE Aluminium conductors, other sizes and constructions including longitudinal water blocking may be provided by agreement between the manufacturer and the purchaser.

Conformity shall be checked by visual examination as specified in 7.1.

4.2 Screens and insulation

4.2.1 Application

The insulation and the semi-conducting screens shall be applied as a continuous single pass triple extrusion, free of factory repairs.

NOTE Precautions should be taken to ensure that gaseous cross-linking by-products are adequately removed from the core prior to supply.

4.2.2 Conductor screen

A conductor screen consisting of an extruded layer of semi-conducting compound, which shall be cross-linked during manufacture of the cable, shall be applied over the conductor. The extruded layer shall be continuous and shall cover the surface of the conductor completely. It shall be fully bonded to the insulation and shall not separate from the insulation due to the effects of bending, load cycling and short-circuit.

NOTE A semi-conducting tape may be applied prior to the extruded layer by agreement between the manufacturer and the purchaser.

Conformity shall be checked by the test methods specified in 7.2.

4.2.3 Insulation

The insulation shall be XLPE or EPR, conforming to the requirements specified in Table 4.

The insulation shall be applied by extrusion and cross-linked to form a compact and homogeneous layer. The colour of the insulation shall be such that it is easily distinguishable from the screening materials.

The thickness of the insulation shall conform to the specifications in Table 1.

Conformity shall be checked by the test methods specified in 7.3.

4.2.4 Insulation screen

The insulation screen shall consist of an extruded layer of cross-linked semi-conducting compound.

The screen shall be fully bonded to the insulation. It shall be continuous and shall cover the surface of the insulation completely, and shall not separate from the insulation due to the effects of bending, load cycling or short-circuit.

Conformity shall be checked by the test methods specified in 7.5.

4.3 Metallic screen

A layer of copper wires shall be applied over the semi-conducting insulation screen in a single helical layer. The approximate number and diameter of the wires and the earth fault capability, based upon either a 35 mm² or 50 mm² copper wire screen with no contribution from the copper foil sheath, shall be as given in Table 1. The wires shall be spaced with an average gap not greater than 4 mm and no gap shall exceed 8 mm.

NOTE 1 Where a greater earth fault capability is required, this should be specified by the purchaser.

NOTE 2 A semi-conducting bedding tape may be applied under the metallic screen and longitudinal water blocking may be provided by agreement between the manufacturer and the purchaser.

Conformity shall be checked by visual examination as specified in 7.7.

4.4 Water blocking tape

Semi-conducting water blocking tape(s) shall be applied over the copper metallic screen to form a compact and circular layer.

NOTE Other water blocking materials may be used by agreement between the manufacturer and the purchaser.

Conformity shall be checked by the test methods specified in 7.8.

4.5 Copper foil sheath

A copper foil sheath shall be longitudinally applied over the water blocking tape(s) with a minimum overlap of 7 mm. The copper foil overlap shall be sealed to prevent ingress of moisture and the copper foil shall not show any mechanical damage due to the effects of bending, load cycling or short-circuit.

The approximate thickness of the copper foil sheath shall conform to the specifications in Table 1.

NOTE Other metallic foils may be used by agreement between the manufacturer and the purchaser.

Conformity shall be checked by the test methods specified in 7.9.

4.6 Oversheath

The oversheath shall be an extruded layer of black medium density polyethylene (MDPE) conforming to the requirements specified in Table 5.

The thickness of the oversheath shall conform to the specifications in Table 1.

NOTE 1 Alternative materials or colours may be provided by agreement between the manufacturer and the purchaser.

NOTE 2 When required by the purchaser an outer semi-conducting coating may be applied to serve as an electrode for a voltage test on the oversheath.

Conformity shall be checked by the test methods specified in 7.10.

4.7 Triplex cables

Cables in triplex formation shall be laid up with a right-hand direction of lay. Coloured, non-hygroscopic marker tapes shall be included within each single core cable to provide phase identification.

NOTE Alternative methods of marking may be used by agreement between the manufacturer and the purchaser.

4.8 Marking

4.8.1 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	33 000 V
c) British Standard number ¹⁾	BS 7870-4.13
d) Manufacturer's identification	XYZ
e) Number of cores, type and nominal area of conductor, e.g. 1 × 300 shall indicate a single core cable with a 300 mm ² copper conductor	

NOTE 1 "1 × 300 AL" indicates a single core cable with a 300 mm² aluminium conductor.

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

The marking of element e) shall be by embossing, indenting or printing on the oversheath.

Elements a), b) and c) shall appear on two or more primary lines along the axis of the cable, approximately equally spaced around the circumference of the cable. Elements d) and e) shall appear on at least one line.

NOTE 2 Elements d) and e) may be on one of the primary lines or a secondary line or lines and need not be on the same line.

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 of marking shall be not greater than 550 mm for elements a), b) and c), and not greater than 1 100 mm for elements d) and e).

Conformity shall be checked by visual examination and measurement as specified in 6.6.

¹⁾ Marking BS 7870-4.13:2001 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.

4.8.2 Identification of year and month of manufacture

A means of identifying the year and month of manufacture of the cable shall be provided throughout the length of the cable by marking on the external surface of the cable.

Marking on the external surface shall be by embossing or by indenting, and shall conform to 4.8.1 in respect of the minimum height of 3 mm and the maximum distance of 1 100 mm between marks.

Conformity shall be checked by visual examination and measurement as specified in 6.6.

4.8.3 Mark of an approval organization

If the mark of an approval organization is used it shall be provided throughout the length of the cable.

Conformity shall be checked by visual examination as specified in 6.6.

4.8.4 Metre marking

If metre marking is used it shall be legible throughout the length of the cable.

If cables are supplied in triplex formation, only one cable shall be marked.

Conformity shall be checked by visual examination as specified in 6.6.

4.9 End sealing

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

4.10 Dimensions

The thickness of the insulation, oversheath and copper foil sheath shall be as given in Table 1.

NOTE Examples of construction, thickness of other layers and the overall diameter of the cable are also given in Table 1.

Table 1 — 19/33 kV single core cables having stranded copper conductors

Description	Unit	Nominal cross-sectional area of conductor							
		mm ²							
		150	185	240	300	400	500	630	800
Approximate thickness of conductor screen	mm	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Minimum average thickness of insulation	mm	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Minimum thickness of insulation at any point	mm	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1
Approximate thickness of insulation screen	mm	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Copper wire screen:									
a) 35 mm ²									
— approximate wire diameter	mm	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
— approximate number of wires		42	42	42	42	42	42	42	42
b) 50 mm ²									
— approximate wire diameter	mm	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26
— approximate number of wires		42	42	42	42	42	42	42	42
Approximate thickness of water blocking tape	mm	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Approximate thickness of copper foil sheath	mm	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Minimum average thickness of oversheath	mm	2.2	2.2	2.3	2.4	2.5	2.6	2.7	2.8
Minimum thickness of oversheath at any point	mm	1.77	1.77	1.85	1.94	2.02	2.11	2.19	2.28
Approximate overall diameter of completed cable	mm	44.3	46.1	48.8	51.3	54.6	57.8	61.7	68.0
Approximate overall diameter of triplex cable	mm	95.7	99.6	105.5	110.8	117.9	124.8	133.3	146.9
Earth fault capability of copper wire screen:									
35 mm ² (1 s)	kA	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
50 mm ² (1 s)	kA	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4

NOTE The approximate overall diameters are given for information only.