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Date: 02 February 2023

Origin: International

Latest date for receipt of comments: 22 March 2023

Project No. 2022/00276

Responsible committee: GEL/82 Photovoltaic Energy Systems

Interested committees:

Title: BS EN 62852 Amd.2 Connectors for DC-application in photovoltaic systems - Safety requirements and tests

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

PROJECT NUMBER: IEC 62852 ED2	
DATE OF CIRCULATION: 2023-01-27	CLOSING DATE FOR COMMENTS: 2023-04-21
SUPERSEDES DOCUMENTS: 82/2007/RR	

IEC TC 82 : SOLAR PHOTOVOLTAIC ENERGY SYSTEMS	
SECRETARIAT: United States of America	SECRETARY: Mr George Kelly
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 64	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☒ QUALITY ASSURANCE ☒ SAFETY	

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- any relevant patent rights of which they are aware and to provide supporting documentation,
- any local regulations or technical reasons that may exist and should be considered should this proposal proceed, recognizing that failure to address such requirements could result in the need for new or existing "in some countries" clauses. See AC/22/2007.

TITLE:

Connectors for DC-application in photovoltaic systems – Safety requirements and tests

NOTE FROM TC/SC OFFICERS:

This project was discussed and supported by WG2 during their meeting in 2022-11. Based on the extent of changes, this may need to be a new edition (ED2 instead of AMD2 ED1)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**CONNECTORS FOR DC-APPLICATION IN PHOTOVOLTAIC SYSTEMS –
SAFETY REQUIREMENTS AND TESTS**

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IEC 62852 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems. It is an International Standard.

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

Draft	Report on voting
82/XX/FDIS	82/XX/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/standardsdev/publications.

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.

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CONNECTORS FOR DC-APPLICATION IN PHOTOVOLTAIC (PV) SYSTEMS – SAFETY REQUIREMENTS AND TESTS

1 Scope

This International Standard applies to connectors for use in the d.c. circuits of photovoltaic systems according to class II of IEC 61140:2001 with rated voltages up to 1 500 V d.c. and rated currents up to 125 A per contact.

This standard applies to connectors from same product family of same manufacturer without breaking capacity but which might be engaged and disengaged under voltage.

Note 1 to entry: The meaning of one manufacturer is in this case of one and the same manufacturer.

This standard also applies to connectors which are intended to be built-in or integrated in enclosures of devices for photovoltaic systems. This standard may be used as a guide for connectors in photovoltaic systems of classes 0 and III according to IEC 61140:2001 as well as for protection for Class II equipment intended for use at less than 50 V d.c. This document does not apply to connectors for data collection, tracker controls or similar, but it may be used as a guide for those connectors.

This standard does not cover any requirement which may be applied for tests of combinations of connectors from different manufacturers

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.

IEC 60050 (all parts): *International Electrotechnical Vocabulary* (available at <http://www.electropedia.org>)

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

IEC 60068-1, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-14, *Environmental testing - Part 2-14: Tests - Test N: Change of temperature*

IEC 60068-2-75, *Environmental testing - Part 2-75: Tests - Test Eh: Hammer tests*

IEC 60068-2-78, *Environmental testing - Part 2-75: Tests - Test Cab: Damp heat, steady state*

IEC 60112, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

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

IEC 60216-5, *Electrical insulating materials – Thermal endurance properties – Part 5: Determination of relative thermal endurance index (RTE) of an insulating material*

IEC 60228:2004, *Conductors of insulated cables*

IEC 60309-1, *Plugs, socket-outlets and couplers for industrial purposes – Part 1: General requirements*

IEC 60352-2, *Solderless connections – Part 2: Solderless crimped connections – General requirements, test methods and practical guidance*

