BS 7870-3.12:2011
Incorporating Corrigendum No. 1

BSI Standards Publication

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

Part 3: Specification for distribution cables of rated voltage 0.6/1 kV

Section 3.12: XLPE insulated combined neutral and earth copper wire concentric cables with copper or aluminium conductors, having low emission of smoke and corrosive gases when affected by fire

(Implementation of HD 603)

Publishing and copyright information

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Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 14, an inside back cover and a back cover.

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

This section of BS 7870 supersedes BS 7870-3.12:2001, which is withdrawn.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.

BS 7870-3.12 specifies a range of XLPE insulated combined neutral/earth (CNE) service cables having low emission of smoke and corrosive gases when affected by fire; it implements Part 5S of HD 603 S1 A3, and is to be read in conjunction with BS 7870-1 and BS 7870-2.

Information about this document

This is a full revision of the standard, and brings the standard up to date in accordance with current practice in the industry.

The start and finish of text introduced or altered by Corrigendum No. 1 is indicated in the text by tags [C1⟩ and ⟨C1].

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 cable 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.

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 concentric copper wire combined neutral/earth (CNE) service cables having a rated voltage of 0.6/1 (1.2) kV. It is applicable to cables that, when assessed by the specified tests, produce lower levels of smoke and corrosive gases under exposure to fire than cables conforming to BS 7870-3.11.

It specifies requirements for the following types of cable:

a) single phase or 3-phase;

b) stranded copper or solid aluminium conductors;

c) XLPE insulation and thermoplastic oversheath with low emission of smoke and corrosive gases when affected by fire.

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.

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

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 cables in this standard shall be 0.6/1(1.2) kV.

The rated voltage of the cable shall be at least equal to the nominal voltage of the system for which it is intended.

4 Phase conductors

The phase conductors shall be either stranded (class 2) plain annealed copper or solid (class 1) aluminium conductors in accordance with BS EN 60228. Class 1 conductors shall also conform to the dimensional requirements specified in BS 3988:1970+A3, **2.4.1**.

Conformity shall be checked by visual examination and, in the case of class 1 conductors, by measurement, as specified in **15.2**.

The d.c. resistance shall conform to the relevant value given in Table 1 to Table 4, as applicable.

Conformity shall be checked by the test method specified in **14.2**.

5 Insulation

The insulation shall be XLPE compound type DIX 3, conforming to the requirements given in BS 7870-1, Annex B.

The insulation shall be applied by extrusion and shall form a compact and homogeneous layer.

The thickness of the insulation shall be in accordance with the relevant values specified in Table 1 to Table 4, as applicable.

Conformity shall be checked by the test method specified in **15.4**.

The cores of all cables shall be identified by colours, as follows:

a) single-core: brown;

b) 3-core: brown, black and grey.

6 Assembly of cores

The cores of 3-phase cables shall be laid up with a right-hand direction of lay and a minimum lay length of 550 mm.

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

7 Bedding for 3-phase cables

A synthetic tape bedding, having an approximate total thickness of 0.5 mm, shall be applied over the laid-up cores of 3-phase cables.

8 Concentric neutral/earth conductor

The neutral/earth conductor shall consist of a single layer of plain annealed copper wires applied with either a right- or left-hand direction of lay or an alternating right- and left-hand direction of lay.

The gap between adjacent wires shall not exceed 4 mm.

The lay length shall not exceed the relevant value given in Table 1 to Table 4, as applicable, by more than 50%

Conformity shall be checked by visual examination and measurement as specified in **15.3**.

The d.c. resistance shall conform to the relevant value given in Table 1 to Table 4, as applicable.

Conformity shall be checked by the test method specified in **14.2**.

NOTE 1 Examples of concentric conductor construction are given in Table 1 to Table 4.

NOTE 2 One or more overlapped synthetic binder tapes may be applied immediately over the concentric conductor layer.

9 Oversheath

The oversheath shall be an extruded layer of compound type DMZ 4, conforming to the requirements given in BS 7870-1, Annex B.

NOTE Oversheaths are normally orange but colours other than orange may be provided by agreement between the manufacturer and the purchaser, subject to their suitability for the particular conditions under which the cables are to be used.

The thickness of the oversheath shall conform to the relevant value specified in Table 1 to Table 4, as applicable.

Conformity shall be checked by the test methods specified in **15.5**.

10 Marking

10.1 External marking

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

Element	Example of marking
a) Cable manufacturer	Manufacturer's name and their unique factory identifier

NOTE 1 A simplified version of the manufacturer's name, or trading name of the manufacturer, may be used in place of the full name.

