



SLOVENSKI STANDARD
SIST EN 62477-1:2012/A1:2017
01-april-2017

**Varnostne zahteve za močnostno elektroniko pretvorniških sistemov in opreme -
1. del: Splošno (IEC 62477-1:2012/A1:2016) - Dopnilo A1**

Safety requirements for power electronic converter systems and equipment - Part 1:
General (IEC 62477-1:2012/A1:2016)

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Usmerniki. Pretvorniki.
Stabilizirano električno
napajanje

Rectifiers. Convertors.
Stabilized power supply

SIST EN 62477-1:2012/A1:2017

en

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EUROPEAN STANDARD

EN 62477-1:2012/A1

NORME EUROPÉENNE

EUROPÄISCHE NORM

February 2017

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English Version

**Safety requirements for power electronic converter systems and equipment - Part 1: General
(IEC 62477-1:2012/A1:2016)**

Exigences de sécurité applicables aux systèmes et matériels électroniques de conversion de puissance - Partie 1: Généralités
(IEC 62477-1:2012/A1:2016)

Sicherheitsanforderungen an Leistungshalbleiter-Umrichtersysteme und -betriebsmittel - Teil 1: Allgemeines
(IEC 62477-1:2012/A1:2016)

This amendment A1 modifies the European Standard EN 62477-1:2012; it was approved by CENELEC on 2016-09-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment 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 amendment 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.

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

EN 62477-1:2012/A1:2017**European foreword**

The text of document 22/270A/FDIS, future IEC 62477-1:2012/A1, prepared by IEC/TC 22 "Power electronic systems and equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62477-1:2012/A1:2017.

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) 2017-08-10
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2020-02-10

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

Endorsement notice

The text of the International Standard IEC 62477-1:2012/A1:2016 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:

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Addition:

<u>SIST EN 62477-1:2012/A1:2017</u>		
IEC 60865 (series)	NOTE	Harmonized as EN 60865 (series). https://standards.iteh.org/catalog/standards/sist/22008e00-bb1f-41b4-b03f-9b4b78c336e0/sist-en-62477-1-2012-a1-2017
IEC 60865-1	NOTE	Harmonized as EN 60865-1.
IEC 60909 (series)	NOTE	Harmonized as EN 60909 (series).
IEC 60909-0:2016	NOTE	Harmonized as EN 60909-0:2016.
IEC 60947-1:2007	NOTE	Harmonized as EN 60947-1:2007.
IEC 60947-6-1:2005	NOTE	Harmonized as EN 60947-6-1:2005.
IEC 60947-6-1:2005/AMD1:2013	NOTE	Harmonized as EN 60947-6-1:2005/A1:2014.
IEC 61439-1:2011	NOTE	Harmonized as EN 61439-1:2011.



INTERNATIONAL STANDARD

NORME INTERNATIONALE

GROUP SAFETY PUBLICATION
PUBLICATION GROUPEE DE SÉCURITÉ

AMENDMENT 1 **iTeh STANDARD PREVIEW**
AMENDEMENT 1
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**Safety requirements for power electronic converter systems and equipment –
Part 1: General** SIST EN 62477-1:2012/A1:2017

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
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FOREWORD

This amendment has been prepared by the IEC technical committee TC22: Power electronic systems and equipment.

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

FDIS	Report on voting
22/270A/FDIS	22/274/RVD

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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[SIST EN 62477-1:2012/A1:2017](https://standards.iteh.ai/catalog/standards/sist/820c9dd9-bbbf-41b4-b03f-9b4b78c336e0/sist-en-62477-1-2012-a1-2017)

<https://standards.iteh.ai/catalog/standards/sist/820c9dd9-bbbf-41b4-b03f-9b4b78c336e0/sist-en-62477-1-2012-a1-2017>

3 Terms and definitions

Replace the existing term and definition 3.35 by the following new term and definition:

3.35

prospective short-circuit current

I_{cp}

r.m.s. value of the current which would flow if the supply conductors to the circuit are short-circuited by a conductor of negligible impedance located as near as practicable to the supply terminals of the PECS

[SOURCE: IEC 61439-1:2011, 3.8.7], modified – "ASSEMBLY" is replaced by "PECS".]

Add the following new terms and definitions:

3.66

conditional short-circuit current

I_{cc}

r.m.s. value of a *prospective short-circuit current* available from a supply source, declared by the PECS manufacturer under specified conditions, using a specific type of *short-circuit protective device* protecting the PECS

Note 1 to entry: See also Figure N.1.

Note 2 to entry: The supply source might be a mains or non-mains supply.

Note 3 to entry: The declared I_{cc} is the minimum current value used for calibration of the supply source.

[SOURCE: IEC 61439-1: 2011, 3.8.10.4], modified – The definition is modified to fit to the use of PECS applications.]

3.67

current-limiting protective device

protective element that, during its operation and specified current range, limits the current to a substantially lower value than the peak value of the prospective current

Note 1 to entry: A current-limiting device is normally a current-limiting fuse or a current-limiting circuit breaker. See IEC 60050-441:1984, 441-18-10.