- 38 IEC 60352-3, *Solderless connections – Part 3: Solderless accessible insulation displacement*
39 *connections – General requirements, test methods and practical guidance*
- 40 IEC 60352-4, *Solderless connections – Part 4: Solderless non-accessible insulation*
41 *displacement connections – General requirements, test methods and practical guidance*
- 42 IEC 60352-5, *Solderless connections – Part 5: Press-in connections – General requirements,*
43 *test methods and practical guidance*
- 44 IEC 60352-6, *Solderless connections – Part 6: Insulation piercing connections – General*
45 *requirements, test methods and practical guidance*
- 46 IEC 60352-7, *Solderless connections – Part 7: Spring clamp connections – General*
47 *requirements, test methods and practical guidance*
- 48 IEC 60364-7-712, *Electrical installations of buildings – Part 7-712: Requirements for special installations*
49 *or locations – Solar photovoltaic (PV) power supply systems*
- 50 IEC 60512 (all parts), *Connectors for electronic equipment – Tests and measurements*
- 51 IEC 60512-1, *Connectors for electronic equipment – Tests and measurements – Part 1: General*
- 52 IEC 60512-11-7, *Electromechanical components for electronic equipment – Basic testing procedures*
53 *and measuring methods – Part 11-7: Climatic tests – Test 11g: Flowing mixed gas corrosion test*
- 54 IEC 60529, *Degrees of protection provided by enclosures (IP Code)*
- 55 IEC 60664-1:2020, *Insulation co-ordination for equipment within low-voltage systems – Part 1:*
56 *Principles, requirements and tests*
- 57 IEC 60695-2-11, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-*
58 *wire flammability test method for end-products*
- 59 IEC 60695-11-10, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical*
60 *flame test methods*
- 61 IEC TR 60943, *Guidance concerning the permissible temperature rise for parts of electrical*
62 *equipment, in particular for terminals*
- 63 IEC 60998-2-3, *Connecting devices for low-voltage circuits for household and similar purposes*
64 *– Part 2-3: Particular requirements for connecting devices as separate entities with insulation-*
65 *piercing clamping units*
- 66 IEC 60999-1, *Connecting devices – Electrical copper conductors – Safety requirements for*
67 *screw-type and screwless-type clamping units – Part 1: General requirements and particular*
68 *requirements for clamping units for conductors from 0,2 mm² up to 35 mm² (included)*
- 69 IEC 60999-2, *Connecting devices – Electrical copper conductors – Safety requirements for*
70 *screw-type and screwless-type clamping units – Part 2: Particular requirements for clamping*
71 *units for conductors above 35 mm² up to 300 mm² (included)*
- 72 IEC 61032, *Protection of persons and equipment by enclosures – Probes for verification*
- 73 IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*
- 74 IEC 61210, *Connecting devices – Flat quick-connect terminations for electrical copper*
75 *conductors – Safety requirements*
- 76 IEC 61215-2, *Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 2:*
77 *Test procedures*
- 78 IEC 61730-1, *Photovoltaic (PV) module safety qualification – Part 1: Requirements for*
79 *construction*
- 80 IEC TS 61836, *Solar photovoltaic energy systems – Terms, definitions and symbols*

IEC 62444, *Cable glands for electrical installations*

IEC 62548, *Photovoltaic (PV) arrays – Design requirements*

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

IEC TR 63225, *Incompatibility of connectors for DC-application in photovoltaic systems*

ISO 527-1, *Plastics- Determination of tensile properties - Part 1: General principles*

ISO 868, *Plastics and ebonite – Determination of indentation hardness by means of a durometer (Shore hardness)*

ISO 4892-2, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc sources*

ISO 4892-3, *Plastics – Methods of exposure to laboratory light sources – Part 3: Fluorescent UV-lamps*

ISO 6988:1985, *Metallic and other non organic coatings – Sulfur dioxide test with general condensation of moisture*

ISO 7619-1, *Rubber, vulcanized or thermoplastic - Determination of indentation hardness - Part 1: Durometer method (Shore hardness)*

UL 1703, *Flat Plate Photovoltaic modules and panels*

UL746 B, *Polymeric Materials – Long term property evaluations*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-581, IEC 60050-826, IEC 60309-1, IEC 60664-1, IEC 60999-1 and IEC 61140, as well as the following apply.

3.1

connector

component which terminates conductors for the purpose of providing connection to and disconnection from a suitable mating component from same connector manufacturer

Note 1 to entry: Connector type is a designation for all devices of a product family specified by the manufacturer.

[SOURCE: IEC 60050-581:2008, 581-06-01, modified: Supplement of “from same connector manufacturer”]

3.2

multi-way connector

connector with more than one contact

Note 1 to entry: Multiple single-way connectors used in a PV-junction box are not to be regarded as a multi-way connector according to this standard.

3.3

connector under voltage

CuV

connector specially designed to be engaged or disengaged in normal use when live but not under load

Note 1 to entry: In this standard, the term “live” is used if contacts are under an applied voltage, but not necessarily carrying current. The term “load” is used if a current is flowing through the contacts.

