

Requisitos de seguridad para sistemas y equipos de conversión de potencia de semiconductores. Parte 2: Convertidores electrónicos de potencia desde 1 000 V en c.a. o 1 500 V en c.c. hasta 36 kV en c.a. o 54 kV en c.c. (Ratificada por la Asociación Española de Normalización en noviembre de 2018.)

Requisitos de seguridad para sistemas y equipos de conversión de potencia de semiconductores. Parte 2: Convertidores electrónicos de potencia desde 1 000 V en c.a. o 1 500 V en c.c. hasta 36 kV en c.a. o 54 kV en c.c. (Ratificada por la Asociación Española de Normalización en noviembre de 2018.)

Safety requirements for power electronic converter systems and equipment - Part 2: Power electronic converters from 1 000 VAC or 1 500 VDC up to 36 kVAC or 54 kVDC (Endorsed by Asociación Española de Normalización in November of 2018.)

Exigences de sécurité applicables aux systèmes et matériels électroniques de conversion de puissance - Partie 2: Convertisseurs électroniques de puissance entre 1 000 V en courant alternatif ou 1 500 V en courant continu et 36 kV en courant alternatif ou 54 kV en courant continu (Entérinée par l'Asociación Española de Normalización en noviembre 2018.)

En cumplimiento del punto 11.2.5.4 de las Reglas Internas de CEN/CENELEC Parte 2, se ha otorgado el rango de documento normativo español UNE al documento normativo europeo EN IEC 62477-2:2018 (Fecha de disponibilidad 2018-09-28)

Este documento está disponible en los idiomas oficiales de CEN/CENELEC/ETSI.

Este anuncio causará efecto a partir del primer día del mes siguiente al de su publicación en la revista AENOR.

La correspondiente versión oficial de este documento se encuentra disponible en la Asociación Española de Normalización (Génova 6 28004 MADRID, www.une.org).

Las observaciones a este documento han de dirigirse a:

Asociación Española de Normalización

Génova, 6
28004 MADRID-España
Tel.: 915 294 900
info@une.org
www.une.org

© UNE 2018

Prohibida la reproducción sin el consentimiento de UNE.

Todos los derechos de p

This is a preview. Click here to purchase the full publication.

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN IEC 62477-2

September 2018

ICS 29.200

English Version

Safety requirements for power electronic converter systems and equipment - Part 2: Power electronic converters from 1 000 V AC or 1 500 V DC up to 36 kV AC or 54 kV DC
(IEC 62477-2:2018)

Exigences de sécurité applicables aux systèmes et matériaux électroniques de conversion de puissance - Partie 2: Convertisseurs électroniques de puissance entre 1 000 V en courant alternatif ou 1 500 V en courant continu et 36 kV en courant alternatif ou 54 kV en courant continu
(IEC 62477-2:2018)

Sicherheitsanforderungen an Leistungshalbleiter-Umrichtersysteme und -Betriebsmittel - Teil 2:
Leistungselektronik Umrichter von 1 000 V a.c. oder 1 500 V d.c. bis 36 kV a.c. oder 54 kV d.c.
(IEC 62477-2:2018)

This European Standard was approved by CENELEC on 2018-07-26. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

© 2018 CENELEC All rights of exploitation in any form and by any means reserved worldwide for CENELEC Members.

Ref. No. EN IEC 62477-2:2018 E

This is a preview. Click here to purchase the full publication.

European foreword

The text of document 22/290/FDIS, future edition 1 of IEC 62477-2, prepared by IEC/TC 22 "Power electronic systems and equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62477-2:2018.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2019-04-26
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2021-07-26

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 62477-2:2018 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60071-1:2006	NOTE Harmonized as EN 60071-1:2006 (not modified)
IEC 60071-2:1996	NOTE Harmonized as EN 60071-2:1997 (not modified)
IEC 60146-1-1	NOTE Harmonized as EN 60146-1-1
IEC 60243-1:2013	NOTE Harmonized as EN 60243-1:2013 (not modified)
IEC 60529:1989	NOTE Harmonized as EN 60529:1991 (not modified)
IEC 60721-3 series	NOTE Harmonized as EN 60721-3 series
IEC 60990:2016	NOTE Harmonized as EN 60990:2016 (not modified)
IEC 61936-1	NOTE Harmonized as EN 61936-1
IEC 62271-200:2011	NOTE Harmonized as EN 62271-200:2012 (not modified)
IEC 62271-201:2014	NOTE Harmonized as EN 62271-201:2014 (not modified)

