IEC 60502-4

Edition 4.0 2023-11

INTERNATIONAL STANDARD

Power cables with extruded insulation and their accessories for rated voltages from 1 kV (U_m = 1,2 kV) up to 30 kV (U_m = 36 kV) –
Part 4: Test requirements on accessories for cables with rated voltages from 6 kV (U_m = 7,2 kV) up to 30 kV (U_m = 36 kV)

IEC 60502-4:2023-11(en)

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POWER CABLES WITH EXTRUDED INSULATION AND THEIR ACCESSORIES FOR RATED VOLTAGES FROM 1 KV (U_m = 1,2 KV) UP TO 30 KV (U_m = 36 KV) –

Part 4: Test requirements on accessories for cables with rated voltages from 6 kV (U_m = 7,2 kV) up to 30 kV (U_m = 36 kV)

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IEC 60502-4 has been prepared by IEC technical committee 20: Electric cables. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2010. This edition constitutes a technical revision.

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

a) Terminations, joints and stop ends are now characterized as either non-range-taking or range-taking and are tested accordingly.

b) Introduction of the 240 mm^2 conductor size for testing non-range-taking terminations, joints and stop ends.

c) Introduction of the 2 500 A separable connector size in Table 3 and the method of testing in Figure 5.

d) Introduction of dynamic short-circuit classes 0, 1, 2 and 3 in 9.2.

e) Introduction of specific requirements for test reports in Clause 10 and Clause 11 and specific recording sheets for cables, connectors and examination in Annex A, Annex B and Annex C.

f) Option to use 2 U_0 for partial discharge testing and removal of DC testing from Table 9, Table 10, Table 11, Table 12, Table 13 and Table 14.

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

Draft	Report on voting
20/2110/FDIS	20/2133/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.

A list of all parts in the IEC 60502 series, published under the general title *Power cables with extruded insulation and their accessories for rated voltages from 1 kV (U_m = 1,2 kV) up to 30 kV (U_m = 36 kV)*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

POWER CABLES WITH EXTRUDED INSULATION AND THEIR ACCESSORIES FOR RATED VOLTAGES FROM 1 KV (U_m = 1,2 KV) UP TO 30 KV (U_m = 36 KV) –

Part 4: Test requirements on accessories for cables with rated voltages from 6 kV (U_m = 7,2 kV) up to 30 kV (U_m = 36 kV)

1 Scope

This part of IEC 60502 specifies the test requirements for type testing of accessories for power cables with rated voltages from 3,6/6 (7,2) kV up to 18/30 (36) kV, complying with IEC 60502-2 or other relevant cable standards.

Accessories for special applications, such as aerial cables, submarine or ship cables or hazardous situations (explosive environments, fire-resistant cables or seismic conditions), are not included.

It is not necessary to repeat these tests, once successfully completed, unless changes are made in the materials, design or manufacturing process which can affect the performance characteristics.

Test methods are included in IEC 61442.

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 60183, *Guide to the selection of high-voltage AC cable systems*

IEC 60502-2:2014, *Power cables with extruded insulation and their accessories for rated voltages from 1 kV (U_m = 1,2 kV) up to 30 kV (U_m = 36 kV) – Part 2: Cables for rated voltages from 6 kV (U_m = 7,2 kV) up to 30 kV (U_m = 36 kV)*

IEC 61238-1-3, *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 61442:2023, *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)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

3.1
connector
device for connecting a conductor to an equipment terminal or for connecting two or more conductors to each other

[SOURCE: IEC 60050-461:2008, 461-17-03 [1], modified – "metallic" has been deleted and "to connect cable conductors together" has been replaced with "for connecting a conductor to an equipment terminal or for connecting two or more conductors to each other".]

3.2
termination
device fitted to the end of a cable to ensure electrical connection with other parts of the system and to maintain the insulation up to the point of connection

[SOURCE: IEC 60050-461:2008, 461-10-01]

3.3
indoor termination
termination intended for use where it is not exposed to either solar radiation or weathering

3.4
outdoor termination
termination intended for use where it is exposed to either solar radiation or weathering or both

3.5
terminal box
air- or compound-filled box fully enclosing a termination

[SOURCE: IEC 60050-461:2008, 461-10-03, modified – "air- or compound-filled" has been added, "enclosing a cable termination and forming a part thereof" has been replaced with "fully enclosing a termination" and the Note has been deleted.]

3.6
shrouded termination
indoor termination with additional insulation at the bushing connection and used in an air-filled terminal box

3.7
straight joint
accessory making a connection between two cables to form a continuous circuit

[SOURCE: IEC 60050-461:2008, 461-11-01]

3.8
branch joint
accessory making a connection of a branch cable to a main cable

[SOURCE: IEC 60050-461:2008, 461-11-17]

3.9
transition joint
straight or branch joint making a connection between cables having different types of insulation

[SOURCE: IEC 60050-461:2008, 461-11-04, modified – "accessory" has been replaced with "straight or branch joint" and "two" has been deleted.]