3.68

minimum required prospective short-circuit current

$I_{cp,mr}$

r.m.s. value of a minimum short-circuit current, which is needed to be available from a supply source in order to ensure safe interruption of the fault, and which is declared by the PECS manufacturer and tested under specified conditions, using a specific type of short-circuit protective device protecting the PECS.

3.69

overcurrent protective device

OCPD

device provided to interrupt an electric circuit in case the current in the electric circuit exceeds a predetermined value for a specified duration

[SOURCE: IEC 60050-826:2004 826-14-14, modified – "conductor" deleted]

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3.70

peak withstand current

I_{pk}

value of peak short-circuit current declared by the PECS manufacturer, that can be carried without damage under specified conditions, defined in terms of current and time

Note 1 to entry: For the purpose of this standard, I_{pk} refers to the initial asymmetric peak value of the prospective test current.

Note 2 to entry: Time may be specified as the number of successive cycles at 50 Hz or 60 Hz.

[SOURCE: IEC 61439-1:2011, 3.8.10.2, modified – The definition is modified to fit to the use of PECS application.]

3.71

short-circuit protective device

SCPD

device intended to protect a circuit or parts of a circuit against short-circuit currents by interrupting them

Note 1 to entry: A *short-circuit protective device* is suitable for protection against short-circuit only, not for protection against overload. An OCPD may also incorporate the function of a SCPD.

[SOURCE: IEC 61439-1:2011, 3.1.11, modified – Note added]

3.72

short time withstand current

I_{cw}

r.m.s. value of short time current, declared by the PECS manufacturer, that can be withstood under specified conditions, defined in terms of current and time

[SOURCE: IEC 61439-1:2011, 3.8.10.3, modified – "rated" removed from the term and "ASSEMBLY" replaced by "PECS"]

4.2 Fault and abnormal conditions

Add, after the second paragraph, the following new paragraph:

Components in 4.2 also include insulation systems, *ports*, etc.

Add, at the end of the bullet list, the following new bullet:

- electromagnetic force and thermal hazard according to 4.3.

4.3.1 General

Add, after the first paragraph, the following new paragraph:

To ensure proper coordination with *short-circuit protective devices* and the available *prospective short-circuit current*, the PECS manufacturer shall specify and test for each *mains supply input port* of the PECS:

- *conditional short-circuit current* (I_{cc}) according to 4.3.2.2, or
- *rated short time withstand current* (I_{cw}) according to 4.3.5.

Individual *mains supply ports* of a PECS shall have specific short-circuit ratings of either I_{cc} or I_{cw} , or of both.

Only in case where compliance does not rely on the characteristic of SCPD, the I_{cw} in 4.3.5 can apply.

In case an output *port* is connected or intended to be connected to the input *mains supply port*, the output *port* shall also be specified with an I_{cc} or I_{cw} rating (e.g. bypass between input *mains supply port* and output *port*).

For marking see 6.2.

See Annex N for further information.

4.3.2.2 Input ports short-circuit withstand current

Replace the title and text as follows:

4.3.2.2 Specification of the rated *conditional short-circuit current* (I_{cc}) on input *ports*

In case the PECS manufacturer selects the *conditional short-circuit current* (I_{cc}) rating according to 4.3.1, the following shall be specified:

- *conditional short-circuit current* (I_{cc}),
- characteristics of the *short-circuit protective device*, and
- *minimum required prospective short-circuit current* ($I_{cp,mr}$).

Compliance is shown, through evaluation according to 4.2 to determine the appropriate combination of testing according to 5.2.4.4, 5.2.4.6 and 5.2.3.11.3 in order to evaluate single fault and abnormal conditions, including insulation faults.

If it is shown by analysis that the result of one test is representative of the worst case, less severe combinations need not be tested.

Add, after 4.3.4, the following new clause:

4.3.5 Input ports short time withstand current, I_{cw}

In case the PECS manufacturer selects the *short time withstand current* (I_{cw}) rating according to 4.3.1, the following shall be specified:

- rated *short time withstand current* (I_{cw}),
- associated duration, and
- rated *peak withstand current* (I_{pk}).

Compliance is shown, through evaluation according to 4.2 to determine the appropriate combination of testing according to 5.2.3.11.3 and 5.2.4.10 in order to evaluate single fault and abnormal conditions, including insulation faults.

If it is shown by analysis that the result of one test is representative of the worst case, less severe combinations need not be tested.

5.2.4.2 Pass criteria

Add, after the last bullet point, the following new bullet points:

- components, e.g. busbar supports, used for the mounting of *live parts* shall not break away from their initial position.
- no conductor shall get pulled out of its terminal connector.

Add, in Table 22 under "Abnormal operation tests", the following new test:

Short time withstand current (I_{cw}) test	X		4.3.5	5.2.4.10
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Add, after 5.2.4.9.4, the following new subclause:

5.2.4.10 Short time withstand current (I_{cw}) test (type test)

5.2.4.10.1 General

As required in 4.3.5, the *short time withstand current* test shall be performed as a *type test* to verify the safety of the PECS.

Short-circuits are applied in the PECS at locations based on the evaluation in 4.2 so that terminals and other parts in the fault current path are being exposed to the short-circuit current.