NOTE 2 Any suitable method may be used to unambiguously identify the manufacturer's factory.

NOTE 3 The manufacturer's own trademark or equivalent may be added but this cannot be used instead of the manufacturer's name and identifier.

b) Electric cable	ELECTRIC CABLE
c) Voltage designation	600/1 000 V
d) British Standard number	BS 7870-3.12 [1)]

[1)] Marking BS 7870-3.12 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.

e) Number of cores, type and nominal area of phase conductors, e.g.:

3-core cable with 25 mm^2 aluminium phase conductors	3 × 25 AL
single-core cable with a 25 mm^2 copper phase conductor	1 × 25

f) Year of manufacture YYYY

NOTE 4 The year of manufacture may take the form of the actual year (e.g. 2011) or a coded year identifier assigned by the manufacturer.

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

For cables with overall diameters greater than 15 mm, as given in Table 1 to Table 4, elements b), c) and d) 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 a), e) and f) shall appear, together or separately, in any sequence that is deemed neither to confuse nor to conflict, either on one of the primary lines, or on a secondary line or lines.

For cables with overall diameters of 15 mm or less, as given in Table 1 to Table 4, the elements shall be arranged as for cables of greater than 15 mm diameter, except that the marking for elements b), c) and d) 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 b), c) and d), and not greater than 1 100 mm for elements a), e) and f).

Conformity shall be checked by visual examination and measurement as specified in **14.5**.

10.2 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 **14.5**.

10.3 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 surface of the cable it shall not render illegible the marking specified in **10.1** and **10.2**.

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 **14.5**.

11 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.

12 Dimensions

The thickness of each component layer shall be as specified in Table 1 to Table 4, as applicable.

NOTE Typical examples of concentric conductor construction and overall cable diameters are also given in Table 1 to Table 4.

Table 1 **Cables with single phase copper conductor and helical concentric copper neutral/earth conductor**

Parameter	**Nominal cross-sectional area of phase conductor** mm^2	
	16	**25**
Form of phase conductor	Circular or compacted circular stranded	
Minimum average thickness of insulation (mm)	0.7	0.9
[C1⟩ Minimum thickness of insulation at any point (mm)	0.53	0.71 ⟨C1]
Minimum average thickness of oversheath (mm)	1.4	1.4
Minimum thickness of oversheath at any point (mm)	1.09	1.09
Maximum d.c. resistance per km of cable at 20 °C:		
a) phase conductor (Ω)	1.15	0.727
b) concentric neutral/earth conductor (Ω)	1.2	0.76
Typical construction:		
Concentric neutral/earth conductor:		
– number of wires	19	25
– diameter of wires (mm)	1.04	1.13
– length of lay (mm)	110	135
Overall diameter of cable (mm)	11.8	13.7

Table 2 **Cables with single phase aluminium conductor and helical concentric copper neutral/earth conductor**

Parameter	Nominal cross-sectional area of phase conductor mm²	
	25	**35**
Form of phase conductor	Circular solid	
Minimum average thickness of insulation (mm)	0.9	0.9
[C1] Minimum thickness of insulation at any point (mm)	0.71	0.71 [C1]
Minimum average thickness of oversheath (mm)	1.4	1.4
Minimum thickness of oversheath at any point (mm)	1.09	1.09
Maximum d.c. resistance per km of cable at 20 °C:		
a) phase conductor (Ω)	1.2	0.868
b) concentric neutral/earth conductor (Ω)	1.3	0.91
Typical construction:		
Concentric neutral/earth conductor:		
– number of wires	27	25
– diameter of wires (mm)	0.85	1.04
– length of lay (mm)	120	135
Overall diameter of cable (mm)	12.3	13.7

Table 3 **Cables with 3-phase copper conductors and helical concentric copper neutral/earth conductor**

Parameter	Nominal cross-sectional area of phase conductor mm²	
	16	**25**
Form of phase conductor	Circular or compacted circular stranded	
Minimum average thickness of insulation (mm)	0.7	0.9
[C1] Minimum thickness of insulation at any point (mm)	0.53	0.71 [C1]
Minimum average thickness of oversheath (mm)	1.8	1.8
Minimum thickness of oversheath at any point (mm)	1.43	1.43
Maximum d.c. resistance per km of cable at 20 °C:		
a) phase conductor (Ω)	1.15	0.727
b) concentric neutral/earth conductor (Ω)	1.2	0.76
Typical construction:		
Concentric neutral/earth conductor:		
– number of wires	48	56
– diameter of wires (mm)	0.67	0.75
– length of lay (mm)	225	275
Bedding tape thickness	0.5	0.5
Overall diameter of cable (mm)	20.6	24.6