3.4

connector without breaking capacity

COC

connector which is not allowed to be engaged or disengaged in normal use when live or under load

[SOURCE: IEC 60050-581:2008, 581-27-73]

3.5 categories of connector

3.5.1

free connector

connector for attachment to the free end of a wire or cable

[SOURCE: IEC 60050-581:2008, 581-06-12]

3.5.2

built-in connector

a pre-manufactured connector that is subsequently integrated into an enclosure

3.5.3

integrated connector

a connector assembly that is manufactured as an integral component during enclosure fabrication

3.6

kind of connection

3.6.1

non-rewirable connector

connector so constructed that the cable cannot be separated from the connector without making it permanently useless

[SOURCE: IEC 60050-581:581-26-33, , modified “useless”]

3.6.2

rewirable connector

connector so constructed that the flexible cable or cord can be replaced.

[SOURCE: IEC 60050-442:442-01-17, modified “connector so constructed that...”]

3.7

connector for Class II equipment

connector in which the protection against indirect contact is realized by double or reinforced insulation

Note 1 to entry: Class II according to IEC 61140.

3.8

intended use

application conditions of connectors which are included within the permissible rated values and environmental conditions and characteristics assigned by the manufacturer

3.9

locking device

feature incorporated in certain components to provide mechanical retention of their mating part

[SOURCE: IEC 60050-581: 581-23-22]

3.10

cycle of mechanical operation

one insertion and one withdrawal of the connector with his counterpart

3.11

clamping unit

part(s) of the terminal necessary for the mechanical clamping and the electrical connection of the conductor(s), including the parts which are necessary to ensure the correct contact pressure

[SOURCE: IEC 60999-1:1999, 3.1]

3.12

upper limiting temperature

170 maximum temperature of a connector as defined by the manufacturer, in which the connector is intended
171 to operate

172 Note 1 to entry: The abbreviation ULT is often used.

173 3.13

174 maximum ambient temperature

175 maximum temperature of the ambient assigned from the manufacturer, in which the connector is able
176 to operate permanently without the upper limiting temperature being exceeded.

177 NOTE: IEC TS 63126 covers requirements for ambient temperatures higher than 70°C.

178 3.14

179 lower limiting temperature

180 minimum temperature of a connector as defined by the manufacturer in which a connector is intended
181 to operate

182 Note 1 to entry: The abbreviation LLT is often used.

183 3.15

184 clearance

185 the shortest distance in air between two conductive parts

186 [SOURCE: IEC 60664-1:2007, 1.3.2]

187 3.16

188 creepage distance

189 shortest distance along the surface of the insulating material between two conductive parts

190 [SOURCE: IEC 60664-1:2007, 1.3.3]

191 3.17

192 overvoltage category

193 numeral defining a transient overvoltage condition

194 [SOURCE: IEC 60664-1:2007, 1.3.10]

195 3.18

196 pollution

197 any addition of foreign matter, solid, liquid, or gaseous, that can result in a reduction of electric strength
198 or surface resistivity of the insulation

199 [SOURCE: IEC 60664-1:2007, 1.3.11]

200 3.19

201 pollution degree

202 numeral characterizing the expected pollution of the micro-environment

203 [SOURCE: IEC 60664-1:2007, 1.3.13]

204 3.20

205 rated voltage

206 value of voltage assigned by the manufacturer to the connector and to which operation and performance
207 characteristics are referred

208 Note 1 to entry: Rated voltage is equivalent to the rated system voltage according to IEC 61730-1.

209 [SOURCE: IEC 60664-1:2007, 1.3.9, modified]

210 3.21

211 rated insulation voltage

212 r.m.s. withstand voltage value assigned by the manufacturer to the connector, characterizing the
213 specified (long term) withstand capability of its insulation

214 Note 1 to entry: The rated insulation voltage is not necessarily equal to the rated voltage, which is primarily related to functional
215 performance.

[SOURCE: IEC 60664-1:2007, 1.3.9.1, modified]

3.22

rated impulse voltage

impulse withstand voltage value assigned by the manufacturer to the connector, characterising the specified withstand capability of its insulation against transient overvoltages

[SOURCE: IEC 60664-1:2007, 1.3.9.2, modified]

3.23

impulse withstand voltage

highest peak value of impulse voltage, of prescribed form and polarity which does not cause breakdown of the insulation under specified conditions

Note 1 to entry: The impulse withstand voltage is equal to or higher than the rated impulse voltage.