5.2.4.10.2 Short time withstand current test method

The input *mains supply port* terminals shall be provided with a cable with a cross-section as specified for the *installation*.

If a switching device is used to initiate the short-circuit or switch the power to the PECS, it shall not limit the test current.

The complete length of the cable (forth and back) shall be approximately 2 m, unless this length is insufficient, in which case the length shall be as short as practical to perform the test.

The testing shall include individual tests for each input *mains supply port*. The worst case combination of terminals (including neutral and earth) shall be subjected to a short-circuit test. Analysis may be used to reduce the number of tests, if it is shown that the results of one terminal combination are representative of the anticipated results of another combination.

The *PECS* can be tested un-energized and not operating as intended prior to the short-circuit withstand test, if it can be shown that the test result is not affected.

A new sample may be used for each short-circuit test.

Table 37 lists the a.c. current test method as a minimum requirement for *PECS*. Requirements for d.c. current are under consideration.

If the specified I_{cp} value is higher than listed in Table 37, the recommended test current is: 16 kA, 20 kA, 25 kA, 35 kA, 50 kA, 65 kA, 85 kA, 100 kA.

Depending on the characteristics of the *PECS*, the actual values observed during the test may be different from those listed in Table 37, in which case the observed values shall be used for the declaration of I_{cw} .

Table 37 – A.c. short time withstand current test, minimum *PECS* requirements
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Rated <i>PECS</i> input current (r.m.s.) A	Prospective test current ^a		Initial asymmetric peak current ratio ^e (I_{pk}/I_{cw})	Minimum duration of prospective test current ^{f, g} (cycles 50 Hz to 60 Hz)
	(r.m.s.) A ^b	Typical power factor ^e		
$I \leq 16$	1 000 ^{c d}	0,95	1,42	1,5
	3 000	0,9		
$16 < I \leq 75$	6 000	0,7	1,53	1,5
$75 < I \leq 400$	10 000	0,5	1,70	1,5
$400 < I \leq 500$	10 000	0,5	1,70	3,0
$500 < I$	20 × I or 50 kA whichever is the lower	0,5 – 0,3 × (I – 500) / 2 000 or 0,2 whichever is the higher	(0,5 I + 3 150) / 2 000 or 2,2 whichever is the lower	3,0

^a Prospective test current, in the context of this standard, shall be understood as *prospective short-circuit current* (I_{cp}) – refer to 3.70.

^b Values compatible with Table 4 of IEC 60947-6-1:2005 and IEC 60947-6-1:2005/AMD1:2013.

^c Pluggable *PECS* only.

^d The typical fault current of public supply networks rated 75 A and below and intended to supply equipment with a rated current of 16 A or below can be calculated from the reference impedances in IEC TR 60725: 2012: phase conductor 0,24 + j0,15 Ω and neutral conductor 0,16 + j0,10 Ω. For 230 V/400 V supplies, this results in typical fault currents of 0,5 kA (230 V) and 0,7 kA (400 V).

^e From Table 16 of IEC 60947-1:2007.

^f In case a lower duration is wanted, the I_{cc} according to 4.3.2.2 can be specified.

^g To ensure global compatibility with external *SCPD* to clear the fault in the specified duration, a higher minimum duration should be considered and specified in which case this specified time shall be used for the test. See also IEC 61439-1:2011, 5.3.4.

5.2.4.10.3 Compliance criteria

As a result of the *short time withstand current* (I_{cw}) test, the PECS shall comply with the compliance criteria of 5.2.4.2.

6.2 Information for selection

Replace the existing bullet list by the following new bullet list:

- the name or trademark of the manufacturer, supplier or importer;
- catalogue number or equivalent;
- electrical ratings for each power *port*:
 - maximum nominal input voltage;
 - maximum nominal output voltage;
 - maximum nominal output current or nominal output power rating;
 - maximum nominal input current rms for dimensioning overload protective elements and wiring;
 - number of phases (e.g. 3 a.c.);
 - nominal frequency range (e.g. 50 Hz to 60 Hz);
 - protective class (I, II, III);
- the type of electrical supply system (e.g. TN, IT) to which the PECS may be connected;
- short-circuit current rating(s) in terms of:
 - *conditional short-circuit current* (I_{cc}) and *minimum required prospective short-circuit current* $I_{cp,mr}$ and the characteristics of the *short-circuit protective device* according to clause 4.3.2.2, or [SIST EN 62477-1:2012/A1:2017](https://standards.iteh.ai/catalog/standards/sist/820c9dd9-bbbf-41b4-b03f-9b4b78c336e0/sist-en-62477-1-2012-a1-2017)
 - *rated short time withstand current* (I_{cw}), duration and the *rated peak withstand current* (I_{pk}) according to 4.3.5.
- *output short-circuit current* in accordance with 4.3.2.3;
- supply requirements of the load (if applicable);
- liquid coolant type and design pressure for liquid cooled PECS;
- IP rating for *enclosure*;
- operating and storage environment;
- reference(s) to relevant standard(s) for manufacture, test, or use;
- reference to instructions for installation, use and maintenance.