IEC 62477-1

Edition 2.0 2022-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

GROUP SAFETY PUBLICATION
PUBLICATION GROUPÉE DE SÉCURITÉ

Safety requirements for power electronic converter systems and equipment – Part 1: General

Exigences de sécurité applicables aux systèmes et matériels électroniques de conversion de puissance – Partie 1: Généralités

IEC 62477-1:2022-05(en-fr)

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

Tel.: +41 22 919 02 11
info@iec.ch
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
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 It also gives information on projects, replaced and withdrawn publications.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
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
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 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
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
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
Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org
Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

IEC 62477-1

Edition 2.0 2022-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

GROUP SAFETY PUBLICATION
PUBLICATION GROUPÉE DE SÉCURITÉ

Safety requirements for power electronic converter systems and equipment – Part 1: General

Exigences de sécurité applicables aux systèmes et matériels électroniques de conversion de puissance – Partie 1: Généralités

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 29.200

ISBN 978-2-8322-2199-0

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

SAFETY REQUIREMENTS FOR POWER ELECTRONIC CONVERTER SYSTEMS AND EQUIPMENT –

Part 1: General

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.

IEC 62477-1 has been prepared by IEC technical committee 22: Power electronic systems and equipment. It is an International Standard.

This document is developed according to the intent of ISO/IEC Guide 51 and IEC Guide 116.

It has the status of a group safety publication in accordance with IEC Guide 104.

This second edition cancels and replaces the first edition published in 2012 and Amendment 1:2016. This edition constitutes a technical revision.

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

a) PECS emitting or receiving radio waves added in the Scope;
b) simplification of the concept of DVC As including the voltage-time-zones;

c) improved consistency of the concept "protection" versus "insulation" according to IEC 61140;
d) limits for touch current updated and limits for PE conductor currents added;
e) thin sheet of tape materials reworked and tests added;
f) inner layers of multi-layer printed wiring boards added;
g) mechanical hazards updated;
h) requirements for enclosures updated;
i) requirements for wiring and connections updated;
j) polymeric enclosure requirements updated;
k) requirements for components added;
l) several test added (e.g. UV, working voltage, SPD, preconditioning);
m) information and marking requirements updated;
n) requirements for the contrast of symbols added;
o) several annexes updated.

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

Draft	Report on voting
22/355/FDIS	22/356/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.

A list of all the parts in the IEC 62477 series, published under the general title *Safety requirements for power electronic converter systems and equipment,* can be found on the IEC website.

In this document, terms in *italic* are defined in Clause 3.

NOTE Due to the requirement in ISO/IEC Directive Part 2, the defined term is in singular. In this document, also the plural is in *italic*.

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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This document relates to products that include *power electronic converters*, with a rated *system voltage* not exceeding 1 000 V AC or 1 500 V DC. It specifies requirements to reduce risks of fire, electric shock, thermal, energy and mechanical hazards, except functional safety as defined in IEC 61508 (all parts). The objectives of this document are to establish a common terminology and basis for the safety requirements of products that contain *power electronic converters* across several IEC technical committees.

During the update of the document, feedback from technical committees which used the IEC 62477-1 as reference document has been taken into consideration.

Modifications have been made to 4.4.2 and Annex A considering the safe to touch voltage *DVC As* under normal operating conditions and *single fault conditions*. On request from TCs using this document as a reference document, the determination of *DVC As* has been simplified. The determination of *DVC As* in IEC 62477-1:2012 and IEC 62477-1:2012/AMD1:2016 was developed based on IEC TS 60479-1:2005[1] and IEC TR 60479-5:2007 and in details taking different environmental condition, size of body contact area and body reaction into consideration. This change also included time-voltage zones in Annex A for relevant body reactions, environmental conditions and contact area.

NOTE See IEC 60479-1:2018 for further information about effects of current on human beings and livestock.

This document follows the simplified concepts of the basic safety standard IEC 61140:2016, 5.2.6, considering two situations in Table 2 of this document:

a) dry and large contact areas;

b) all other cases.

For the temporary increase of voltage during *single fault conditions*, it was decided to use the more simplified approach to limit the voltage to the maximum voltage of *DVC B* which is also used by other committees.

This document has been developed with the intention

- to be used as a reference document for product committees inside TC 22 in the development of product standards for *power electronic converter systems* and equipment,
- to replace IEC 62103[2] as a product family standard providing minimum requirements for safety aspects of *power electronic converter systems* and equipment in apparatus for which no product standard exists, and

  NOTE The scope of IEC 62103 contains reliability and electromagnetic compatibility aspects, which are not covered by this document.

- to be used as a reference document for product committees outside TC 22 in the development of product standards of *power electronic converter systems* and equipment intended renewable energy sources. TC 82, TC 88, TC 105 and TC 114, in particular, have been identified as relevant technical committees at the time of publication.

Technical committees using this document should carefully consider the relevance of each paragraph in this document for the product under consideration and reference, add, replace or modify requirement as relevant. Product specific topics not covered by this document are in the responsibility of the technical committees using this document as reference document.

---

1 This publication has been withdrawn.

2 This publication has been withdrawn.

This group safety standard will not take precedence over any product specific standard according to IEC Guide 104. IEC Guide 104 provides information about the responsibility of product committees to use group safety standards for the development of their own product standards.