[SOURCE: IEC 60664-1:2007, 1.3.8.1]

3.24

r.m.s. withstand voltage

power-frequency withstand voltage

highest r.m.s. value of a voltage which does not cause breakdown of the insulation under specified conditions

[SOURCE: IEC 60664-1:2007, 1.3.8.2]

3.25

rated current

current value assigned by the manufacturer, which the connector can carry continuously (without interruption) and simultaneously through all its contacts wired with the largest specified conductor, preferably at an ambient temperature of 85°C, without the upper limiting temperature being exceeded

Note 1 to entry: If other ambient temperature values are used for the definition of the rated current, the manufacturer should state in the technical documentation the ambient temperature on which the rating is based, with reference, if appropriate, to the derating curve defined in IEC 60512-5-2, test 5b.

3.26

functional insulation

insulation between conductive parts which is necessary only for the proper functioning of the equipment

[SOURCE: IEC 60664-1:2007, 1.3.17.1]

3.27

basic insulation

insulation applied to live parts to provide basic protection against electric shock

Note 1 to entry: Basic insulation does not necessarily include insulation used exclusively for functional purposes (see IEC 61140:2001, 3.10.1).

[SOURCE: IEC 60664-1:2007, 1.3.17.2]

3.28

supplementary insulation

independent insulation applied in addition to basic insulation, in order to provide protection against electric shock in the event of a failure of basic insulation (see IEC 61140:2001, 3.10.2)

[SOURCE: IEC 60664-1:2007, 1.3.17.3]

3.29

double insulation

insulation comprising both basic insulation and supplementary insulation (see IEC 61140:2001, 3.10.3)

[SOURCE: IEC 60664-1:2007, 1.3.17.4]

3.30

reinforced insulation

single insulation system applied to live parts, which provides a degree of protection against electric shock equivalent to double insulation under the conditions specified in the relevant IEC standard (see IEC 61140:2001, 3.10.4)

Note 1 to entry: A single insulation system does not imply that the insulation is a homogeneous piece. It may comprise several layers which cannot be tested separately as basic or supplementary insulation

3.31**internal insulation**

part of basic insulation providing the required clearance and creepage distances inside a conductive housing or enclosure

3.32**manufacturer**

organization, situated at a stated location or locations, that carries out or controls such stages in the manufacture, assessment, handling and storage of a product that enables it to accept responsibility for continued compliance of the product with the relevant requirements and undertakes all obligations in that connection

Note 1 to entry: The terms "manufacturer" and "organization" are often used interchangeably.

[SOURCE: IEC 60050-426: 426-27-01 with following modification: Note 2 has not been considered]

3.33**product family**

collection of complementary products produced under the same brand name

factory assembled connector

connector that is intended to be assembled and terminated to the cable under controlled conditions at a manufacturer's location.

[SOURCE: UL 62852:2022]

3.35**field assembled connector**

connector that is intended to be assembled and terminated to the cable in the field.

[SOURCE: UL 62852:2022]

4 Classification

4.1 General

In order to apply the relevant test requirements, connectors shall be classified by the manufacturer's specification, according to their intended use under consideration of class II, according to IEC 61140 and characteristics, as set out below.

4.2 Categories of connector

- a) Free connector.
- b) Built-in connector.
- c) Integrated connector.

4.3 Additional characteristics

- a) Connector with cable anchorage.
- b) IP-code of a connector according to IEC 60529.
- c) Connector for Class II equipment.
- d) Non-rewirable connector.
- e) Rewirable connector.
- f) Terminations and connection methods.
- g) Factory assembled connectors
- h) Field assembled connectors

5 Constructional requirements and performance

5.1 General

This standard does not define electrical rating values for voltage and current. These values are assigned by the manufacturer.

Connectors shall be suitable for durable outdoor use in an ambient temperature area from – 40 °C to +85 °C.

Multi-way connectors shall be designed so that these requirements for earth-faulted and short-circuit-proofed installation complies with IEC 62548 or IEC 60364-7-712.

Compliance with the requirements is verified by the specified tests of this standard.

5.2 Marking and identification

5.2.1 Identification

Connectors shall be identified and characterised by the following:

- a) manufacturer's name, trademark or mark of origin;
- b) product family (if applicable) and type reference (for example, the catalogue number);
- c) rated current in amperes (A);
- d) rated voltages or rated insulation voltages between line to earth and line to line in volts (V);
- e) rated impulse voltage in kilovolts (kV), if specified;
- f) pollution degree;
- g) degree of protection by enclosure according to IEC 60529;
- h) specified temperatures: ULT, LLT, maximum ambient temperature (minimum +85 °C);
- i) type of terminals;