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Interested committees:

Title: BS EN IEC 61439-8 Low-voltage switchgear and controlgear assemblies

Part 8: Assemblies for use in photovoltaic installations

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

- i) has any issues related to 3rd party IPR, patent or copyright
- ii) affects other national standard(s)
- iii) requires additional national guidance or information

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Responsible Committee Secretary: **Mr Simon Bounds (BSI)**Direct tel: **0208 996 7281**E-mail: simon.bounds@bsigroup.com

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 Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.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

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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.	



121B/185/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER:

IEC 61439-8 ED1

DATE OF CIRCULATION:

2023-07-28

CLOSING DATE FOR COMMENTS:

2023-10-20

SUPERSEDES DOCUMENTS:

121B/164/NP, 121B/174/RVN

IEC SC 121B : LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR ASSEMBLIES

SECRETARIAT:

Germany

SECRETARY:

Mr Jörg Hußmann

OF INTEREST TO THE FOLLOWING COMMITTEES:

TC 23, SC 23E, TC 64, TC 82, SC 121A

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

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Recipients of this document are invited to submit, with their comments, notification of 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](#) OR [NEW GUIDANCE DOC](#)).

TITLE:

Low-voltage switchgear and controlgear assemblies - Part 8: Assemblies for use in photovoltaic installations

NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR ASSEMBLIES –**Part X: Assemblies for use in photovoltaic installations****FOREWORD**

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International Standard IEC 61439-X has been prepared by subcommittee 121B: Low-voltage switchgear and controlgear assemblies, of IEC technical committee 121: Switchgear and controlgear and their assemblies for low voltage.

This first edition cancels and replaces Annex DD of IEC 61439-2 edition 3, published in 2020. It constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous Annex DD in IEC 61439-2: 2020:

The text of this document is based on the following documents:

FDIS	Report on voting
121B/XXX/FDIS	121B/XXX/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.

- 130 This document has been drafted in accordance with the ISO/IEC Directives, Part 2.
- 131 In this document, general terms and definitions are defined in Clause 3.
- 132 The reader's attention is drawn to the fact that Annex EE lists all the "in-some-country" clauses
133 on differing practices of a less permanent nature relating to the subject of this document.
- 134 This document is to be read in conjunction with IEC 61439-1:2020. The provisions of the general
135 rules dealt with in IEC 61439-1 are only applicable to this document insofar as they are
136 specifically cited. When this document states "addition", "modification" or "replacement", the
137 relevant text in IEC 61439-1 is to be adapted accordingly.
- 138 Subclauses that are numbered with a 101 (102, 103, etc.) suffix are additional to the same
139 subclause in IEC 61439-1.
- 140 Tables and figures in this document that are new are numbered starting with 101.
- 141 New annexes in this document are lettered AA, BB, etc.
- 142 In this document, the term Photovoltaic Assembly (PVA) is defined in 3.1.101.
- 143 NOTE Throughout the IEC 61439 series of standards, the term assembly (see 3.1.1 of IEC 61439-1:2020) is used
144 for a low-voltage switchgear and controlgear assembly.
- 145 A list of all parts of the IEC 61439 series, under the general title *Low-voltage switchgear and*
146 *controlgear assemblies* can be found on the IEC website.
- 147 The committee has decided that the contents of this document will remain unchanged until the
148 stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to
149 the specific document. At this date, the document will be
- 150 • reconfirmed,
 - 151 • withdrawn,
 - 152 • replaced by a revised edition, or
 - 153 • amended.
 - 154

INTRODUCTION

The photovoltaic technology enables electricity to be produced directly from sunlight, which is a source of renewable energy. Photovoltaic (PV) energy is one of the most promising technologies meeting the pressing need for green renewable energy and is a part of the answer to the challenge of sustainable development. Pushed by sustainable energy policies, extensive country engagement, technology development, and cost reduction the number of photovoltaic (PV) installations according to IEC60364-7-712 is increasing rapidly.

PV installations are usually split into two main categories:

- large scale-utility PV installations, where electricity production is exported to the grid
- small PV installations, for example rooftop installation, where the produced energy can be consumed locally or exported to the grid.

PV applications have characteristics that require assemblies with specific performance. A typical arrangement of a PV installation is shown in figure 101. Further examples are provided in Annex FF.

