

INTERNATIONAL STANDARD

Electric cables for photovoltaic systems with a voltage rating of 1,5 kV DC
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IEC 62930:2017

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**ELECTRIC CABLES FOR PHOTOVOLTAIC SYSTEMS
WITH A VOLTAGE RATING OF 1,5 kV DC**

FOREWORD

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

FDIS	Report on voting
20/1764/FDIS	20/1777/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

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- replaced by a revised edition, or
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A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

This document specifies cables for use in photovoltaic (PV) systems for installation at the direct current (DC) side. These cables are suitable for permanent outdoor long-term use under variable demanding climate conditions. Relatively stringent requirements are set for these products in line with the expected usage conditions.

During the writing of this document, the work of IEC TC 64 (Electrical installations and protection against electric shock) and IEC TC 82 (Solar photovoltaic energy systems) on the design and installation of PV systems has been taken into account.

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ELECTRIC CABLES FOR PHOTOVOLTAIC SYSTEMS WITH A VOLTAGE RATING OF 1,5 kV DC

1 Scope

This document applies to single-core cross-linked insulated power cables with cross-linked sheath. These cables are for use at the direct current (DC) side of photovoltaic systems, with a rated DC voltage up to 1,5 kV between conductors and between conductor and earth. This document includes halogen free low smoke cables and cables that can contain halogens.

The cables are suitable to be used with Class II equipment as defined in IEC 61140.

The cables are designed to operate at a normal continuous maximum conductor temperature of 90 °C. The permissible period of use at a maximum conductor temperature of 120 °C is limited to 20 000 h.

NOTE The expected period of use under normal usage conditions as specified in this document is at least 25 years.

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 62930:2017](https://standards.iteh.ai/catalog/standards/sist/3300ce54-a72c-4493-b5a0-5180427e77a1/iec-62930-2017)

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IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60216-1, *Electrical insulating materials – Thermal endurance properties – Part 1: Ageing procedures and evaluation of test results*

IEC 60216-2, *Electrical insulating materials – Thermal endurance properties – Part 2: Determination of thermal endurance properties of electrical insulating materials – Choice of test criteria*

IEC 60227-2:1997, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 2: Test methods*

IEC 60245-2:1994, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 2: Test methods*

IEC 60228:2004, *Conductors of insulated cables*

IEC 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*

IEC 60332-1-2:2004/AMD1:2015

IEC 60364-5-52, *Low-voltage electrical installations – Part 5-52: Selection and erection of electrical equipment – Wiring systems*

IEC 60719, *Calculation of the lower and upper limits for the average outer dimensions of cables with circular copper conductors and of rated voltages up to and including 450/750 V*

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 60811-403, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 403: Miscellaneous tests – Ozone resistance test on cross-linked compounds*

IEC 60811-404, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 404: Miscellaneous tests – Mineral oil immersion tests for sheaths*

IEC 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*

IEC 60811-503, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 503: Mechanical tests – Shrinkage test for sheaths*

IEC 60811-504, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 504: Mechanical tests – Bending tests at low temperature for insulation and sheaths*

IEC 60811-505, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 505: Mechanical tests – Elongation at low temperature for insulations and sheaths*

IEC 60811-506, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 506: Mechanical tests – Impact test at low temperature for insulations and sheaths*

IEC 60811-507, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 507: Mechanical tests – Hot set test for cross-linked materials*

IEC 61034-2, *Measurement of smoke density of cables burning under defined conditions – Part 2: Test procedure and requirements*

IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*

IEC 62230, *Electric cables – Spark-test method*

IEC 62440:2008, *Electric cables with a rated voltage not exceeding 450/750 V – Guide to use*

IEC 62821-1:2015, *Electric cables – Halogen-free, low smoke, thermoplastic insulated and sheathed cables of rated voltages up to and including 450/750 V – Part 1: General requirements*

IEC 62821-2:2015, *Electric cables – Halogen-free, low smoke, thermoplastic insulated and sheathed cables of rated voltages up to and including 450/750 V – Part 2: Test methods*

3 Terms and definitions

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

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

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

3.1

type test

T

tests required to be carried out before supplying a type of cable covered by IEC 62930 on a general commercial basis, in order to demonstrate satisfactory performance characteristics to meet the intended application

Note 1 to entry: Type tests are of such a nature that, after they have been made, they need not be repeated unless changes are made in the cable materials, design or type of manufacturing process which might change the performance characteristics.

3.2

sample test

S

tests carried out on samples of completed cable, or components taken from a completed cable adequate to verify that the finished product meets the design specifications

3.3

routine test

R

tests carried out on all production cable lengths to demonstrate their integrity

3.4

halogen free material

material containing no more than a defined impurity level of halogens

4 Rated voltage

The cables specified by this document are in particular designed for use at the direct current (DC) side of photovoltaic-systems, with a rated DC voltage up to 1,5 kV between conductors as well as between conductor and earth.

Annex A provides further guidance on voltage ratings.

5 Requirements for the construction of cables

5.1 Conductors

5.1.1 Material

The conductors shall be copper, and in accordance with IEC 60228.

The wires of conductors shall be tin coated. The wires shall be covered with a continuous layer of tin coating.

There shall be no visible gaps in the continuous layer, when examined with normal or corrected vision.

5.1.2 Construction

The class of the conductor shall be Class 5 in accordance with IEC 60228 for cable that is directly connected to PV modules. Class 2 conductors are allowed for cables intended for fixed installation and not directly connected to the PV modules.

The nominal cross-sectional areas for each conductor class are given in Table 1.

5.1.3 Separator between conductor and insulation

A non-metallic separator may be applied between the conductor and the insulation. If a non-metallic separator is applied in a halogen free low smoke cable, it shall be halogen free.

5.1.4 Check of construction

Compliance with the requirements of 5.1.1, 5.1.2 and 5.1.3, including the requirements of IEC 60228, shall be checked by inspection and by measurement.

5.2 Insulation

5.2.1 Material

The insulation material shall be a cross-linked compound and fulfil the requirements as specified in Table B.1 in Annex B.

5.2.2 Application to the conductor

The insulation shall be applied by extrusion, such that it fits closely on the conductor, but it shall be possible to remove it without damage to the insulation itself, to the conductor or to the tin coating. It is permitted to apply the insulation in a single layer, or in a number of non-separable layers. Where more than one layer is used, all testing shall be carried out on the complete insulation as though it were a single layer.

NOTE Insulation applied in more than one layer does not conform to the definition of “double insulation” given, for instance, in IEC 61140.

Compliance shall be checked by inspection and by manual test.

5.2.3 Thickness

The average of the measured values, rounded to 0,1 mm, shall be not less than the specified value for each size shown in Table 1.

The smallest value measured shall not fall below 90 % of the specified value by more than 0,1 mm, i.e.:

$$t_m \geq 0,9t_s - 0,1$$

where:

t_m is the minimum insulation thickness at any point in millimetres;

t_s is the specified insulation thickness, in millimetres.

Compliance shall be checked using the test given in 1.9 of IEC 60245-2:1994.