Annex ZA
(normative)

**Normative references to international publications
with their corresponding European publications**

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60204-11	-	Safety of machinery - Electrical equipment-of machines - Part 11: Requirements for equipment for voltages above 1 000 V AC or 1 500 V DC and not exceeding 36 kV		-
IEC 60417-DB	-	Graphical symbols for use on equipment	-	-
IEC 60617-DB	-	Graphical symbols for diagrams	-	-
IEC 60730-1	-	Automatic electrical controls - Part 1:EN 60730-1 General requirements	-	-
IEC 61230	-	Live working - Portable equipment for earthing or earthing and short-circuiting	EN 61230	-
IEC 62271-102	-	High-voltage switchgear and controlgear -EN IEC 62271-102 Part 102: Alternating current disconnectors and earthing switches	-	-
IEC 62477-1	2012	Safety requirements for power electronic converter systems and equipment - Part 1: General	EN 62477-1	2012
-	-		+ A11	2014
+ A1	2016		+ A1	2017
IEC Guide 104	-	The preparation of safety publications and-the use of basic safety publications and group safety publications		-
ISO/IEC Guide 51	2014	Safety aspects - Guidelines for their-inclusion in standards		-



INTERNATIONAL STANDARD

NORME INTERNATIONALE

GROUP SAFETY PUBLICATION
PUBLICATION GROUPÉE DE SÉCURITÉ

**Safety requirements for power electronic converter systems and equipment –
Part 2: Power electronic converters from 1 000 V AC or 1 500 V DC up to 36 kV
AC or 54 kV DC**

**Exigences de sécurité applicables aux systèmes et matériels électroniques de
conversion de puissance –**

**Partie 2: Convertisseurs électroniques de puissance entre 1 000 V en courant
alternatif ou 1 500 V en courant continu et 36 kV en courant alternatif ou 54 kV
en courant continu**

This is a preview. Click here to purchase the full publication.



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2018 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 Central Office
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 corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

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 also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

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.

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.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 21 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalelement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

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.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

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 aussi 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.



INTERNATIONAL STANDARD

NORME INTERNATIONALE

GROUP SAFETY PUBLICATION
PUBLICATION GROUPÉE DE SÉCURITÉ

**Safety requirements for power electronic converter systems and equipment –
Part 2: Power electronic converters from 1 000 V AC or 1 500 V DC up to 36 kV
AC or 54 kV DC**

**Exigences de sécurité applicables aux systèmes et matériels électroniques de
conversion de puissance –**

**Partie 2: Convertisseurs électroniques de puissance entre 1 000 V en courant
alternatif ou 1 500 V en courant continu et 36 kV en courant alternatif ou 54 kV
en courant continu**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.200

ISBN 978-2-8322-5787-6

**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	7
INTRODUCTION	9
1 Scope	10
2 Normative references	11
3 Terms and definitions	11
4 Protection against hazards	12
4.1 General	12
4.2 Fault and abnormal conditions	13
4.3 Short-circuit and overload protection	14
4.3.1 General	14
4.3.2 Specification of input short-circuit withstand strength and output short-circuit current ability	14
4.3.3 Short-circuit coordination (backup protection)	14
4.3.4 Protection by several devices	14
4.3.5 Input ports short time withstand current, I_{cw}	14
4.4 Protection against electric shock	14
4.4.1 General	14
4.4.2 Decisive voltage class	15
4.4.3 Provision for basic protection	16
4.4.4 Provision for fault protection	17
4.4.5 Enhanced protection	18
4.4.6 Protective measures	18
4.4.7 Insulation	19
4.4.8 Compatibility with residual current-operated protective devices (RCD)	24
4.4.9 Capacitor discharge	24
4.5 Protection against electrical energy hazards	26
4.5.1 Operator access areas	26
4.5.2 Service access areas	28
4.6 Protection against fire and thermal hazards	28
4.6.1 Circuits representing a fire hazard	28
4.6.2 Components representing a fire hazard	28
4.6.3 Fire enclosures	28
4.6.4 Temperature limits	29
4.6.5 Limited power sources	29
4.7 Protection against mechanical hazards	29
4.7.1 General	29
4.7.2 Specific requirements for liquid cooled PECS	29
4.8 Equipment with multiple sources of supply	30
4.9 Protection against environmental stresses	30
4.10 Protection against sonic pressure hazards	30
4.10.1 General	30
4.10.2 Sonic pressure and sound level	31
4.11 Wiring and connections	31
4.11.1 General	31
4.11.2 Routing	31
4.11.3 Colour coding	31
4.11.4 Splices and connections	31