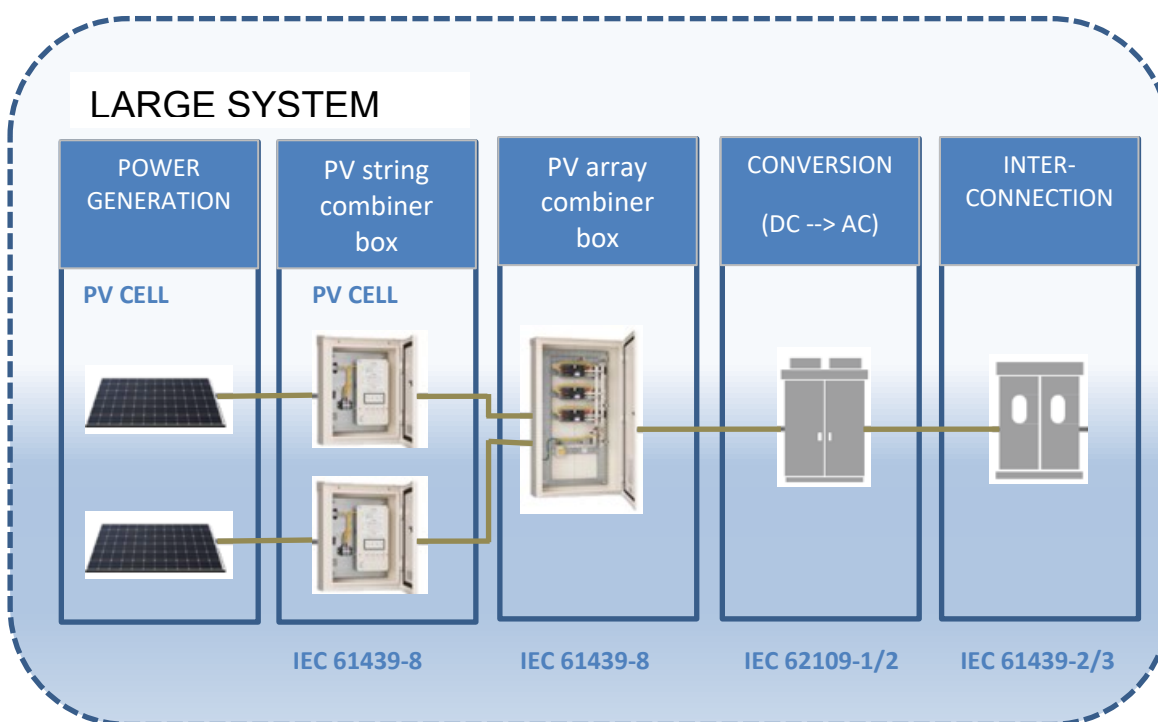


Figure 101 – typical architecture of large scale-utility PV installations

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR ASSEMBLIES –

Part X: Assemblies for use in photovoltaic installations

1 Scope

This part of the IEC 61439 series specifies requirements for the design and verification of assemblies for use in photovoltaic installations. Such photovoltaic assemblies are designated PVAs.

PVAs have the following characteristics:

- assemblies used for the combination or recombination of electrical energy in DC systems for which the voltage does not exceed 1 500 V DC and supply to an AC network where the voltage does not exceed 1 000 V AC;
- stationary assemblies with an enclosure;
- assemblies intended for operation by authorised persons, but can be located in an area accessible to ordinary persons;
- suitable for indoor or outdoor installation.

This document identifies definitions, specify the service conditions, detail the construction requirements, define the technical characteristics, and provide verifications for PVAs.

PVAs can also include control and or signaling devices associated with the distribution of electrical energy.

This document applies to all PVAs whether they are designed and manufactured on a one-off basis or fully standardized and manufactured in quantity.

The manufacture and/or assembly can be carried out by an entity other than the original manufacturer (see 3.10.1 of IEC 61439-1:2020). This document does not apply to individual devices, for example, circuit-breakers, fuse switches and self-contained components such as, motor starters, power electronic converter systems and equipment (PECS), switch mode power supplies (SMPS), uninterruptable power supplies (UPS), basic drive modules (BDM), complete drive modules (CDM), adjustable speed power drives systems (PDS), stand-alone energy storage systems (battery and capacitor systems), other electronic equipment which comply with their relevant product standards, and junction boxes for photovoltaic modules. This document describes their integration into a PVA or an empty enclosure used as a part of a PVA.

For some applications, such as, explosive atmospheres, functional safety, there may be a need to comply with the requirements of other standards or legislation in addition to those specified in the IEC 61439 series.

This document does not apply to the specific types of assemblies covered by other parts of IEC 61439.

Unless local legislation details additional requirements, equipment within the scope of this document, which complies with this document, is deemed to meet essential safety requirements. This includes fully verified specifier options, for example user choice of protection against accidental contact with hazardous live parts of IPXXB or IP3XD. Where special requirements are agreed between the user and manufacturer, that are not fully specified within this document, for example, (i) part of the assembly is outside the scope of this document, (ii) exceptional vibration is present at the place of installation, (iii) exceptional voltage variations occur in service, or (iv) possible adverse effects from sonic or ultrasonic sources, a risk

assessment and/or additional or more severe verifications may be required to demonstrate that the essential safety requirements have been fulfilled.