Table 4 **Cables with 3-phase aluminium conductors and helical concentric copper neutral/earth conductor**

Parameter	**Nominal cross-sectional area of phase conductor** mm²	
	25	**35**
Form of phase conductor	Circular solid	
Minimum average thickness of insulation (mm)	0.9	0.9
[C1⟩ Minimum thickness of insulation at any point (mm)	0.71	0.71 ⟨C1]
Minimum average thickness of oversheath (mm)	1.8	1.8
Minimum thickness of oversheath at any point (mm)	1.43	1.43
Maximum d.c. resistance per km of cable at 20 °C:		
a) phase conductor (Ω)	1.2	0.868
b) concentric neutral/earth conductor (Ω)	1.3	0.91
Typical construction:		
Concentric neutral/earth conductor:		
– number of wires	45	61
– diameter of wires (mm)	0.67	0.67
– length of lay (mm)	255	285
Bedding tape thickness (mm)	0.5	0.5
Overall diameter of cable (mm)	22.6	24.8

13 Tests

Testing shall be performed in accordance with the schedule of tests specified in Table 5.

Table 5 **Schedule of tests**

Test	Requirements given in clause	Test method Clause of BS 7870-2 unless otherwise specified
Routine tests		
Phase conductor resistance	**14.2**	**3.1.1**
Concentric neutral/earth conductor resistance	**14.2**	**3.1.1**
Voltage test on complete cable	**14.3**	**3.2.1**
Spark test		
– insulation	**14.4**	**3.6.1**
– oversheath	**14.4**	**3.6.1**
Cable markings	Clause **10**	**14.5** this standard
Sample tests		
Phase conductor material and construction	Clause **4**	**15.2** this standard BS 3988 (Class 1 conductors)
Concentric neutral/earth conductor material and construction	Clause **8**	**15.3** this standard
Insulation		
– application	Clause **5**	**15.4** this standard
– thickness	Clause **5**	**15.4** this standard
– colour	Clause **5**	**15.4** this standard
– durability of colour	**15.4**	**2.5.4**
– shrinkage	**15.4**	BS EN 60811-1-3
Oversheath		
– application	Clause **9**	**15.5** this standard
– thickness	Clause **9**	**15.5** this standard
Tests under fire conditions		
– flame propagation on single cable	**15.6**	BS EN 60332-1-2
– smoke emission	**15.7**	BS EN 61034-1 and BS EN 61034-2
Type tests		
Corrosive and acid gas	**16.2**	BS EN 50267-2-1
Insulation	**16.3**	BS 7870-1, Annex B
Oversheath	**16.4**	BS 7870-1, Annex B
Shrinkage of oversheath	**16.5**	Annex B this standard
Insulation resistance of oversheath	**16.6**	BS 7870-1, Annex B
Compatibility	Table 6	**16.7** this standard
Tests under fire conditions		
– flame propagation on multiple cables	**16.8**	BS EN 60332-3-24
– smoke emission	**16.9**	BS EN 61034-1 and BS EN 61034-2
Abrasion test	**16.10**	**2.4.5**

14 Routine tests

14.1 General

Routine tests shall be as specified in Table 5.

14.2 Conductor resistance

The d.c. resistances of the phase and concentric neutral/earth conductors shall be measured in accordance with BS 7870-2, **3.1.1**, and shall be as given in Table 1 to Table 4, as applicable.

14.3 Voltage test on complete cable

When a voltage test is carried out in accordance with BS 7870-2, **3.2.1**, using a test voltage of 3.5 kV r.m.s. for a duration of 5 min, no breakdown of the insulation shall occur.

14.4 Spark test

Spark testing of the insulation and the oversheath shall be carried out in accordance with BS 7870-2, **3.6.1**. No failures shall occur.

14.5 Cable markings

The cable markings shall be checked by visual examination and measurement and shall conform to the requirements of Clause **10**.

15 Sample tests

15.1 General

Sample tests shall be as specified in Table 5.

15.2 Phase conductor material and construction

The phase conductor material and construction shall be checked by visual examination and, in the case of class 1 conductors, by measurement in accordance with BS 3988:1970+A.3, and shall conform to the requirements of Clause **4**.

15.3 Concentric neutral/earth conductor material and construction

The concentric neutral/earth conductor material and construction shall be checked by visual examination and shall conform to the requirements of Clause **8**. The gap between adjacent wires shall be measured and shall not exceed 4 mm.

The length of lay shall be measured and shall not exceed the relevant value given in Table 1 to Table 4, as applicable, by more than 50%.

