SLOVENSKI STANDARD
SIST EN 50618:2015

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Električni kabli za fotonapetostne sisteme

Electric cables for photovoltaic systems

Kabel und Leitungen - Leitungen für Photovoltaic Systeme

Câbles électriques pour systèmes photovoltaïques

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Electric cables for photovoltaic systems (BT(DE/NOT)258)

Câbles électriques pour systèmes photovoltaïques (BT(DE/NOT)258)

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European Committee for Electrotechnical Standardization
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Foreword

This document (EN 50618:2014) has been prepared by CLC/TC 20 “Electric cables”.

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-10-27
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2017-10-27

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

Introduction

This standard specifies cables for use in Photovoltaic (PV) Systems, in particular for installation at the Direct Current (d.c.) side. These cables are suitable for permanent outdoor use for many years under variable demanding climate conditions. Relatively stringent requirements are set for these products in line with the expected harsh usage conditions.

During the writing of this standard the joint work of TC 64 (Electrical installations and protection against electric shock) and TC 82 (Solar Photovoltaic Energy Systems) on the design and installation of PV systems has been taken into account.

1 Scope

This European Standard applies to low smoke halogen-free, flexible, single-core power cables with cross-linked insulation and sheath. In particular for use at the direct current (d.c.) side of photovoltaic systems, with a nominal d.c. voltage of 1,5 kV between conductors and between conductor and earth.

The cables are suitable to be used with Class II equipment.

The cables are designed to operate at a normal maximum conductor temperature of 90 °C, but for a maximum of 20 000 hours a max. conductor temperature of 120 °C at a max. ambient temperature of 90 °C is permitted.

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

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50289-4-17, *Communication cables – Specifications for test methods – Part 4-17: Test methods for UV resistance evaluation of the sheath of electrical and optical fibre cable*

EN 50395:2005, *Electrical test methods for low voltage energy cables*

EN 50396:2005, *Non electrical test methods for low voltage energy cables*

EN 50525-1:2011, *Electric cables – Low voltage energy cables of rated voltages up to and including 450/750 V (U_0/U) – Part 1: General requirements*

EN 50565-1:2014, *Electric cables – Guide to use for cables with a rated voltage not exceeding 450/750 V (U_0/U) – Part 1: General guidance*

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

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

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

EN 60228:2005, *Conductors of insulated cables (IEC 60228:2004)*

EN 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)*

EN 60811-401, *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)*

EN 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 60811-403)*

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

EN 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 60811-501)*

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

EN 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 60811-504)*

EN 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 60811-505)*

EN 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 60811-506)*

EN 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 60811-507)*

EN 61034-1, *Measurement of smoke density of cables burning under defined conditions – Part 1: Test apparatus (IEC 61034-1)*

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

EN 62230:2007, *Electric cables – Spark-test method (IEC 62230:2006)*

HD 60364-5-52:2011, *Low-voltage electrical installations – Part 5-52: Selection and erection of electrical equipment – Wiring systems*

HD 60364-7-712, *Electrical installations of buildings – Part 7-712: Requirements for special installations or locations – Solar photovoltaic (PV) power supply systems (IEC 60364-7-712)*

3 Terms and definitions

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

3.1
type tests (T)
tests required to be made before supplying a type of cable covered by this standard 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 tests (S)
tests made 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 tests (R)
tests made on all production cable lengths to demonstrate their integrity

3.4
halogen-free material
material complying with the requirements of Annex B of EN 50525-1:2011

4 Rated voltage

The cables specified in this standard are in particular designed for use at the direct current (d.c.) side of photovoltaic-systems, with a nominal d.c. voltage of 1,5 kV between conductors as well as between conductor and earth.

The cables have a rated voltage of 1,0/1,0 kV when used in alternating current (a.c.) systems.

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 EN 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 EN 60228.

The maximum diameters of the wires in the conductor shall be in accordance with EN 60228.

5.1.3 Separator between conductor and insulation

It is permitted to use a separating tape between the conductor and the insulation.

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 EN 60228, shall be checked by inspection and by measurement.

5.1.5 Electrical resistance

The resistance of each conductor at 20 °C shall be in accordance with the requirements of EN 60228 for a metal coated Class 5 conductor.

Compliance shall be checked by the test given in Clause 5 of EN 50395:2005.

5.2 Insulation

5.2.1 Material

The insulation material shall be cross-linked 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 coherent 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 HD 60364.

Compliance shall be checked by inspection and by manual test.

5.2.3 Thickness

For each piece of insulation, 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 EN 50396:2005, 4.1.

5.3 Sheath

5.3.1 Material

The sheath material shall be cross-linked and fulfil the requirements as specified in Table B.1.

5.3.2 Application

The sheath shall be applied homogeneously by extrusion. It is permitted to apply the sheath in a single layer, or in a number of coherent layers. Where more than one layer is used, all testing shall be carried out on the complete sheathing as though it were a single layer.

The application of the sheath shall give the finished cable a practically circular shape.

A separator may be applied under the sheath.

5.3.3 Thickness

For each piece of sheath, 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 85 % of the specified value by more than 0,1 mm, i.e.:

$$t_m \geq 0,85t_s - 0,1$$

where

t_m is the minimum sheath thickness at any point, in millimetres;

t_s is the specified sheath thickness, in millimetres.

Compliance shall be checked using the test given in EN 50396:2005, 4.2.

5.3.4 Colour

The sheath shall be coloured black, unless otherwise agreed between manufacturer and customer.

The colour shall be throughout the whole of the sheath.

6 Marking

6.1 General

The sheath of the cable shall be marked by printing, embossing or indenting.

6.2 Indication of origin

Cables shall be provided with an identification of origin consisting of the continuous marking of the manufacturer's name or trademark, or (if legally protected) identification number.

6.3 Code designation

Cables shall be marked with the following code designation 'H1Z2Z2-K'.

6.4 Nominal cross-sectional area of conductor

Cables shall be marked with the nominal cross-sectional area, for example '2,5 mm^2'.

6.5 Continuity of marking

Each specified marking shall be regarded as continuous if the distance between the end of the mark and the beginning of the next identical mark does not exceed 550 mm.

NOTE A 'Specified Marking' is any mandatory marking covered by this standard.

Other marking, such as that required under recognized voluntary 3rd party approval schemes, may also follow the requirements of this subclause.

The diagram below shows an example of the marking as used on the outer sheath of the cable.

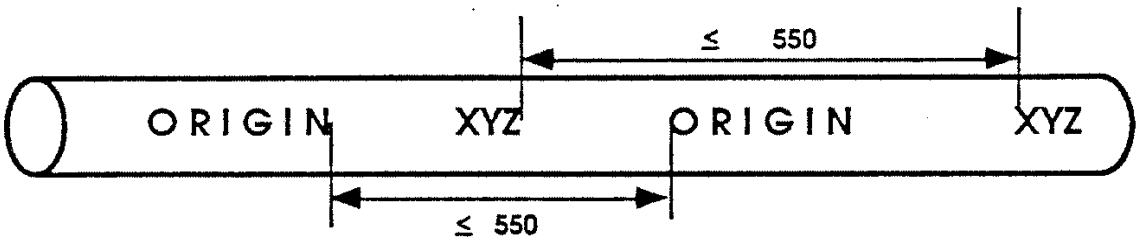

Figure 1 – Example of the marking as used on the outer sheath of the cable

6.6 Use of the name CENELEC

The name CENELEC, in full or abbreviated, shall not be marked on, or in, the cables.