



IEC 61439-2

Edition 3.0 2020-07

INTERNATIONAL STANDARD

**Low-voltage switchgear and controlgear assemblies –
Part 2: Power switchgear and controlgear assemblies**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.130.20

ISBN 978-2-8322-8587-9

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

CONTENTS

FOREWORD.....	3
1 Scope.....	5
2 Normative references	6
3 Terms and definitions	6
4 Symbols and abbreviations.....	9
5 Interface characteristics	9
6 Information	10
7 Service conditions	11
8 Constructional requirements	11
9 Performance requirements	14
10 Design verification.....	15
11 Routine verification.....	19
Annexes	22
Annex AA (informative) Items subject to agreement between the PSC-assembly manufacturer and the user	23
Annex BB (informative) Forms of internal separation (see 8.101).....	27
Annex CC (informative) Determining power loss by measurement for circuits exceeding 1600 A in a reference design	32
Annex DD (informative) Assemblies for use in photovoltaic installations	34
Annex EE (informative) Items subject to agreement between the photovoltaic assembly (PVA) manufacturer and the user	43
Annex FF (informative) Design verification (PVA only)	47
Annex GG (informative) List of notes concerning certain countries.....	49
Bibliography.....	50
Figure BB.1 – Symbols used in Figures BB.2, BB.3 and BB.4	27
Figure BB.2 – Forms 1 and 2	29
Figure BB.3 – Form 3.....	30
Figure BB.4 – Form 4.....	31
Figure CC.1 – Power loss measurement	33
Figure DD.101 – Indicative arrangement of radiant heat lamps for temperature-rise test with simulated solar radiation.....	41
Table 101 – Values of assumed loading.....	19
Table 102 – Test voltages across the open contacts of equipment suitable for isolation.....	19
Table 103 – Electrical conditions for the different positions of withdrawable parts	20
Table 104 – Forms of internal separation	21
Table AA.1 – Items subject to agreement between the PSC-assembly manufacturer and the user	23
Table DD.101 – Solar radiation conditions	38
Table EE.1 – Items subject to agreement between the PVA manufacturer and the user	43
Table FF.1 – List of design verifications to be performed on PVA.....	47

INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR ASSEMBLIES –**Part 2: Power switchgear and controlgear assemblies****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 61439-2 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 third edition cancels and replaces the second edition published in 2011. It constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) addition of Annexes DD, EE and FF for assemblies for use in photovoltaic installation;
- b) clarification of the requirements for forms of internal separation and the addition of the requirement, when the form of separation is higher than 1, all parts within the functional unit compartment that remain live when the functional unit is switched off shall be protected to at least IPXXB;
- c) alignment with the structure of IEC 61439-1:2020;

- d) addition of temperature-rise verification for; (i) temperature-rise verification of assemblies with natural cooling and circuits rated above 1 600 A by a combination of comparison with a reference design and calculation, and; (ii) temperature-rise verification of assemblies with active cooling and rated currents up to 1 600 A.
- e) consideration of IP with active cooling.

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

FDIS	Report on voting
121B/104/FDIS	121B/109/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.

In this document, general terms and definitions are defined in Clause 3. Further terms and definitions specific to Annex DD are given in this annex to facilitate easier reading.

The reader's attention is drawn to the fact that Annex GG lists all the “in-some-country” clauses on differing practices of a less permanent nature relating to the subject of this document.

This document is to be read in conjunction with IEC 61439-1:2020. The provisions of the general rules dealt with in IEC 61439-1 are only applicable to this document insofar as they are specifically cited. When this document states “addition”, “modification” or “replacement”, the relevant text in IEC 61439-1 is to be adapted accordingly.

Subclauses that are numbered with a 101 (102, 103, etc.) suffix are additional to the same subclause in IEC 61439-1.

Tables and figures in this document that are new are numbered starting with 101.

New annexes in this document are lettered AA, BB, etc.

In this document, the term PSC-assembly is defined in 3.1.101.

NOTE Throughout the IEC 61439 series of standards, the term assembly (see 3.1.1 of IEC 61439-1:2020) is used for a low-voltage switchgear and controlgear assembly.

A list of all parts of the IEC 61439 series, under the general title *Low-voltage switchgear and controlgear assemblies* can be found on the IEC website.

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.

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR ASSEMBLIES –

Part 2: Power switchgear and controlgear assemblies

1 Scope

This part of IEC 61439 defines the specific requirements for the power switchgear and controlgear assembly (abbreviated 'PSC-assembly' throughout this document see 3.1.101) as follows:

- assemblies for which the rated voltage does not exceed 1 000 V AC or 1 500 V DC;
- assemblies designed for a nominal frequency of the incoming supply or supplies not exceeding 1 000 Hz;

NOTE 1 Frequencies above 1 kHz are considered as high frequencies, see also IEC 60664-1:2007, 5.3.3.2.5 to take into account additional constraints to insulation coordination.

- assemblies intended for indoor and outdoor applications;
- stationary or movable assemblies with or without enclosures;
- assemblies intended for use in connection with the generation, transmission, distribution and conversion of electrical energy, and for the control of equipment consuming electrical energy and for associated data processing;
- assemblies designed for use under special service conditions, for example in ships and in rail vehicles, provided that the other relevant specific requirements are complied with;

NOTE 2 Supplementary requirements for assemblies in ships are covered by IEC 60092-302-2.

This document also applies to assemblies for use in photovoltaic installations, designated as photovoltaic assemblies (PVA). The particular characteristics, specific service conditions and the requirements for PVA's are included in Annexes DD, EE and FF.

This document provides supplementary requirements for PSC-assemblies intended for use as part of the electrical equipment of machines and can be applied in addition to the requirements given in IEC 60204-1.

This document applies to all assemblies whether they are designed, manufactured and verified on a one-off basis or fully standardised 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), and other electronic equipment which comply with their relevant product standards. This document describes their integration into a PSC-assembly or an empty enclosure used as a part of a PSC-assembly.

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. For assemblies not covered by other parts, this part applies.

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 60204-1:2016, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 60947-3:2008, *Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*

IEC 60947-3:2008/AMD1:2012

IEC 60947-3:2008/AMD2:2015

IEC 61140:2016, *Protection against electric shock – Common aspects for installation and equipment*

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

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