4.11.5	Accessible connections	31
4.11.6	Interconnections between parts of the PECS	31
4.11.7	Supply connections.....	31
4.11.8	Terminals	31
4.12	Enclosures.....	31
4.12.1	General	31
4.12.2	Handles and manual controls.....	32
4.12.3	Cast metal	32
4.12.4	Sheet metal	32
4.12.5	Stability test for enclosure	32
5	Test requirements	32
5.1	General.....	32
5.1.1	Test objectives and classification.....	32
5.1.2	Selection of test samples	33
5.1.3	Sequence of tests	33
5.1.4	Earthing conditions	33
5.1.5	General conditions for tests	33
5.1.6	Compliance	33
5.1.7	Test overview	33
5.2	Test specifications	33
5.2.1	Visual inspections (type test, sample test and routine test)	33
5.2.2	Mechanical tests.....	34
5.2.3	Electrical tests	35
5.2.4	Abnormal operation and simulated faults tests	38
5.2.5	Material tests.....	42
5.2.6	Environmental tests (type tests).....	42
5.2.7	Hydrostatic pressure test (type test and routine test)	43
6	Information and marking requirements	43
6.1	General.....	43
6.2	Information for selection	43
6.3	Information for installation and commissioning	43
6.3.1	General	43
6.3.2	Mechanical considerations.....	43
6.3.3	Environment	43
6.3.4	Handling and mounting	43
6.3.5	Enclosure temperature.....	43
6.3.6	Connections	43
6.3.7	Protection requirements.....	44
6.3.8	Commissioning	45
6.4	Information for use.....	45
6.4.1	General	45
6.4.2	Adjustment	45
6.4.3	Labels, signs and signals.....	45
6.5	Information for maintenance.....	45
6.5.1	General	45
6.5.2	Capacitor discharge.....	45
6.5.3	Auto restart/bypass connection.....	45
6.5.4	Other hazards.....	46
6.5.5	Equipment with multiple sources of supply.....	46

Annex A (normative) Additional information for protection against electric shock	47
A.1 General.....	47
A.2 Protection by means of DVC As	47
A.3 Protection by means of protective impedance	47
A.4 Protection by using limited voltages	47
A.5 Evaluation of working voltage and selection of DVC for touch voltage, PELV and SELV circuits	47
A.6 Evaluation of the working voltage of circuits.....	47
A.7 Examples of the use of elements of protective measures	47
Annex B (informative) Considerations for the reduction of the pollution degree	49
Annex C (informative) Symbols referred to in IEC 62477-1	50
Annex D (normative) Evaluation of clearance and creepage distances	51
Annex E (informative) Altitude correction for clearances	52
Annex F (normative) Clearance and creepage distance determination for frequencies greater than 30 kHz	53
Annex G (informative) Cross-sections of round conductors	54
Annex H (informative) Guidelines for RCD compatibility.....	55
H.1 Selection of RCD type.....	55
Annex I (informative) Examples of overvoltage category reduction.....	56
Annex J (informative) Burn thresholds for touchable surfaces	57
Annex K (informative) Table of electrochemical potentials	58
Annex L (informative) Measuring instrument for touch current measurements	59
L.1 Measuring instrument.....	59
Annex M (informative) Test probes for determining access	60
Annex N (informative) Guidance regarding short-circuit current.....	61
Annex AA (normative) Arc fault test and labelling requirements	62
AA.1 Overview.....	62
AA.2 References	62
AA.3 Terms and definitions.....	62
AA.4 Ratings	65
AA.4.1 General	65
AA.4.2 Internal arc classification	65
AA.5 Testing	70
AA.5.1 General	70
AA.5.2 Test preparation	71
AA.5.3 Test conditions	77
AA.5.4 Assessment.....	86
AA.6 Arc-prohibiting design	89
AA.6.1 General	89
AA.6.2 Requirements	90
AA.6.3 Testing	91
AA.7 Information and marking requirements	92
AA.7.1 General	92
AA.7.2 IAC rating plate	93
AA.7.3 Information in manuals	94
AA.7.4 Product marking – Internal protection	96
AA.8 Internal arc classification concepts	96