

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 4.20: Three-core 11 kV cables
(Implementation of HD 620)**

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
- ERA Technology Ltd.
- Electricity Association
- London Underground Ltd.
- UK Steel Association

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Foreword

BS 7870 was prepared by Technical Committee GEL/20. It 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 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 part 1.

This section of BS 7870 implements part of HD 620-60 and part of HD 620-80, and is to be read in conjunction with BS 7870-1 and -2.

A guide to use for these types of cable is under consideration.

Annex A and annex B are informative.

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.

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 14, an inside back cover and a back cover.

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1 Scope

This section of BS 7870 specifies the construction and dimensions of 6.35/11(12) kV three-core cables having aluminium conductors, cross-linked polyethylene (XLPE) or ethylene propylene rubber (EPR) extruded insulation, copper or steel wire collective metallic screen and an oversheath of medium density polyethylene (MDPE).

It is applicable to cables which are suitable for laying direct in ground, in ducts or in air.

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

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

User options are listed in annex A.

Guidance on type testing is given in annex B.

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.

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

BS 6469, *Insulating and sheathing materials of electric cables.*

BS 6469-99, *Test methods used in the United Kingdom but not specified in parts 1 to 5*

BS 6469-99.1:1992, *Non-electrical tests.*

BS 7870, *LV and MV polymeric insulated cables for use by distribution and generation utilities.*

BS 7870-1, *General.*

BS 7870-2:1999, *Methods of test.*

BS EN 60811, *Insulating and sheathing materials of electric cables. Common test methods.*

BS EN 60811-1, *General application.*

BS EN 60811-1-1:1995, *Measurement of thickness and overall dimensions. Tests for determining the mechanical properties.*

BS EN 60811-1-2:1995, *Thermal ageing methods.*

BS EN 60811-1-3:1995, *Methods for determining the density. Water absorption tests. Shrinkage test.*

BS EN 60811-2, *Methods specific to elastomeric compounds.*

BS EN 60811-2-1:1995, *Ozone resistance test. Hot set test. Mineral oil immersion test.*

BS EN 60811-3, *Methods specific to PVC compounds.*

BS EN 60811-3-1:1995, *Pressure test at high temperature. Tests for resistance to cracking.*

3 Voltage designation

Cables are designated by the voltage U_0 , U and U_m expressed in the form U_0/U (U_m).

The voltage designation of cables in this standard is:

6.35/11(12) kV.

4 Construction and dimensions

4.1 Conductors

The conductors shall be aluminium, shaped or circular, solid or stranded conforming to BS 6360 in the following sizes:

95, 185 and 300 mm².

Aluminium conductors shall be either solid (class 1) or stranded (class 2) conductors.

The dimensions of shaped solid aluminium conductors shall conform to the specifications in Table 1.

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

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.

Table 1 — Dimensions of shaped solid aluminium conductors

Nominal cross-sectional area of conductor mm ²	Approximate dimensions of conductor				Minimum corner radius of conductor mm
	Width mm	Depth mm	Back radius mm	Corner radius mm	
95	13.9	9.1	11.4	2.8	2.6
185	20.5	12.6	15.4	3.0	2.8
300	27.3	16.2	19.5	3.0	2.8



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4.2.2 Conductor screen

A conductor screen consisting of an extruded layer of semi-conducting compound, which shall be cross-linked during the 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 at the discretion of the manufacturer.

4.2.3 Insulation

The insulation shall be XLPE or EPR conforming to the requirements of this specification.

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 Tables 2 to 9.

4.2.4 Insulation screen

The insulation screen shall consist of an extruded layer of cross-linked semi-conducting compound. The screen shall be either bonded or cold strippable, by agreement between the manufacturer and the purchaser. It shall be continuous and cover the surface of the insulation completely and shall not separate from the insulation due to the effects of bending, load cycling and short-circuit.

4.2.5 Core identification

The cable cores shall be identified within the cable either with core numbering marked on the cores or another method agreed between the manufacturer and the purchaser.

4.3 Laying up

The cores shall be laid up with a right hand direction of lay. Fillers shall be used but only sufficient to form a compact substantially circular and robust cable. The fillers shall be compatible with adjacent materials. The shape of the filler shall not prevent electrical contact between the insulation screen and the semi-conducting inner covering.

NOTE 1 With a copper wire collective screen, fillers may be reduced or omitted by agreement between the manufacturer and the purchaser. Attention is drawn to the possible effects on performance e.g. spiking, short-circuit and normal rating.

NOTE 2 Longitudinal water blocking may be provided by agreement between the manufacturer and the purchaser.

4.4 Inner covering

A lapped tape inner covering shall be applied around the laid up cores to hold the cores firmly and provide a bedding for the collective metallic screen. The material used for this inner covering shall be semi-conducting tapes compatible with the other materials used for the cable construction.

The approximate thickness of the inner covering shall conform to the specifications in Tables 2 to 9.

4.5 Collective metallic screen

The collective metallic screen shall consist of copper or galvanized steel wire.

NOTE At the option of the manufacturer a binder tape may be applied over the metallic screen.

4.5.1 Copper wire screen

A layer of copper wires shall be applied over the semi-conducting inner covering in a single helical layer.

The number, approximate diameter of the wires and earth fault capability, based upon a 35 mm² screen shall conform to the specifications in Tables 2 to 5.

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

The wires shall be spaced with an average gap not greater than 4 mm and no gap shall exceed 8 mm.

4.5.2 Galvanized steel wire armour

A layer of galvanized steel wires shall be applied over the semi-conducting inner covering in a single helical layer with a left hand lay. The wires shall cover a minimum of 95 % of the perimeter.

The nominal diameter of the wires and earth fault capability of the armour shall conform to the specifications in Tables 6 to 9.

NOTE Where a greater fault level is required, a number of galvanized steel wires may be substituted by tinned copper wires subject to agreement between the purchaser and the manufacturer.

4.6 Oversheath

The oversheath shall comprise an extruded layer of red medium density polyethylene (MDPE) conforming to the requirements of this specification. The thickness of the oversheath shall conform to the specifications in Tables 2 to 9.

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

4.7 Cable markings

4.7.1 Marking of oversheath

The external surface of all cables in this standard shall be legibly marked with the following elements of marking.

Element	Example of marking
a) Electric cable	ELECTRIC CABLE
b) Voltage designation	11 000 V
c) Specification number	BS 7870-4.20
d) Manufacturer's identification	XYZ
e) The number of cores, type and nominal area of conductor e.g. 3 × 95 AL indicates a three-core cable with 95 mm ² aluminium conductors.	

NOTE Where the option of copper conductors is agreed (see annex A) the equivalent marking for a three-core 95 mm² cable would be 3 × 95.