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.

Clause 2 of IEC 61439-1:2020 is applicable in addition to the following:

Addition:

IEC 60068-2-14:2009, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60269-6:2010, *Low-voltage fuses – Part 6: Supplementary requirements for fuse-links for the protection of solar photovoltaic energy systems*

IEC 60364-7-712:2017, *Low voltage electrical installations – Part 7-712: Requirements for special installations or locations – Solar photovoltaic (PV) power supply systems*

IEC TR60890:2020, *A method of temperature-rise verification of low-voltage switchgear and controlgear assemblies by calculation*

IEC 60898-2:2016, *Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations – Part 2: Circuit-breakers for AC and DC operation*

IEC 60898-3:2019, *Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations – Part 3: Circuit-breakers for DC operation*

IEC 60947-2:2016, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*
IEC 60947-2:2016/AMD1:2019

IEC 60947-3:2020, *Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*

IEC 61439-1:2020, *Low-voltage switchgear and controlgear assemblies – Part 1: General rules*

IEC 62109-1, *Safety of power converters for use in photovoltaic power systems – Part 1: General requirements*

IEC 62109-2, *Safety of power converters for use in photovoltaic power systems – Part 2: Particular requirements for inverters*

IEC 62262:2002, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*
IEC 62262:2002/AMD1:2021

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61439-1:2020 and the following apply.

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

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

272 Clause 3 of IEC 61439-1:2020 is applicable, except as follows.

273 **3.1 General terms**

274 *Additional terms and definitions:*

275 **photovoltaic assembly**

276 PVA

277 assembly which may include a PV string combiner box and/or an array combiner box intended
278 to be used in a photovoltaic installation which, in use, receives electrical energy from one or
279 more supplies and distributes that energy through one or more outgoing circuits to other
280 equipment

281 **3.1.102**

282 **photovoltaic string combiner box**

283 enclosure where photovoltaic strings are electrically connected which may also contain
284 overcurrent protection devices and/or disconnection devices

285

286 **3.1.103**

287 **photovoltaic array combiner box**

288 enclosure where photovoltaic sub-arrays or arrays are electrically connected and which may
289 also contain overcurrent protection and/or disconnection devices

290

291 **3.1.104**

292 **test situation**

293 condition of a PVA or part of it in which the relevant main circuits are open on its supply side
294 but not necessarily isolated whilst the associated auxiliary circuits are connected, allowing
295 operational tests of the incorporated device(s)

296 **3.1.105**

297 **form of internal separation**

298 classification of physical separation within a PVA

299 **3.1.106**

300 **Irradiance**

301 G

302 electromagnetic radiated power per unit of area expressed in W/m²

303 **3.2 Constructional units of assemblies**

304 *Replacement of the title:*

305 **3.2 Constructional units of PVAs**

306 *Additional terms and definitions:*

3.2.100**3.2.101****withdrawable part**

removable part intended to be moved from the connected position to the isolated position and to a test position, if any, whilst remaining mechanically attached to the PVA

3.2.102**test position**

position of a withdrawable part in which the relevant main circuits are open on its supply side but not necessarily isolated and in which the auxiliary circuits are connected allowing operation tests of the incorporated device(s), the withdrawable part remaining mechanically attached to the PVA-assembly

Note 1 to entry: The opening can also be achieved without any mechanical movement of the withdrawable part by operation of a suitable device.

3.2.103**isolated position**

position of a withdrawable part in which an isolating distance is established in main and auxiliary circuits on its supply side, the withdrawable part remaining mechanically attached to the PVA-assembly

Note 1 to entry: The isolating distance can also be established without any mechanical movement of the withdrawable part by operation of a suitable device, e.g. a disconnector in accordance with IEC 60947-3.

3.2.104**isolating distance**

clearance between open contacts of withdrawable parts meeting the safety requirements specified for disconnectors

[SOURCE: IEC 60050-441:2000, 441-17-35, modified – The context information has been moved to after contacts and changed.]

3.4 Structural parts of assemblies

Addition:

3.4.100**3.4.101****active cooling**

use of equipment mounted on or within the assembly, installed to reduce or control the assembly's internal air temperature during normal operation, which requires energization to operate

Note 1 to entry: Examples include fans, internal air conditioning, heat exchangers, etc.

