

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

Part 7: Specification for power cables having rated voltages of 3.8/6.6 kV and 6.35/11 kV with special fire performance for use in power stations —

Section 7.2: Single core and 3-core cables with halogen-free materials and with aluminium or steel wire armouring

(Implementation of HD 622)

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Committees responsible for this British Standard

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

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Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
1 Scope	1
2 Normative references	1
3 Voltage designation	2
4 General requirements	2
5 Cables without metallic coverings	13
6 Cables with metallic coverings	13
Annex A (informative) Guide to use	19
Bibliography	25
Table 1 — Single core 3 800/6 600 V cable with stranded aluminium or copper circular conductors	3
Table 2 — 3-core 3 800/6 600 V cable with stranded aluminium or copper circular conductors	3
Table 3 — Single core 6 350/11 000 V cable with stranded aluminium or copper circular conductors	4
Table 4 — 3-core 6 350/11 000 V cable with stranded aluminium or copper circular conductors	4
Table 5 — Schedule of tests	6
Table 6 — Compatibility test	8
Table 7 — Cold bending test	9
Table 8 — Bend test	9
Table 9 — Power factor variation with voltage	9
Table 10 — Power factor variation with temperature	10
Table 11 — Impulse testing	10
Table 12 — Special type tests for Type 2 cables	11
Table 13 — Requirements for non-electrical tests for 90 °C insulation	15
Table 14 — Requirements for non-electrical tests for halogen-free bedding and oversheath	16
Table 15 — Diameter of round wire armour	18
Table 16 — Mass of zinc coating	18
Table A.1 — Maximum permissible voltage	19
Table A.2 — Armour resistance for 3.8/6.6 kV cables	20
Table A.3 — Armour resistance for 6.35/11 kV cables	21
Table A.4 — Gross cross-sectional areas of armour wires for 3.8/6.6 kV cables	22
Table A.5 — Gross cross-sectional areas of armour wires for 6.35/11 kV cables	22
Table A.6 — D.C. test on cable insulation	24

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, 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 BS 7870-1.

BS 7870-7.1 specifies a range of PVC sheathed reduced fire propagation performance cables, and implements HD 622-3H.

BS 7870-7.2 specifies a range of halogen-free sheathed cables, having reduced fire propagation performance and low emission of smoke when affected by fire. It implements HD 622-4H 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.

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 25 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 single core and 3-core cross-linked polyethylene (XLPE) or ethylene propylene rubber (EPR) insulated and halogen-free sheathed cables with aluminium or steel wire armouring, having reduced fire propagation performance and low emission of smoke when affected by fire.

It specifies requirements for the following categories of cable:

- a) single core XLPE or EPR insulated aluminium wire armoured 3.8/6.6 kV;
- b) 3-core XLPE or EPR insulated aluminium wire armoured or steel wire armoured 3.8/6.6 kV;
- c) single core XLPE or EPR insulated aluminium wire armoured 6.35/11 kV;
- d) 3-core XLPE or EPR insulated aluminium wire armoured or steel wire armoured 6.35/11 kV.

It specifies requirements for two different types of cable:

- 1) Type 1 — cable intended to be suitable for the installation and operating conditions prevailing in a conventional fossil-fuelled power station or equivalent location;
- 2) Type 2 — cable intended to be suitable for the installation and operating conditions prevailing in a pressurized water reactor (PWR) power station, but excluding locations in or around the containment area.

NOTE 1 Type 1 and Type 2 cables are both required to conform to the common constructional requirements of this section of BS 7870, but the performance requirements differ as indicated in the relevant clauses and test schedules. The more onerous type testing of Type 2 cables acknowledges the limited size range and voltage of cables currently used in certain PWR projects.

This section of BS 7870 is applicable to cables for fixed installations that are mainly intended for use in power generating plants and substations, and where the combination of ambient temperature and temperature rise due to loading current results in a conductor temperature not exceeding 90 °C.

NOTE 2 Annex A contains a “guide to use” for the cables specified in this section of BS 7870.

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 7870-7.1, *LV and MV polymeric insulated cables for use by distribution and generation utilities — Part 7: Specification for power cables having rated voltages of 3.8/6.6 kV and 6.35/11 kV with special fire performance for use in power stations — Section 7.1: Single and 3-core cables with halogenated materials and with aluminium or steel wire armouring*.

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: Procedures — Section 2.1: 1 kW pre-mixed flame*.

BS EN 60811-1-1:1995, *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 60811-1-3:1995, *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*.

BS EN 60811-1-4:1995, *Insulating and sheathing materials of electric cables — Common test methods — Part 1: General application — Section 1.4: Test at low temperatures*.

BS EN 60811-2-1:1995, *Insulating and sheathing materials of electric cables — Common test methods — Part 2: Methods specific to elastomeric compounds — Section 2.1: Ozone resistance, hot set and mineral oil immersion tests.*

BS EN 60811-3-1:1995, *Insulating and sheathing materials of electric cables — Common test methods — Part 3: Methods specific to PVC compounds — Section 3.1: Pressure test at high temperature — Tests for resistance to cracking.*

BS EN 60811-3-2:1995, *Insulating and sheathing materials of electric cables — Common test methods — Part 3: Methods specific to PVC compounds — Section 3.2: Loss of mass test — Thermal stability test.*

BS ISO 4589-2:1996, *Plastics — Determination of burning behaviour by oxygen index — Part 2: Ambient-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 designations of cables in this standard are:

- a) 3.8/6.6 (7.2) kV;
- b) 6.35/11 (12) kV.

4 General requirements

4.1 Identification of cores in 3-core cables

The cores of 3-core cables shall be unmarked.

