

BS 7870-2:2022



BSI Standards Publication

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

Part 2: Methods of test (Implementation of HD 605 S3:2019)

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Published by BSI Standards Limited 2022

ISBN 978 0 539 21138 2

ICS 29.060.20

The following BSI references relate to the work on this document:

Committee reference GEL/20/16

Draft for comment 22/30451543 DC

Amendments/corrigenda issued since publication

Date	Text affected

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Summary of pages

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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 30 November 2022. 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 the committee manager.

Supersession

This British Standard supersedes [BS 7870-2:2011](#), which is withdrawn.

Relationship with other publications

[BS 7870](#) implements the nationally applicable parts of Harmonization Documents HD 603, HD 605, HD 620, HD 626 and HD 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 installation having 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 BS 7870-1:2011+A1:2022, Table 1.

This part of [BS 7870](#) implements the nationally applicable parts of HD 605 S2:2008.

BS 7870-2 should be read in conjunction with BS 7870-1:2011+A1:2022 and the appropriate parts and sections of [BS 7870](#).

Information about this document

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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 methods are expressed as a set of instructions, a description, or 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.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).

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Introduction

Tests applicable to each type of cable are given in the particular sections which, where applicable, also specify the test sequence, the frequency of testing and the possibility of repeating failed tests.

The test methods included in BS 7870-2 are used in the other parts of [BS 7870](#) as well as other British Standards. This revision of BS 7870-2 includes significant clause renumbering and while standards updated after this revision will use the new numbers, a large number of standards referencing BS 7870-2 will continue to use the 2011 clause numbers.

[Table 1](#) will be needed to find the correct test method when referring to BS 7870-2 from standards published up until 2021.

Table 1 — *Clause references*

Old clause number	New clause number	New clause title
2.1.1	7.1.1	Measurement of insulation thickness
2.1.2	7.1.2	Measurement of non-metallic sheath thickness
—	7.1.3	Measurement of cable dimensions
2.1.3.1	7.1.3.1	Measurement of overall dimensions
2.1.3.2	7.1.3.2	Measurement of ovality
2.1.4.3 a) 2.1.4.3 b) 2.1.4.3 c)	7.1.4	Measurement of round armour wires
—	7.1.5	Measurement of thickness of metallic sheath
2.1.5 a)	7.1.5.1	Strip method
2.1.5 b)	7.1.5.2	Ring method
—	7.1.6	Check of application of tapes and wires
2.1.6.1 2.1.8	7.1.6.1	Method 1
2.1.6.2	7.1.6.2	Method 2
2.1.10.5	7.1.7	Method for inspection for protrusions, contaminants and discoloured particles in cross-linked polyethylene (XLPE) cable insulation
2.1.11.3	7.1.8	Determination of the thickness of semi-conducting layers
2.2.2.2	7.2.1	Determination of tear resistance of the protective sheath
2.2.8.1 2.2.8.6 2.2.8.8	7.2.2	Strippability test on extruded semi-conducting insulation screen
2.2.11	7.2.3	Insulation screen cutting test
2.2.12	7.2.4	Water immersion test on sheath
—	7.3.1	Bend tests for complete cable

Table 1 — *Clause references (continued)*

Old clause number	New clause number	New clause title
2.4.1.7	7.3.1.1	Standard bend test for complete cable
2.4.1.8	7.3.1.2	Cold bend test
2.4.5	7.3.2	Abrasion test
2.4.9	7.3.3	Water penetration test method
2.4.12.2	7.3.4	Special compatibility test
2.4.20	7.3.5	Determination of UV stability of medium density polyethylene (MDPE) sheath
2.5.4	7.4.1	Checking durability of colours and marking
2.5.9	7.4.2	Swell height of water blocking tape
2.5.10	7.4.3	Measurement of water content of insulation
3.1.1	8.1	Conductors
—	8.2	Voltage tests
3.2.1	8.2.2	Test on complete cable
3.2.1.1	8.2.2.1	Single core cables
3.2.1.2	8.2.2.2	Multicore cables
3.2.3.1 3.2.3.3	8.2.3	Tests on oversheath
3.2.4.2	8.2.4	Impulse voltage test followed by a.c. voltage test
3.2.5	8.2.5	Special four-hour voltage test
3.3.1	8.3.1	Insulation resistance test on insulated cores
3.3.2	8.3.2	Insulation resistance test on screened or armoured complete cable
3.3.4	8.3.3	Oversheath resistance test on screened or armoured complete cable
3.6.1	8.4	Spark tests
3.8.1	8.5	Heating cycle test
3.9.1 3.9.3	8.6	Measurement of the electrical resistivity of the semi-conducting screens
3.10.1 3.10.3	8.7	Partial discharge test
	8.8	Tan δ measurement
3.11.1	8.8.1	Tan δ test in relation to temperature
3.11.3.1 3.11.3.2	8.8.2	Tan δ test as a function of voltage
3.13	8.9	Adherence of screens at short circuit temperature

Table 1 — Clause references (continued)

Old clause number	New clause number	New clause title
3.14	8.9.3	Resistivity test for water blocking tape
5.4.8	9	Long-term tests for resistance to water

1 Scope

This British Standard collates and specifies the test methods to be used for testing LV and MV polymeric insulated and sheathed electric cables, of rated voltage up to and including 19/33 kV, intended for public distribution systems, and for use in power generating plants and sub-stations.

The test methods in this part of [BS 7870](#) are additional to those already harmonized, e.g. in the BS EN IEC 60332 series and the BS EN 60811 series, and are for use in testing cable types specified in BS 7870-3, BS 7870-4 and [BS 7870-5](#). In each case, these British Standards provide complementary information needed for the practical application of the test method to each specific type of cable. Therefore, this British Standard is not sufficient for carrying out and evaluating the tests on electric cables.

