

INTERNATIONAL STANDARD



Power cables with extruded insulation and their accessories for rated voltages above 30 kV ($U_m = 36$ kV) up to 150 kV ($U_m = 170$ kV) – Test methods and requirements

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**POWER CABLES WITH EXTRUDED INSULATION
AND THEIR ACCESSORIES FOR RATED VOLTAGES
ABOVE 30 kV ($U_m = 36$ kV) UP TO 150 kV ($U_m = 170$ kV) –
TEST METHODS AND REQUIREMENTS**

FOREWORD

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International Standard IEC 60840 has been prepared by IEC technical committee 20: Electric cables.

This fifth edition cancels and replaces the fourth edition, published in 2011. This edition constitutes a technical revision.

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

- Gas immersed cable terminations for use at rated voltages above 52 kV are required to be designed, type and routine tested in accordance with IEC 62271-209 in addition to the routine and type tests specified in this document.
- Requirements are introduced for composite outdoor termination insulators.
- The test cylinder diameters specified for the bending test (type and prequalification tests) have been modified in line with IEC TR 61901:2016.
- A low smoke halogen free oversheath material, designated ST₁₂ is introduced.
- Additional tests under fire conditions are introduced: vertical flame spread, smoke density, acidity and conductivity, which shall be applied according to the fire performance declared for the cable.
- A test for water penetration in the conductor is added.
- In addition to tests on the outer protection of joints, type tests on the screen sectionalizing insulation of all accessories have been introduced.

NOTE For a more detailed history of events leading up to this fifth edition, see the Introduction.

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

FDIS	Report on voting
20/1909/FDIS	20/1910/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://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.

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The contents of the corrigendum of February 2021 have been included in this copy.

INTRODUCTION

The first edition of IEC 60840, published in 1988, dealt only with cables. Accessories were added to the second edition, published in February 1999, which separately covered test methods and test requirements for

- a) cables alone,
- b) cables together with accessories (a cable system).

Some countries then suggested that a better discrimination be made between systems, cables and accessories, particularly for the lower voltages of the scope, for example 45 kV. This was taken into account in the third edition (2004) and ~~is~~ has been retained ~~in this revision, which gives~~ subsequently, giving the type approval requirements and the range of approvals for:

- a) cable systems,
- b) cables alone,
- c) accessories alone.

Manufacturers and users may choose the most appropriate option for type approval.

~~At its meeting in November 2004, TC 20 decided to prepare a further major revision of IEC 60840 and concluded that this edition should incorporate the recommendations for testing HV and EHV extruded cables that were under preparation by CIGRE study committee B1 WG B1.06. This work was made available as CIGRE technical brochure No. 303, before the meeting of TC 20 in October 2006. The brochure, entitled "Revision of qualification procedures for extruded (extra) high voltage a.c. underground cables", has therefore been considered by TC 20, and considerable parts implemented in this standard. Cables with high electrical stresses at the conductor screen and/or insulation screen are now required to undergo a prequalification test procedure (simplified compared to that in IEC 62067) as a cable system inclusive of accessories.~~

The fourth edition (2011) introduced the prequalification test procedure, as a cable system inclusive of accessories, for cables with high electrical stresses at the conductor screen and/or insulation screen.

~~Additionally the following other significant changes to this standard have been introduced~~ Other significant changes in the fourth edition were:

- a) The clause numbering of this document and IEC 62067 ~~(which has been revised at the same time as this standard) has been~~ was coordinated to achieve as much commonality as possible ~~to assist users who use both standards.~~
- b) In the case of the sample test, the lightning impulse voltage test is no longer followed by a power frequency voltage test.

In this fifth edition the principle changes are as follows:

- a) New definitions have been added for three different cable screen designs following IEC TR 61901:2016.
- b) Gas immersed cable terminations for use at rated voltages above 52 kV are required to be designed, type and routine tested in accordance with IEC 62271-209 in addition to the routine and type tests specified in this document.
- c) Requirements are introduced for composite outdoor termination insulators.
- d) The test cylinder diameters specified for the bending test (type and prequalification tests) have been modified in line with IEC TR 61901:2016.
- e) A low smoke halogen free oversheath material, designated ST₁₂ is introduced.

- f) Additional tests under fire conditions are introduced: vertical flame spread, smoke density, acidity and conductivity, which are applied according to the fire performance declared for the cable.
- g) A test for water penetration in the conductor is added.
- h) In addition to tests on the outer protection of joints, type tests on the screen sectionalizing insulation of all accessories have been introduced.
- i) A list of relevant CIGRE references is given in the bibliography.

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POWER CABLES WITH EXTRUDED INSULATION AND THEIR ACCESSORIES FOR RATED VOLTAGES ABOVE 30 kV ($U_m = 36$ kV) UP TO 150 kV ($U_m = 170$ kV) – TEST METHODS AND REQUIREMENTS

1 Scope

This document specifies test methods and requirements for power cable systems, cables alone and accessories alone, for fixed installations and for rated voltages above 30 kV ($U_m = 36$ kV) up to and including 150 kV ($U_m = 170$ kV).

The requirements apply to single-core cables and to individually screened three-core cables and to their accessories for usual conditions of installation and operation, but not to special cables, such as submarine cables and their accessories, for which modifications to the standard tests ~~may be necessary~~ or the setup of special test conditions ~~may need to be devised~~ can be necessary.

This document does not cover transition joints between cables with extruded insulation and paper insulated cables.

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 60840:2020](https://standards.iteh.ai/IEC/60840/2020)

~~NOTE – The IEC 60811 series is currently undergoing a revision, which will lead to a restructuring of its parts. A description of this, as well as a cross-reference table between the current and planned parts will be given in IEC 60811-100.~~

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

~~IEC 60183, *Guide to the selection of high-voltage cables*~~

IEC 60228, *Conductors of insulated cables*

IEC 60229:2007, *Electric cables – Tests on extruded oversheaths with a special protective function*

IEC 60230, *Impulse tests on cables and their accessories*

IEC 60287-1-1:2006, *Electric cables – Calculation of the current rating – Part 1-1: Current rating equations (100 % load factor) and calculation of losses – General*

IEC 60332-1-2, *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*

IEC 60332-3-24, *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*