4.2 Thickness of insulation

The mean value of the thickness of insulation, excluding semi-conducting layers, shall be not less than the specified value for each type and size of cable shown in Table 1, Table 2, Table 3 and Table 4.

If the thickness at any place is less than the specified value, the difference shall not exceed $0.1 \text{ mm} + 10 \%$ of the specified value.

Conformity shall be checked by the test specified in BS 7870-2:1999, **2.1.1**.

4.3 Thickness of extruded bedding

The minimum thickness of extruded bedding shall not fall below the specified value for each type and size of cable shown in Table 1, Table 2, Table 3 and Table 4 by more than $15 \% + 0.1 \text{ mm}$.

Conformity shall be checked by the test given in BS 7870-2:1999, **2.1.2**.

4.4 Thickness of oversheath

The minimum thickness at any point of the oversheath shall not fall below the specified value for each type and size of cable shown in Table 1, Table 2, Table 3 and Table 4 by more than $0.2 \text{ mm} + 20 \%$ of the specified value.

Conformity shall be checked by the test given in BS 7870-2:1999, **2.1.2**.

Table 1 — Single core 3 800/6 600 V cable with stranded aluminium or copper circular conductors

Nominal cross-sectional area of conductor ^a mm ²	Thickness of insulation mm	Thickness of extruded bedding mm	Nominal armour wire diameter mm	Thickness of oversheath mm	Approximate overall diameter mm
50	2.5	1.2	1.6	1.8	26.7
70	2.5	1.2	1.6	1.8	28.4
95	2.5	1.2	1.6	1.9	30.3
120	2.5	1.2	1.6	1.9	31.9
150	2.5	1.2	1.6	2.0	33.5
185	2.5	1.2	2.0	2.0	36.1
240	2.6	1.2	2.0	2.1	38.9
300	2.8	1.2	2.0	2.2	41.8
400	3.0	1.2	2.0	2.3	45.5
500	3.2	1.3	2.5	2.5	50.5
630	3.2	1.4	2.5	2.6	54.6
800 ^b	3.2	1.4	2.5	2.7	60.8
1 000 ^b	3.2	1.5	2.5	2.9	65.9

^a Circular compacted stranded conductor class 2.
^b These sizes apply to cables with copper conductors only.

Table 2 — 3-core 3 800/6 600 V cable with stranded aluminium or copper circular conductors

Nominal cross-sectional area of conductor ^a mm ²	Thickness of insulation mm	Thickness of extruded bedding mm	Nominal armour wire diameter ^b mm	Thickness of oversheath mm	Approximate overall diameter mm
50	2.5	1.3	2.5	2.5	50.3
70	2.5	1.3	2.5	2.6	54.2
95	2.5	1.4	2.5	2.7	58.3
120	2.5	1.5	2.5	2.8	62.1
150	2.5	1.5	2.5	2.9	65.3
185	2.5	1.6	2.5	3.0	69.6
240	2.6	1.7	2.3	3.2	75.8
300	2.8	1.8	3.15	3.5	83.8
400	3.0	2.0	3.15	3.7	92.1

^a Circular compacted stranded conductor class 2.
^b Armour wires may be of aluminium or galvanized steel.

Table 3 — Single core 6 350/11 000 V cable with stranded aluminium or copper circular conductors

Nominal cross-sectional area of conductor ^a mm ²	Thickness of insulation mm	Thickness of extruded bedding mm	Nominal armour wire diameter ^b mm	Thickness of oversheath mm	Approximate overall diameter mm
50	3.4	1.2	1.6	1.8	28.5
70	3.4	1.2	1.6	1.9	30.4
95	3.4	1.2	1.6	1.9	32.1
120	3.4	1.2	1.6	2.0	33.9
150	3.4	1.2	2.0	2.1	36.3
185	3.4	1.2	2.0	2.1	38.1
240	3.4	1.2	2.0	2.2	40.7
300	3.4	1.2	2.0	2.2	43.0
400	3.4	1.2	2.0	2.4	46.5
500	3.4	1.3	2.5	2.5	50.9
630	3.4	1.4	2.5	2.6	55.0

^a Circular compacted stranded conductor class 2.**Table 4 — 3-core 6 350/11 000 V cable with stranded aluminium or copper circular conductors**

Nominal cross-sectional area of conductor ^a mm ²	Thickness of insulation mm	Thickness of extruded bedding mm	Nominal armour wire diameter ^b mm	Thickness of oversheath mm	Approximate overall diameter mm
50	3.4	1.4	2.5	2.6	54.6
70	3.4	1.4	2.5	2.7	58.5
95	3.4	1.5	2.5	2.8	62.6
120	3.4	1.6	2.5	3.0	66.6
150	3.4	1.6	2.5	3.1	69.8
185	3.4	1.7	2.5	3.2	74.1
240	3.4	1.8	3.15	3.4	81.2
300	3.4	1.9	3.15	3.6	86.8

^a Circular compacted stranded conductor class 2.^b Armour wires may be of aluminium or galvanized steel.

4.5 Marking

4.5.1 External marking

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

Element	Example of marking
a) Electric cable	ELECTRIC CABLE
b) Voltage designation	6 600 V or 11 000 V
c) British Standard number ¹⁾	BS 7870-7.2 Type 1 (or Type 2)
d) Manufacturer's identification	XYZ
e) The number of cores, type and nominal conductor area, e.g.	
1) Copper conductor cable	3 × 185
2) Aluminium conductor cable	1 × 400 AL

The marking of elements a) to d) shall be by embossing, by indenting on the oversheath, or by other durable means agreed with the purchaser.

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.

Elements d) and e) shall appear on at least one line.

NOTE 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.

4.5.2 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.

4.5.3 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.

¹⁾ Marking BS 7870-7.2:2003 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.