

# INTERNATIONAL STANDARD

**Electric cables for photovoltaic systems with a voltage rating of 1,5 kV DC**



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2017 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
Fax: +41 22 919 03 00  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

### About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

### About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

#### IEC Catalogue - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

#### IEC publications search - [www.iec.ch/searchpub](http://www.iec.ch/searchpub)

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

#### IEC Glossary - [std.iec.ch/glossary](http://std.iec.ch/glossary)

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

#### IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [csc@iec.ch](mailto:csc@iec.ch).

generated by EVS



IEC 62930

Edition 1.0 2017-12

# INTERNATIONAL STANDARD

---

**Electric cables for photovoltaic systems with a voltage rating of 1,5 kV DC**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

---

ICS 29.060.20; 27.160

ISBN 978-2-8322-5145-4

**Warning! Make sure that you obtained this publication from an authorized distributor.**

## CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references .....	7
3 Terms and definitions .....	8
4 Rated voltage.....	9
5 Requirements for the construction of cables .....	9
5.1 Conductors .....	9
5.1.1 Material.....	9
5.1.2 Construction .....	10
5.1.3 Separator between conductor and insulation.....	10
5.1.4 Check of construction .....	10
5.2 Insulation .....	10
5.2.1 Material .....	10
5.2.2 Application to the conductor .....	10
5.2.3 Thickness .....	10
5.3 Sheath.....	11
5.3.1 Material .....	11
5.3.2 Application.....	11
5.3.3 Thickness .....	11
5.3.4 Colour .....	11
5.4 Multi-core cables and additional elements.....	11
6 Marking .....	11
6.1 General.....	11
6.2 Indication of origin .....	11
6.3 Code marking .....	12
6.4 Additional marking .....	12
6.5 Nominal cross-sectional area of conductor.....	12
6.6 Continuity of marking .....	12
6.7 Additional requirements .....	12
6.7.1 Durability.....	12
6.7.2 Legibility.....	12
7 Requirements for completed cables.....	12
7.1 General.....	12
7.2 Electrical tests - check for absence of faults on the insulation or on the complete cable.....	13
7.3 Non electrical tests - overall diameters and ovality.....	13
Annex A (normative) Guide to use .....	19
A.1 Use of cables for PV systems .....	19
A.2 Groups.....	21
A.3 Short-circuit-temperature .....	21
Annex B (normative) Requirements for insulation and sheathing materials.....	22
Annex C (normative) Cold impact test.....	24
Annex D (normative) Dynamic penetration test .....	25
Annex E (normative) Weathering/UV resistance test .....	26
Bibliography.....	27

Figure 1 – Example of marking as used on the outer sheath of the cable .....	12
Figure D.1 – Arrangement for dynamic penetration test.....	25
Table 1 – Dimensional and insulation resistance values for class 5 conductor cables .....	13
Table 2 – Dimensional and insulation resistance values for class 2 conductor cables .....	14
Table 3 – Tests for cables to IEC 62930 .....	15
Table A.1 – Intended use of cables for PV systems (environmental conditions).....	20
Table A.2 – Recommended use of cables for PV systems.....	20
Table A.3 – Current carrying capacity of PV cables.....	21
Table A.4 – Current rating conversion factors for different ambient temperatures.....	21
Table B.1 – Requirements for insulation and sheathing materials.....	22
Table C.1 – Parameters for cold impact test .....	24

This document is a preview generated by EVS

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

### FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62930 has been prepared by IEC technical committee 20: Electric cables.

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

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

A bilingual version of this publication may be issued at a later date.

This document is a preview generated by EVS

## 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.

This document is a preview generated by EVS

## 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 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.