15.4 Insulation

The application of the insulation shall be checked by visual examination and shall conform to the requirements of Clause **5**.

A cable sample shall be taken from one end of each drum length of cable selected for the test, and any portion that may have suffered damage shall be discarded. The thickness of the insulation of each of the samples shall be measured in accordance with the procedure given in BS 7870-2, **2.1.1**, with the measurement being made in one place only.

If any of the thicknesses measured does not conform to the requirements specified in Table 1 to Table 4, as applicable, two further samples shall be checked for the non-conforming parameter. If both the further samples meet the specified requirements, the cable shall be deemed to conform to the standard, but if either does not meet the specified requirements, the cable shall be deemed not to conform to the standard.

When tested in accordance with BS 7870-2, **2.5.4**, the colours shall remain identifiable.

When a 200 mm sample of core is tested at (130 ±2) °C for 1 h and another 200 mm sample of core is tested at (60 ±2) °C for 4 h in accordance with BS EN 60811-1-3, Clause **10**, the shrinkage of the insulation shall not exceed 2%.

15.5 Oversheath

The application of the oversheath shall be checked by visual examination and shall conform to the requirements of Clause **9**.

A cable sample shall be taken from one end of each drum length of cable selected for the test, and any portion that may have suffered damage shall be discarded. The thickness of the oversheath of each of the samples shall be measured in accordance with the procedure given in BS 7870-2, **2.1.2**, with the measurement being made in one place only.

If any of the thicknesses measured does not conform to the requirements specified in Table 1 to Table 4, as applicable, two further samples shall be checked for the non-conforming parameter. If both the further samples meet the specified requirements, the cable shall be deemed to conform to the standard, but if either does not meet the specified requirements, the cable shall be deemed not to conform to the standard.

15.6 Flame propagation on a single cable

A cable sample shall be taken from one end of each drum length of cable selected for the test, and any portion that may have suffered damage shall be discarded. The sample shall be tested in accordance with BS EN 60332-1-2. After the test, the cable shall conform to the performance recommendations given in BS EN 60332-1-2:2004, Annex A.

15.7 Smoke emission

When a sample of the complete cable is tested in accordance with BS EN 61034-1 and BS EN 61034-2, the light transmittance value shall not fall below 70% at any time during the test.

The number of test pieces of cable in the sample to be tested shall be determined in accordance with BS EN 61034-2 using the relevant value of overall cable diameter given in Table 1 to Table 4, as applicable. The sample of cable shall be tested as a flat horizontal unit.

16 Type tests

16.1 General

Type tests shall be as specified in Table 5.

16.2 Corrosive and acid gas

Each non-metallic component shall be tested in accordance with BS EN 50267-2-1. The level of HCl in each component shall not exceed 0.5%.

16.3 Insulation

The insulation shall be tested in accordance with the test methods given in BS 7870-1, Annex B and shall conform to the requirements for type DIX 3.

16.4 Oversheath

The oversheath shall be tested in accordance with the test methods given in BS 7870-1, Annex B and shall conform to the requirements for type DMZ 4.

16.5 Shrinkage of oversheath

When a sample of complete cable is tested in accordance with Annex B, the shrinkage of the oversheath shall not exceed 4%.

16.6 Insulation resistance of oversheath

A sample of the complete cable shall be tested in accordance with the test method given in BS 7870-1, Annex B and shall conform to the requirement for type DMZ 4.

16.7 Compatibility test

A sample of completed cable shall be tested in accordance with BS EN 60811-1-2, **8.1.4**, for 7 days at (100 ±2) °C. The materials shall conform to the requirements specified in Table 6.

Table 6 **Requirements for compatibility of insulation and oversheath**

Parameter	Requirements	
	Insulation DIX 3	Oversheath DMZ 4
Minimum tensile strength (N/mm^2)	12.5	10
Minimum elongation at break (%)	200	100
Maximum variation of tensile strength (%) [A)]	25	40
Maximum variation of elongation at break (%) [A)]	25	40

[A)] The variation is the difference between the respective values obtained prior to and after heat treatment expressed as a percentage of the former.

16.8 Flame propagation on multiple cables

When a sample of complete cable is tested in accordance with BS EN 60332-3-24, it shall conform to the performance recommendations given in BS EN 60332-3-24:2009, Annex B.

16.9 Smoke emission

When a sample of the complete cable is tested in accordance with BS EN 61034-1 and BS EN 61034-2, the light transmittance value shall not fall below 70% at any time during the test.

The number of test pieces of cable in the sample to be tested shall be determined in accordance with BS EN 61034-2 using the relevant value of overall cable diameter given in Table 1 to Table 4, as applicable. The sample of cable shall be tested as a flat horizontal unit.

