

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Test methods for accessories for power cables with rated voltages from 6 kV ($U_m = 7,2$ kV) up to 30 kV ($U_m = 36$ kV)

Méthodes d'essais des accessoires de câbles d'énergie de tensions assignées de 6 kV ($U_m = 7,2$ kV) à 30 kV ($U_m = 36$ kV)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**TEST METHODS FOR ACCESSORIES
FOR POWER CABLES WITH RATED VOLTAGES
FROM 6 kV ($U_m = 7,2$ kV) UP TO 30 kV ($U_m = 36$ kV)****FOREWORD**

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This third edition cancels and replaces the second edition published in 2005. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) 4.6 – the option to start tests immediately has been included;
- b) 4.11 – methods for testing on belted cables have been included;
- c) 5.3.2 and 10.3 – details of insulation resistance testing has been added;
- d) 8.2 – pre-stress with slightly increased test voltage before applying the partial discharge test has been included;
- e) 11.2 – testing of accessories with external earthing devices has been included;
- f) 11.2 – short-circuit duration and maximum kA levels have been added;

g) 11.2 – temperature measurement is not required if the time between short-circuits > 1 h.

The text of this International Standard is based on the following documents:

Draft	Report on voting
20/2108/FDIS	20/2132/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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TEST METHODS FOR ACCESSORIES FOR POWER CABLES WITH RATED VOLTAGES FROM 6 kV ($U_m = 7,2$ kV) UP TO 30 kV ($U_m = 36$ kV)

1 Scope

This document specifies the test methods applicable for type testing accessories for power cables with rated voltages from 3,6/6 (7,2) kV up to 18/30 (36) kV. The test methods specified in this document apply to accessories for extruded and paper insulated cables according to IEC 60502-2 and IEC 60055-1 respectively.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60060-1:2010, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60230:2018, *Impulse tests on cables and their accessories*
IEC 60230:2018/AMD1:2021

IEC 60270:2000, *High-voltage test techniques – Partial discharge measurements*
IEC 60270:2000/AMD1:2015

IEC 60811-401:2012, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 401: Miscellaneous tests – Thermal ageing methods – Ageing in an air oven*
IEC 60811-401:2012/AMD1:2017

IEC 60885-2:1987¹, *Electrical test methods for electric cables – Part 2: partial discharge tests*

IEC 61238-1-3:2018, *Compression and mechanical connectors for power cables – Part 1-3: Test methods and requirements for compression and mechanical connectors for power cables for rated voltages above 1 kV ($U_m = 1,2$ kV) up to 30 kV ($U_m = 36$ kV) tested on non-insulated conductors*

IEC 60949:1988, *Calculation of thermally permissible short-circuit currents, taking into account non-adiabatic heating effects*
IEC 60949:1988/AMD1:2008

¹ Withdrawn.

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

4 Test installations and conditions

4.1 The test methods described in this document are intended to be used for type tests.

4.2 The test arrangements and the number of test samples are given in the relevant standard.

4.3 The test conditions are specified in Clause 5 to Clause 21. When they are not, they shall be as specified in the relevant standards.

4.4 The testing parameters and the requirements are given in the relevant standard, unless otherwise stated.

4.5 For transition joints (either extruded insulation to extruded insulation or extruded insulation to paper insulation), the testing parameters (voltage and conductor temperature) are those of the lower rated cable.

4.6 The tests can be started immediately after installation of accessories on the cable test loops, unless otherwise specified by the manufacturer. The time interval between installation of the accessories and the start of the tests shall be recorded in the test report.

4.7 Cable screens, and armour if any, shall be bonded and earthed at one end only to prevent circulating currents.

4.8 All parts of an accessory which are normally earthed shall be connected to the cable screen. Any supporting metalwork shall also be earthed.

4.9 The ambient temperature shall be $(20 \pm 15) ^\circ\text{C}$.

4.10 Tap water shall be used for all tests in water.

4.11 Tests on belted cables:

When conducting AC voltage tests and heating cycle voltage tests, a three-phase test voltage and current system shall be used.

When conducting DC voltage tests and the impulse tests, the test voltage shall be applied to one cable conductor and the other two cable conductors and the screen shall be earthed. All cable conductors shall be tested separately.

5 AC voltage tests

5.1 Dry test for all accessories

5.1.1 Installation

The set(s) of accessories shall be erected with all associated metalwork and fittings. The accessories shall be clean and dry before applying the test voltage.

5.1.2 Method

The test shall be made at ambient temperature, and the procedure for voltage application shall be as specified in IEC 60060-1:2010, Clause 6, unless otherwise specified.

