

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

---

**Low-voltage electrical installations -  
Part 7-712: Requirements for special installations or locations - Solar  
photovoltaic (PV) power supply installations**

**Installations électriques à basse tension -  
Partie 7-712: Exigences applicables aux installations ou emplacements spéciaux -  
Installations d'énergie solaire photovoltaïque (PV)**

<https://standards.iteh.ai/catalog/standards/iec/4b324c2f-1b95-4ee2-9108-f59e2c08808f/iec-60364-7-712-2025>



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2025 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.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

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

Tel.: +41 22 919 02 11  
[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 corrigendum or an amendment might have been published.

#### IEC publications search -

[webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

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 once a month by email.

#### 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: [sales@iec.ch](mailto:sales@iec.ch).

#### IEC Products & Services Portal - [products.iec.ch](http://products.iec.ch)

Discover our powerful search engine and read freely all the publications, previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

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

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

### A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

### A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

#### Recherche de publications IEC -

[webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

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

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

#### Service Clients - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: [sales@iec.ch](mailto:sales@iec.ch).

#### IEC Products & Services Portal - [products.iec.ch](http://products.iec.ch)

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications, symboles graphiques et le glossaire. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

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

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 500 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 25 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

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

**Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

## CONTENTS

|                                                                                                   |    |
|---------------------------------------------------------------------------------------------------|----|
| FOREWORD .....                                                                                    | 3  |
| INTRODUCTION .....                                                                                | 5  |
| 712 Solar photovoltaic (PV) power supply installations .....                                      | 6  |
| 712.1 Scope .....                                                                                 | 6  |
| 712.2 Normative references .....                                                                  | 6  |
| 712.3 Terms, definitions and symbols .....                                                        | 8  |
| 712.31 Purposes, supplies and structure .....                                                     | 13 |
| 712.4 Protection for safety .....                                                                 | 25 |
| 712.41 Protection against electric shock .....                                                    | 25 |
| 712.410 Introduction .....                                                                        | 25 |
| 712.411 Protective measure: automatic disconnection of supply .....                               | 26 |
| 712.412 Protective measure: double or reinforced insulation .....                                 | 29 |
| 712.414 Protective measure: extra-low-voltage provided by SELV and PELV .....                     | 30 |
| 712.42 Protection against thermal effects .....                                                   | 30 |
| 712.421 Protection against fire caused by electrical equipment .....                              | 30 |
| 712.430 Protection against overcurrent .....                                                      | 32 |
| 712.44 Protection against voltage disturbances and electromagnetic disturbances .....             | 36 |
| 712.443 Protection against transient overvoltages of atmospheric origin or due to switching ..... | 36 |
| 712.5 Selection and erection of electrical equipment .....                                        | 37 |
| 712.51 Common rules .....                                                                         | 37 |
| 712.510 Introduction .....                                                                        | 37 |
| 712.511 Compliance with standards .....                                                           | 38 |
| 712.512 Operational conditions and external influences .....                                      | 38 |
| 712.513 Accessibility .....                                                                       | 39 |
| 712.514 Identification .....                                                                      | 39 |
| 712.515 Prevention of mutual detrimental influence .....                                          | 41 |
| 712.52 Wiring systems .....                                                                       | 42 |
| 712.521 Types of wiring system .....                                                              | 42 |
| 712.522 Selection and erection of wiring systems in relation to external influences .....         | 45 |
| 712.523 Current-carrying capacities .....                                                         | 45 |
| 712.524 Cross-sectional areas of conductors .....                                                 | 45 |
| 712.526 Electrical connections .....                                                              | 47 |
| 712.527 Selection and erection of wiring systems to minimize spread of fire .....                 | 47 |
| 712.53 Devices for protection for safety, isolation, switching, control and monitoring .....      | 48 |
| 712.531 Equipment for protection against electric shock .....                                     | 48 |
| 712.532 Devices and precautions for protection against thermal effects .....                      | 48 |
| 712.533 Devices for protection against overcurrent .....                                          | 48 |
| 712.534 Devices for protection against transient overvoltages .....                               | 50 |
| 712.536 Isolation and switching .....                                                             | 52 |
| 712.537 Monitoring .....                                                                          | 53 |
| 712.54 Earthing arrangements and protective conductors .....                                      | 55 |
| 712.542 Earthing arrangements .....                                                               | 55 |
| 712.544 Protective bonding conductors .....                                                       | 55 |
| 712.55 Other equipment .....                                                                      | 56 |
| 712.6 Verification .....                                                                          | 57 |