16.10 Abrasion test

When a sample of complete cable is tested in accordance with BS 7870-2, **2.4.5**, the oversheath shall show no visible cracks or splits in the external or internal surface when viewed with normal or corrected vision, without magnification.

Annex A (informative)

Guide to selection and use of cables

The object of this annex is to provide specific recommendations for the selection (taking into account the cable system), storage, transportation and installation of cables specified in this section of BS 7870.

The general recommendations given in BS 7870-1, Annex A apply except where amended in Table A.1.

Table A.1 **Guide to use**

BS 7870-1 Annex A Clause	**Recommendations for this section of BS 7870**
A.2.2 System categories	Category A or B
A.3.1.2 Drum barrel diameter	Minimum barrel diameter 25*D* (where *D* is the overall diameter of the cable given in Table 1 to Table 4, as applicable)
A.3.2.5 Cable coils	Minimum coil diameter 25*D* (where *D* is the overall diameter of the cable given in Table 1 to Table 4, as applicable)
A.4.6 Bending radii during installation	Minimum bending radius 8*D* (where *D* is the overall diameter of the cable given in Table 1 to Table 4, as applicable)
A.4.10 Lowest temperature of cable prior to and during installation	Minimum temperature 0 °C for 24 h prior to installation
A.4.11 Cable fixing	No recommendations given for the maximum horizontal distance and the maximum vertical distance between cleats but care should be taken when deciding these distances to avoid the risk of damage or hazardous conditions under normal or fault conditions
A.4.12 Pulling force	For Cu conductors σ = 50 N/mm^2 For Al conductors σ = 30 N/mm^2
A.4.14 Testing after installation	A voltage test after installation is not a recommendation of this section of BS 7870, but if a test is made then a d.c. voltage should be applied and gradually increased to 3 500 V and maintained at this value for 15 min. No breakdown should occur

Annex B (normative) Test for shrinkage of oversheath on cable

B.1 General

NOTE This test determines the shrinkage of the oversheath during heat treatment.

The test shall be carried out in accordance with BS EN 60811-1-3, Clause **11**, except as specified in **B.2** to **B.5**.

B.2 Selection of samples

Take one sample, about 300 mm in length, from each cable to be tested, at least 500 mm away from the end of the cable length.

B.3 Preparation of test piece

Within an interval of not more than 5 min from the time of cutting the sample, mark a test length of (200 ±5) mm on the middle part of the sample. Measure the distance between the marks to an accuracy of 0.5 mm. Prepare the test piece by removing the oversheath from both ends of the sample up to positions between 2 mm and 5 mm away from the marks. Bind the concentric neutral/earth wires at both ends of the test piece.

B.4 Procedure

Perform the test in an air oven as described in BS EN 60811-1-3, Clause **11**. Support the test piece by means of a freshly prepared talc bath.

The combined volume of the test apparatus and the test piece shall not exceed 10% of the volume of the oven.

Preheat the oven with the test apparatus in place for a minimum of 2 h at 80 °C before the test piece is introduced.

Support the test piece horizontally on the surface of the talc bath. Ensure that there is a sufficient depth of talc so that the test piece does not touch the bottom of the bath. Spread the talc evenly, without compacting it, at the start of the test, so as to permit free movement of the oversheath.

Introduce the test piece into the oven, and maintain it at a temperature of (80 ±2) °C for 4 h. At the end of this period, remove the apparatus with the test piece in place, and allow it to cool to ambient temperature.

Re-measure the distance between the two marks on the test piece to the nearest 0.5 mm.

B.5 Evaluation of results

Calculate the difference in the distance between the marks before the heat treatment and after the heating and cooling, and record the shrinkage as a percentage of the distance between the marks before the treatment.

Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 7870-3.11, *LV and MV polymeric insulated cables for use by distribution and generation utilities – Part 3: Specification for distribution cables of rated voltage 0.6/1 kV – Section 3.11: XLPE insulated combined neutral and earth copper wire concentric cables with copper or aluminium conductors*

HD 603 S1, *Distribution cables of rated voltage 0.6/1 kV*

HD 605 S2, *Electric cables – Additional test methods*

HD 620 S2, *Distribution cables with extruded insulation for rated voltages from 3.6/6 (7.2) kV up to and including 20.8/36 (42) kV*

HD 626 S1, *Overhead distribution cables of rated voltage $U_o/U(U_m)$: 0.6/1(1.2) kV*

HD 627 S1, *Multicore and multipair cable for installation above and below ground*

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