BS 7870-4.20:2011+A1:2016

BSI Standards Publication

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 to 33 kV

Section 4.20: Three-core 11 kV cables

(Implementation of HD 620)

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Foreword

Publishing information

This section of BS 7870 is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 December 2011. It was prepared by Subcommittee GEL/20/16, *Medium/High voltage cables*, under the authority of Technical Committee GEL/20, *Electric cables*. A list of organizations represented on these committees can be obtained on request to their secretary.

Supersession

BS 7870-4.20:2011+A1:2016 supersedes BS 7870-4.20:2011, which is withdrawn.

Relationship with other publications

BS 7870 implements the nationally applicable parts of Harmonization Documents HD 603, 605, 620, 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.

This section of BS 7870 implements HD 620 S2 Part 10 O, and is to be read in conjunction with BS 7870-1 and BS 7870-2.

Information about this document

BS 7870-4.20:2011 was a full revision of the standard and brought the standard up to date in accordance with current practice in the industry.

The start and finish of text introduced or altered by Amendment No 1 is indicated in the text by tags ▶A1⟩ ⟨A1◀. Minor editorial changes are not tagged.

A general guide to use for the types of cable specified in BS 7870 is given in BS 7870-1 and specific details for the types of cables specified in this section of BS 7870 are given in Annex A.

Hazard warnings

WARNING. This British Standard calls for the use of substances and/or procedures that can 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.

Use of this document

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.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

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Contractual and legal considerations

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 cannot confer immunity from legal obligations.

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1 Scope

This section of BS 7870 specifies requirements for the construction, dimensions and mechanical and electrical properties of 6.35/11(12) kV three-core cables having either aluminium or copper conductors, cross-linked polyethylene (XLPE) or ethylene propylene rubber (EPR) extruded insulation, a copper wire metallic screen and an oversheath of one of the following compounds.

a) medium density polyethylene (MDPE) compound type DMP 5 (Type A cables);

b) thermoplastic compound type DMZ 4 for cables having a low emission of smoke and corrosive gases when affected by fire (Type B cables).

This section of BS 7870 is applicable to cables that are designed for a maximum continuous conductor operating temperature of 90 °C and for a maximum short-circuit conductor temperature of 250 °C.

NOTE Information to be supplied by the purchaser, and items to be agreed between the purchaser and the manufacturer at the time of enquiry and/or order are given in Annex B. Guidance on type testing is given in Annex C.

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 3988:1970+A3:1989, *Specification for wrought aluminium for electrical purposes – Solid conductors for insulated cables*

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

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

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 the amount of halogen acid gas*

BS EN 60228:2005, *Specification for conductors in insulated cables and cords*

BS EN 60332-1-2:2004, *Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame*

BS EN 60332-3-24:2009, *Tests on electric and optical fibre cables under fire conditions – Part 3-24: Test for vertical flame spread of vertically-mounted bunched wires or cables – Category C*

BS EN 60811-1-2, *Common test methods for insulating and sheathing materials of electric and optical cables – Common test methods – Part 1-2: General application –Thermal ageing methods*

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

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

BS EN 61034-1, *Measurement of smoke density of cables burning under defined conditions – Part 1: Apparatus*

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BS EN 61034-2, *Measurement of smoke density of cables burning under defined conditions – Part 2: Test procedure and requirements*

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 the cables specified in this standard shall be 6.35/11(12) kV.

4 Construction and dimensions

4.1 Conductors

Unless copper conductors are specified by the purchaser [see **B.1**b)], conductors shall be aluminium. The conductors shall be circular and shall conform to BS EN 60228. Aluminium conductors shall be either solid (class 1) or stranded (class 2). Copper conductors shall be stranded (class 2). Stranded conductors shall be compacted or uncompacted. A1 *Text deleted.* A1

A1 *NOTE For Class 1 conductors the manufacturer should declare the minimum and maximum diameter of conductor to enable correct selection of cable accessories.* A1

Conformity shall be checked by visual examination. A1 *Text deleted.* A1

The nominal conductor sizes shall be as given in Table 1.

If agreed between the purchaser and the manufacturer, longitudinal water blocking of conductors shall be provided [see **B.2**a)].

4.2 Semi-conducting screens and insulation

4.2.1 Application

The semi-conducting screens and insulation shall be applied by a continuous single pass triple extrusion, and shall be free from 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 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.

Conformity shall be checked by visual examination as specified in **7.2**.

The conductor screen 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.

Conformity shall be checked by the impulse voltage test specified in **8.2.7**.

The nominal conductor screen thickness shall be 0.7 mm and the minimum thickness at any point shall be 0.3 mm.

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

NOTE A semi-conducting tape may be applied prior to the extruded layer at the discretion of the manufacturer.

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4.2.3 Insulation

The insulation shall be either XLPE (type DIX 3) or EPR (type DIE 5) conforming to the requirements given in BS 7870-1, Annex B.

The insulation shall be applied by extrusion and cross-linked to form a compact and homogeneous layer.

NOTE The colour of the insulation should be such that it is easily distinguishable from the screening materials.

The nominal insulation thickness shall be 3.4 mm and the minimum thickness at any point shall be 2.96 mm.

Conformity shall be checked by the test methods given 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 either bonded or cold strippable as specified by the purchaser [see **B.1**c)].

The insulation screen shall be continuous and cover the surface of the insulation completely.

Conformity shall be checked by visual examination as specified in **7.5.1**.

The insulation screen shall not separate from the insulation due to the effects of bending, load cycling and short-circuit.

Conformity shall be checked by the partial discharge test specified in **8.2.2**.

Bonded insulation screens shall have a nominal thickness of 0.5 mm and the minimum thickness at any point shall be 0.3 mm.

Conformity shall be checked by the test methods specified in **7.5.1**.

Cold strippable screens shall have a nominal thickness of 0.7 mm. The minimum thickness at any point shall be 0.5 mm, as determined using a guarded knife when performing the insulation cutting resistance test in accordance with BS 7870-2, **2.2.11**, and the insulation screen shall conform to the insulation cutting resistance requirement specified in **6.4**.

4.2.5 Core identification

The cable cores shall be identified within the cable either by numbers marked on the cores or by another method agreed between the manufacturer and the purchaser [see **B.2**b)].

4.3 Laying up

The cores shall be laid up with a right-hand direction of lay.

A1 *NOTE 1 Typical lay factor L/D (where L is length of lay and D is diameter over the laid-up cores) should be in the range of 24 – 40.* A1

Fillers shall be used but only sufficient to form a compact substantially circular and robust cable. The fillers shall be selected which are compatible with adjacent materials. The shape of the filler shall not prevent electrical contact between the insulation screen and the semi-conducting inner covering. If agreed between the purchaser and the manufacturer the fillers shall be reduced or omitted [see **B.2**.c)].

NOTE 2 Attention is drawn to the possible effects on performance of omitting the fillers e.g. in the case of spiking or short-circuit and in normal operation.

If agreed between the purchaser and the manufacturer [see **B.2**d)], longitudinal water blocking of the laid up cores shall be provided.

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