5.2 Wet test for outdoor terminations

5.2.1 Installation

The terminations shall be erected in a vertical position, unless they are to be specifically installed in another orientation, with the relative spacing as under service conditions and according to the manufacturer's instructions.

5.2.2 Method

The wet test method is as described in IEC 60060-1:2010, 4.4, and shall be carried out at ambient temperature, unless otherwise specified.

5.3 Test in water for stop ends

5.3.1 Installation

The stop ends shall be installed in a water tank of such dimensions as to have a height of water of $1,00^{+0,1}_0$ m over their top surface, unless otherwise specified. The water shall be at ambient temperature.

5.3.2 Method

The procedure for voltage application shall be as specified in IEC 60060-1:2010, 6.2, unless otherwise specified.

After the AC voltage withstand, the insulation resistance shall be measured between the screen and water. The DC test voltage shall be in the range of 100 V to 1 000 V and shall be applied for a sufficient time to reach reasonably steady measurement, but in any case, not less than 1 min and not more than 5 min.

6 DC voltage tests

6.1 Installation

The set(s) of accessories shall be erected with all associated metalwork and fittings. The accessories shall be clean and dry before applying the test voltage.

6.2 Method

A voltage of negative polarity shall be applied to the cable conductor.

The test shall be made at ambient temperature and the procedure for voltage application shall be as specified in IEC 60060-1:2010, Clause 5.

7 Impulse voltage tests

7.1 Installation

For preparation of the test installation, involving metal enclosures and terminal boxes, reference shall be made to the relevant standard.

The three phases of the three-core accessories can be tested together, unless the spaces between each phase are specified. In this case (such as three single-core terminations in an enclosure), each phase of the three-core accessories shall be tested at a time, with the other two phases earthed.

7.2 Method

The test shall be conducted according to the procedure given in IEC 60230:2018, Clause 5, Clause 6, Clause 7, Clause 9 and Clause 10 and IEC 60230:2018/AMD1:2021, Clause 10, and shall be carried out at ambient temperature, unless otherwise specified.

7.3 Test at elevated temperature

The installation and the measurement of temperature are given in Clause 9.

The cable conductor shall be heated and stabilized for at least 2 h at a temperature of

- 5 K to 10 K above the maximum cable conductor temperature in normal operation for extruded insulation cables,
- 0 K to 5 K above the maximum cable conductor temperature in normal operation for paper insulated cables,

before and during the impulse test.

8 Partial discharge test

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8.1 General

This test is only required for accessories for extruded insulation single-core cables and three-core cables with individually semi-conducting screened cores. It is not required for accessories incorporating paper insulated cables.

8.2 Method

The test shall be conducted in accordance with IEC 60270:2000 and IEC 60270:2000/AMD1:2015 and IEC 60885-2:1987² and shall be carried out at ambient temperature, unless otherwise specified.

The partial discharge shall be measured at the test voltage given in the relevant standard after maintaining the test object for 1 min at a pre-stressing voltage equal to the specified test voltage increased by $0,25 U_0$.

8.3 Test at elevated temperature

The installation and the measurement of temperature are given in Clause 9.

² Withdrawn.

The cable conductor shall be heated and stabilized for at least 2 h at a temperature of 5 K to 10 K above the maximum cable conductor temperature in normal operation, before and during the partial discharge test.

9 Tests at elevated temperature

9.1 Installation and connection

The accessories shall be erected, supported where necessary and provided with connections to permit heating current to be circulated.

Where terminations or separable connectors are to be tested, the connection between either lugs or bushings shall have an electrical cross-section equivalent to that of the cable conductor.

Where branch joints are to be tested, only the main cable shall carry the heating current.

Three-core accessories can be connected for either single-phase or three-phase heating current. When heated with single-phase current a single-phase voltage shall be superimposed on the heating current. Respectively when heated with three-phase current a three-phase voltage shall be superimposed on the heating current. In the case of a magnetic covering, a three-phase heating current shall be applied.

Accessories for belted cables shall be subjected to three-phase voltage.