3.10
stop end
accessory providing a means of insulating the unconnected end of an energized cable

[SOURCE: IEC 60050-461:2008, 461-10-07, modified – The preferred terms "pot end" and "insulating cap" have been deleted and "insulating device to terminate" has been replaced with "accessory providing a means of insulating".]

3.11
separable connector
fully insulated termination permitting the connection and the disconnection of a cable to other equipment

3.12
screened separable connector
separable connector which has a fully screened external surface

3.13
unscreened separable connector
separable connector which does not have an external screen

3.14
plug-in type separable connector
separable connector in which the electrical contact is made by a sliding device

3.15
bolted type separable connector
separable connector in which the electrical contact is made by a bolted device

3.16
deadbreak separable connector
separable connector designed to be connected and disconnected on de-energized circuits only

3.17
range-taking accessory
accessory designed to take more than one cross-section of cable

3.18
metallic housing
metal enclosure in intimate contact with the outer screen of a separable connector and having at least the same current carrying capacity to earth as the metallic screen of the cable with which the separable connector is used

3.19
loop joint
accessory making an end connection between two parallel cables to form a continuous circuit constructed as a branch joint with the single end replaced with a stop end

4 Types of accessories

The accessories covered by this document are listed below:

– indoor and outdoor terminations of all designs, including terminal boxes;
– straight joints, branch joints and stop ends of all designs, suitable for use underground or in air;
– screened or unscreened plug-in type or bolted type separable connectors.

NOTE Transition joints connecting cables with extruded insulation to paper-insulated cables are not included in the scope of this document. The requirements for these accessories are dealt with in the IEC 60055 series [2][1].

5 Voltage designations and maximum conductor temperatures

5.1 Rated voltages

The rated voltages U_0/U (U_m) of accessories considered in this document are given in IEC 60502-2:2014, 4.1.

For a given application, the rated voltage of an accessory shall be consistent with that of the cable, and shall be suitable for the operating condition of the system in which they are used, in accordance with the recommendations of IEC 60183.

5.2 Maximum conductor temperatures

The accessories shall be suitable for use on cables having the conductor temperatures specified in IEC 60502-2:2014, 4.2 for normal operation.

The maximum conductor temperatures of the cables under short-circuit conditions are given in IEC 60502-2:2014, Table 3.

6 Components

6.1 Connectors

Connectors used within the accessory shall comply with IEC 61238-1-3, or with another relevant standard or specification when agreed between either the manufacturer or supplier and the customer. All connectors shall be identified in accordance with Annex B.

6.2 Materials

It is not a prerequisite for compliance with this document that any component material (resin, heat-shrink tubing, etc.) should be subject to any form of individual type testing.

If type testing of resins, pressure sensitive adhesive tapes and flexible insulating sleevings for electrical purposes is required, reference should be made to the relevant standards developed by IEC technical committee 15, as listed for information in the Bibliography [3], [4], [5].

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1 Numbers in square brackets refer to the Bibliography.

The term "material characterization" is sometimes used in conjunction with both type testing and fingerprinting of component materials, but it is undefined, and its use should therefore be avoided.

7 Assembly of accessories to be tested

7.1 Identification

7.1.1 Cables

Cables used for testing shall comply with IEC 60502-2 and shall be of the same rated voltage as the accessories to be tested.

Constructional details of the cables shall be identified (refer to Annex A).

7.1.2 Connectors

Connectors used within the accessories shall be identified in accordance with Annex B.

7.1.3 Accessories

Accessories to be tested shall be correctly identified with respect to

– name of manufacturer or supplier;
– type, designation, manufacturing date or code, end of shelf-life date;
– non-range-taking (for only one size of cable)
  • specific cross-sections or cable insulation diameter;
  • minimum and maximum cable insulation diameter;
– range-taking (for minimum two different sizes of cable)
  • minimum and maximum nominal cross-sections, material and shape of cable conductor;
  • minimum and maximum cable insulation diameters;
– connector type(s);
– rated voltage (see 5.1);
– minimum value of U_0 for separable connector screen fault current initiation;
– installation instructions (reference and date);
– inside dimensions or type of terminal box if applicable;
– list of kit contents.

7.2 Installation and connections

7.2.1 General

The conductor cross-sectional area shall be as specified in 7.2.2, 7.2.3 and 7.2.4, unless otherwise specified.

7.2.2 Non-range-taking terminations, joints and stop ends

For joints, terminations and stop ends, which are declared as non-range-taking, one of the following cable cross-sections shall be used: 120 mm^2 or 150 mm^2 or 185 mm^2 or 240 mm^2.

Compliance for one type of accessory, for the range of cable cross-sections from 95 mm^2 to 300 mm^2, shall be obtained by successfully completing all the appropriate tests of Table 9, Table 10 and Table 11 on any one of the cable cross-sections specified above.