This British Standard does not specify full test conditions (e.g. temperatures, durations) and/or requirements to be met. Such data needed to carry out the tests is given in the particular sections of [BS 7870](#).

NOTE The words “particular section” refer throughout to the individual sections of [BS 7870](#) in which particular cable types are specified.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions of this document¹⁾. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

[BS 7870](#) (all parts), *LV and MV polymeric insulated cables for use by distribution and generation utilities*

BS EN 60228, *Conductors of insulated cables*

BS EN 60811-201, *Electric and optical fibre cables — Test methods for non-metallic materials — Part 201: General tests — Measurement of insulation thickness*

BS EN 60811-202, *Electric and optical fibre cables — Test methods for non-metallic materials — Part 202: General tests — Measurement of thickness of non-metallic sheath*

BS EN 60811-203, *Electric and optical fibre cables — Test methods for non-metallic materials — Part 203: General tests — Measurement of overall dimensions*

BS EN 60811-401, *Electric and optical fibre cables — Test methods for non-metallic materials — Part 401: Miscellaneous tests — Thermal ageing methods — Ageing in an air oven*

BS EN 60811-501, *Electric and optical fibre cables — Test methods for non-metallic materials — Part 501: Mechanical tests — Tests for determining the mechanical properties of insulating and sheathing compounds*

¹⁾ Documents that are referred to solely in an informative manner are listed in the Bibliography.

BS EN 60885-3, *Electrical test methods for electric cables — Part 3: Test methods for partial discharge measurements on lengths of extruded power cables*

BS EN 62230, *Electric cables — Spark test method*

[BS EN IEC 60230](#), *Impulse tests on cables and their accessories*

BS EN IEC 60332 (all parts), *Tests on electric and optical fibre cables under fire conditions*

BS EN ISO 4892 (all parts), *Plastics — Methods of exposure to laboratory light sources*

HD 603, *Distribution cables of rated voltage 0,6/1 kV*

HD 605, *Electric cables — Additional test methods*

HD 620, *Distribution cables with extruded insulation for rated voltages from 3,6/6 (7,2) kV to 20,8/36 (42) kV*

HD 626, *Overhead distribution cables of rated voltage $U_0/U(U_m)$: 0,6/1 (1,2) kV*

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

3 Terms and definitions

For the purposes of this British Standard, the terms and definitions given in [BS 7870-1](#) apply.

4 Sampling

COMMENTARY ON CLAUSE 4

The size and number of samples are specified either in this British Standard or in the particular section of [BS 7870](#).

If a marking is indented in the insulation or sheath surface, the samples used for the tests shall be taken so as to include such markings.

For multicore cables, with the exception of the test specified in [7.1.1](#), not more than three cores (of different colours, if available) shall be tested, unless otherwise specified for a particular test.

5 Tests conditions

5.1 Ambient temperature

Unless otherwise specified in the details for the particular test, tests shall be made at an ambient temperature of $(20 \pm 15) ^\circ\text{C}$.

5.2 Tolerance on temperature values

Unless otherwise specified in the particular specification, the tolerance on temperature values quoted in the test methods shall be as shown in [Table 2](#).

Table 2 — *Tolerance on temperature values*

Specified temperature, t	Tolerance
$^\circ\text{C}$	K
$-40 \leq t \leq 0$	± 2
$0 < t \leq 50$	According to relevant clause
$50 < t \leq 150$	± 2
$t > 150$	± 3

5.3 Frequency and waveform of power-frequency test voltages

Unless otherwise specified, the test voltage shall be in the range 49 Hz to 61 Hz of approximately sine-wave form, the peak ratio value/r.m.s. value being equal to $\sqrt{2}$ with a tolerance of $\pm 7\%$.

NOTE 1 The test voltage values quoted are r.m.s. values.

NOTE 2 R.m.s. stands for root mean square.

5.4 Pre-conditioning

Unless otherwise stated, tests shall be carried out not less than 16 h after the extrusion or cross-linking, if any, of the insulating or sheathing compounds.

6 Rounding of numbers

Unless stated otherwise, the results declared for a test shall be presented to the same number of decimal places as the requirement. To achieve this, the method of rounding shall be as follows:

- a) if the last figure to be retained is followed, before rounding, by 0, 1, 2, 3 or 4, it shall remain unchanged (rounding down); or
- b) if the last figure to be retained is followed, before rounding, by 9, 8, 7, 6 or 5, it shall be increased by one (rounding up).

NOTE 1 It might be required that values are rounded to more than one decimal place. This might occur, for example, in calculating the average value of several measurement results, or the minimum value by applying a percentage tolerance to a given nominal value.

NOTE 2 Examples are:

- 2.449 approximately 2.45 rounded to two decimal places;
- 2.449 approximately 2.4 rounded to one decimal place;
- 25.0478 approximately 25.048 rounded to three decimal places;
- 25.0478 approximately 25.05 rounded to two decimal places; and
- 25.0478 approximately 25.0 rounded to one decimal place.

7 Non-electrical tests

7.1 Dimensional measurements

7.1.1 Measurement of insulation thickness

7.1.1.1 Procedure

The thickness of insulation shall be measured in accordance with BS EN 60811-201. Unless otherwise specified, one sample of cable shall be taken and measurement made at three places.

Conformity shall be checked on each core of cables having up to five cores and on the number of cores stated in the individual specification for cables with more than five cores.

If withdrawal of the conductor is difficult, it shall be stretched in a tensile machine.

7.1.1.2 Evaluation of results

Unless otherwise specified, the mean of the 18 values (expressed in mm) obtained from the three pieces of insulation from each core shall be calculated to two decimal places and rounded off, and this shall be taken as the mean value of the thickness of insulation.