3.4.102**pressure relief flap**

mechanical component provided to limit the pressure rise in case of internal arc-faults

Additional terms and definitions:

3.4.103 Electrical connections of functional units

3.4.103.1.1

disconnectable connection

connection which is connected or disconnected by manual operation of the connecting means without a tool

3.4.103.1.2

withdrawable connection

connection which is connected or disconnected by bringing the functional unit into the connected or isolated position

3.5 Assembly location

3.5.101

Assembly location with restricted access

Assembly location accessible for all persons who are permitted to have access to the assembly location (e.g. private housing, private parking areas or similar places)

3.5.102

Assembly location with non-restricted access

Assembly location accessible to any person (e.g. the PVA is in an unrestricted area) but the assembly is not intended to be operated by an ordinary person

3.10 Manufacturer

Additional terms and definitions:

3.10.100

3.10.101

photovoltaic assembly manufacturer

PVA assembly manufacturer

organization taking the responsibility for the completed photovoltaic assembly

Note 1 to entry: The PVA assembly manufacturer can be the same or a different organization to the original manufacturer.

4 Symbols and abbreviations

Clause 4 of IEC 61439-1:2020 is applicable.

5 Interface characteristics

Clause 5 of IEC 61439-1:2020 is applicable, except as follows.

5.1 General

Replacement:

The characteristics of the PVA shall ensure compatibility with the ratings of the circuits to which it is connected and the installation conditions. These characteristics shall be declared by the PVA manufacturer using the criteria identified in 5.2 to 5.6 of IEC 61439-1:2020, as amended by this document.

The specification schedule detailed in the informative Annex AA is intended to help the user and the PVA assembly manufacturer to meet this objective, whether the user:



- selects catalogue products, the characteristics of which meet their needs, and the requirements of this document; and/or,
- makes a specific agreement with the assembly manufacturer.

NOTE Annex AA also relates to the topics dealt with in Clauses 6 and 7.

5.1.1

5.2

5.2.1

5.2.2 Rated operational voltage (U_e) (of a circuit of an assembly)

Addition:

The rated voltage (U_e) of the DC circuits of a PVA shall be specified by the manufacturer.

NOTE The installation designer will ensure that the rated voltage of the circuit of the PVA specified or purchased is equal to or exceed the maximum voltage in service. This will consider the open-circuit maximum voltage according to IEC 60364-7-712:2017 and any energy storage connected to the DC circuit of the PVA.

5.3

5.3.1 Rated current of the assembly (I_{nA})

Replacement:

Where an assembly only has AC parts the rating of the assembly shall be in accordance with this document.

The rated current of the DC part of a PVA is determined by the sum of the rated currents of the incoming circuits (I_{nc}). Where an assembly has both AC and DC parts, which may include energy storage, it shall be given an AC and a DC rated current.

5.3.2 Rated current of a circuit (I_{nc})

Addition:

Each circuit of a PVA assembly shall be capable of carrying the current produced by the associated strings or sub-array continuously.

NOTE The installation designer will ensure that the rated current of the circuits of the PVA are equal to or exceed the maximum currents in service.

5.3.3 Group rated current of a main circuit ()

Addition:

For further information on the assumed loading of the outgoing circuits, see 5.4.

5.4 Rated diversity factor (RDF)

Addition:

In the absence of an agreement between the assembly manufacturer and user concerning the actual load currents, it is assumed that all circuits can be loaded continuously and simultaneously, corresponding to RDF equal to one, that is, no diversity is allowed.

5.5 Other characteristics

Replacement of item f):

- f) degree of protection against contact with hazardous live parts, ingress of solid foreign bodies and water, IP code (See 8.2.2 of IEC 61439-1:2020), including the degree of protection for any distinct positions for removable and withdrawable parts;

Replacement of item g):

- g) intended for use by electrically skilled, competent or instructed persons (see 3.7.13, 3.7.14 and 3.7.15 of IEC 61439-1:2020);

Replacement of item l):

- l) type of construction – fixed, removable or withdrawable parts (see 8.5.1 of IEC 61439-1:2020 and 8.5.2);

Addition:

- aa) form of internal separation and associated degree of protection(s), IP code (see 8.101);
bb) types of electrical connections of functional units (see 8.5.101);
cc) mounting orientation (horizontal, vertical, etc.) if the assembly can be mounted in different positions from vertical.

6 Information

Clause 6 of IEC 61439-1:2020 is applicable, except as follows.

6.1 Assembly designation marking

Replacement of the title and item g):

6.1 PVA designation marking

- g) IEC 61439-8;

Addition:

- h) symbols "Do not disconnect under load", as given in Annex A of the IEC 62790:2020, or an adequate warning notice in the respective national language.

6.2.1

6.2.2 Instructions for handling, installation, operation and maintenance

Addition:

A PVA that can be energized from more than one source shall carry a warning label indicating that the assembly is energized from more than one source, and that parts inside the assembly can still be live unless isolated from all sources of supply including all PV circuits.

Where a PVA is intended for indoor installation or outdoors without exposure to direct sunlight it shall include a warning to avoid exposure to direct sunlight.

Where a PVA is exposed to direct sunlight, operators should note that the temperatures of external parts that are exposed to solar radiation may be high and precautions should be taken if they need to be touched.