|                                                                                                                                                      |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Annex A (normative) Calculation of $U_{OC\ MAX}$ and $I_{SC\ MAX}$ .....                                                                             | 58 |
| A.1 Calculation of $U_{OC\ MAX}$ .....                                                                                                               | 58 |
| A.2 Calculation of $I_{SC\ MAX}$ .....                                                                                                               | 59 |
| Annex B (informative) Performance issues .....                                                                                                       | 60 |
| Annex C (informative) Further examples of architecture configurations .....                                                                          | 61 |
| Annex D (normative) Current carrying capacities of PV cables – Temperature correction factors .....                                                  | 62 |
| Annex E (informative) List of notes concerning certain countries .....                                                                               | 65 |
| Bibliography .....                                                                                                                                   | 68 |
| Figure 1 – General functional configuration of a PV installation with energy storage .....                                                           | 14 |
| Figure 2 – DCU string: defined by output of DC/DC converters in serial connection .....                                                              | 15 |
| Figure 3 – PCE using an external transformer .....                                                                                                   | 16 |
| Figure 4 – Example of PV array diagram – Single string case .....                                                                                    | 18 |
| Figure 5 – Example of PV array diagram – Multiple parallel string case .....                                                                         | 19 |
| Figure 6 – Example of PV array diagram – Multiple parallel DCU string case .....                                                                     | 20 |
| Figure 7 – Example of PV array diagram – Multiple parallel string case with array divided into sub-arrays .....                                      | 21 |
| Figure 8 – Example of PV array using PCE with multiple separate DC inputs .....                                                                      | 22 |
| Figure 9 – Example of PV array using PCE with multiple DC inputs internally connected to a common DC bus .....                                       | 23 |
| Figure 10 – Example of fault protection on DC bus circuit using an IT system .....                                                                   | 27 |
| Figure 11 – Example of fault protection on DC bus circuit with non-separated PCE connected to a TT or TN system .....                                | 28 |
| Figure 12 – Example of fault protection on DC bus circuit with separated PCE using a TT or TN system .....                                           | 29 |
| Figure 13 – Example of a PV array diagram where strings are grouped under one OCPD per group .....                                                   | 35 |
| Figure 14 – Example of a sign indicating the presence of a photovoltaic installation .....                                                           | 40 |
| Figure 15 – Example of PV string wiring and DCU string wiring with minimum loop area .....                                                           | 43 |
| Figure 16 – String wiring harness .....                                                                                                              | 44 |
| Figure C.1 – Further architecture configurations of the DC bus .....                                                                                 | 61 |
| Figure D.1 – 98 <sup>th</sup> percentile temperature for an open-rack, or thermally unrestricted, glass superstrate, polymer backsheets module ..... | 63 |
| Figure D.2 – 98 <sup>th</sup> percentile temperature for a close-roof mounted glass superstrate, polymer backsheets module .....                     | 64 |
| Table 1 – Calculation of the critical length $L_{crit}$ .....                                                                                        | 37 |
| Table 2 – Minimum current rating of circuits .....                                                                                                   | 46 |
| Table 3 – Isolation devices in PV array installations .....                                                                                          | 52 |
| Table 4 – Minimum insulation resistance thresholds for detection of failure of insulation to earth .....                                             | 53 |
| Table 5 – Response time limits for sudden changes in residual current .....                                                                          | 55 |
| Table D.1 – Current carrying capacity of PV cables .....                                                                                             | 62 |
| Table D.2 – Current rating conversion factors for different ambient temperatures .....                                                               | 63 |
| Table E.1 – List of notes concerning certain countries .....                                                                                         | 65 |

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### **Low-voltage electrical installations - Part 7-712: Requirements for special installations or locations - Solar photovoltaic (PV) power supply installations**

#### 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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 60364-7-712 has been prepared by IEC technical committee 64: Electrical installations and protection against electric shock. It is an International Standard.

This third edition cancels and replaces the second edition published in 2017. This edition constitutes a technical revision.

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

- a) The technical content has been extensively revised and expanded, taking into account experience gained in the construction and operation of PV installations, and developments made in technology, since the second edition was published.
- b) Key changes include requirements for PV power generation plants, direct connection to battery circuits, introduction of DC bus circuit and DCUs.

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

| Draft        | Report on voting |
|--------------|------------------|
| 64/2765/FDIS | 64/2785/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](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

A list of all parts in the IEC 60364 series, published under the general title *Low-voltage electrical installations*, can be found on the IEC website.

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

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](http://webstore.iec.ch) in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

IEC Standards  
 (https://standards.iteh.ai)  
 Document Preview

IEC 60364-7-712:2025

<https://standards.iteh.ai/catalog/standards/iec/4b324c2f-1b95-4ee2-9108-f59e2c08808f/iec-60364-7-712-2025>

## INTRODUCTION

For the purposes of this part of IEC 60364 (IEC 60364-7-712), the requirements of the general Part 1 to Part 6 and Part 8 of IEC 60364 apply.

The IEC 60364-7-7XX parts of IEC 60364 contain particular requirements for special installations or locations which are based on the requirements of the general parts of IEC 60364 (IEC 60364-1 to IEC 60364-6 and IEC 60364-8). These IEC 60364-7-7XX parts are considered in conjunction with the requirements of the general parts.

The particular requirements of this document supplement, modify or replace certain of the requirements of the general parts of IEC 60364 being valid at the time of publication of this document. The absence of reference to the exclusion of a part or a clause of a general part means that the corresponding clauses of the general part are applicable (undated references).

Requirements of other IEC 60364-7XX parts being relevant for installations covered by this document also apply. This document can therefore also supplement, modify or replace certain of these requirements valid at the time of publication of this document.

The clause numbering of this document follows the pattern and corresponding references of IEC 60364. The numbers following the particular number of this document are those of the corresponding parts, or clauses of the other parts of the IEC 60364 series, valid at the time of publication of this document, as indicated in the normative references of this document (dated references). If requirements or explanations additional to those of the other parts of the IEC 60364 series are necessary, the numbering of such items appears as 712.101, 712.102, 712.103, etc.

In the case where new or amended general parts with modified numbering were published after this document was issued, it is possible that the clause numbers referring to a general part in this document will possibly no longer align with the latest edition of the general part. Dated references should be observed.

Attention is drawn to the co-existence of IEC 60364-7-712 and IEC 62548-1. Both standards have been developed in close coordination by different technical committees.