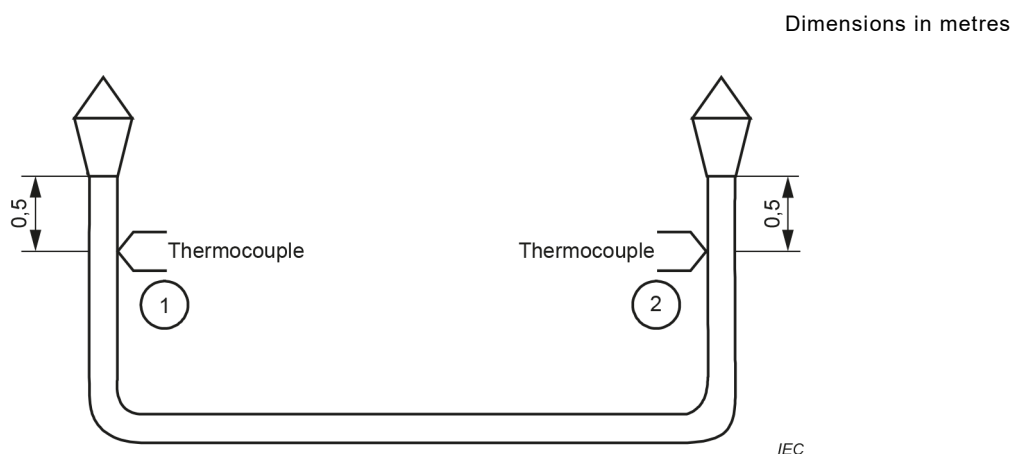
9.2 Measurement of temperature

9.2.1 Cable conductor temperature

It is recommended that one of the methods described in Annex A is used to determine the actual conductor temperature.

9.2.2 Thermocouple position

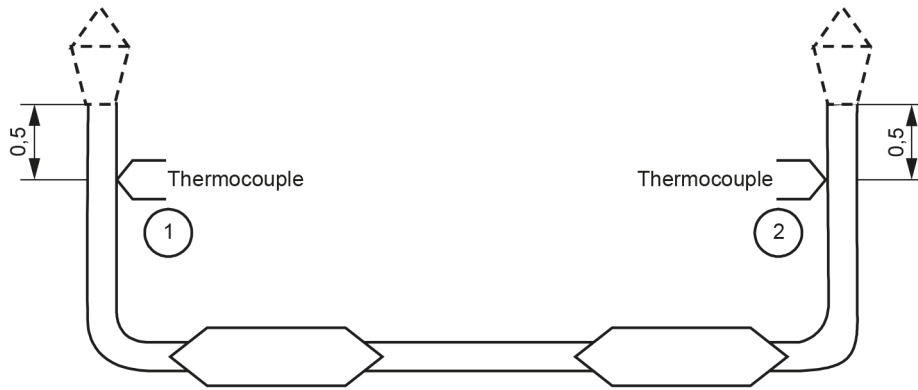
If method 2 of Annex A is used to determine the conductor temperature, two thermocouples shall be attached to the cable sheath as shown in Figure 1 to Figure 6.



All distances mentioned to position thermocouples are minimum values.

Figure 1 – Terminations tested in air

Dimensions in metres

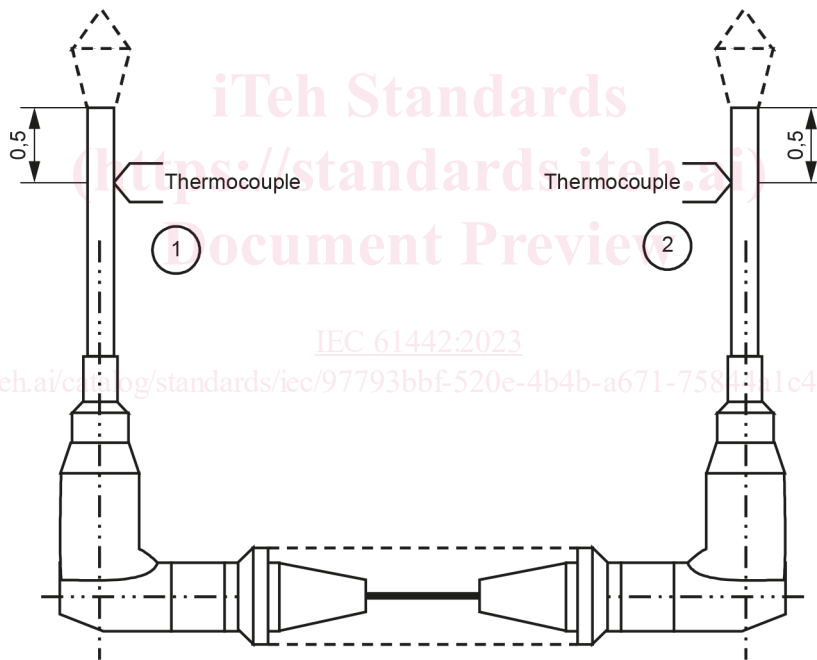


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All distances mentioned to position thermocouples are minimum values.

Figure 2 – Joints tested in air

Dimensions in metres



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All distances mentioned to position thermocouples are minimum values.

Figure 3 – Separable connectors tested in air