SLOVENSKI STANDARD
SIST EN 50539-11:2013

01-maj-2013

Nizkonapetostne naprave za zaščito pred prenapetostnimi udari - Naprave za zaščito pred prenapetostnimi udari za specifične aplikacije, vključno z enosmernimi - 11. del: Zahteve in preskusi za SPD v fotovoltaičnih aplikacijah

Low-voltage surge protective devices - Surge protective devices for specific application including d.c. - Part 11: Requirements and tests for SPDs in photovoltaic applications

Überspannungsschutzgeräte für Niederspannung - Überspannungsschutzgeräte für besondere Anwendungen einschließlich Gleichspannung - Teil 11: Anforderungen und Prüfungen für Überspannungsschutzgeräte für den Einsatz in Photovoltaik Installationen

Parafoudres basse tension - Parafoudres pour applications spécifiques incluant le courant continu - Partie 11: Exigences et essais pour parafoudres connectés aux installations photovoltaïques

Ta slovenski standard je istoveten z: **EN 50539-11:2013**

ICS:

29.120.50	Varovalke in druga medtokovna zaščita	Fuses and other overcurrent protection devices

SIST EN 50539-11:2013 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 50539-11

March 2013

ICS 29.120.50

English version

Low-voltage surge protective devices - Surge protective devices for specific application including d.c. - Part 11: Requirements and tests for SPDs in photovoltaic applications

Parafoudres basse tension - Parafoudres pour applications spécifiques incluant le courant continu - Partie 11: Exigences et essais pour parafoudres connectés aux installations photovoltaïque

Überspannungsschutzgeräte für Niederspannung - Überspannungsschutzgeräte für besondere Anwendungen einschließlich Gleichspannung - Teil 11: Anforderungen und Prüfungen für Überspannungsschutzgeräte für den Einsatz in Photovoltaik-Installationen

This European Standard was approved by CENELEC on 2012-10-15. 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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 50539-11:2013 E

Contents

Foreword

This document (EN 50539-11:2013) has been prepared by CLC/TC 37A "Low voltage surge protective devices".

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2013-10-15
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2015-10-15

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.

1 Scope

This European Standard defines the requirements and tests for SPDs intended to be installed on the d.c. side of photovoltaic installations to protect against induced and direct lightning effects. These devices are connected to d.c. power circuits of photovoltaic generators, rated up to 1 500 V.

It takes into account that photovoltaic generators:

- behave like current generators,
- that their nominal current depends on the light intensity,
- that their short-circuit current is almost equal to the nominal current,
- are connected in series and/or parallel combinations leading to a great variety of voltages, currents and powers from a few hundreds of W (in residential installations) to several MW (photovoltaic fields).

The very specific electrical parameters of PV installations on the d.c. side require specific test requirements for SPDs.

SPDs with separate input and output terminal(s) that contain a specific series impedance between these terminal(s) (so called two port SPDs according to EN 61643-11) are currently not sufficiently covered by the requirements of this standard and require additional consideration.

NOTE In general SPDs for PV applications do not contain a specific series impedance between the input/output terminals due to power efficiency considerations.

SPDs complying with this standard are exclusively dedicated to be installed on the d.c. side of photovoltaic generators. PV installation including batteries and other d.c. applications are not taken into account and additional requirements and tests may be necessary for such applications.

SPDs for which the manufacturers declares short circuit mode overload behaviour, shall require specific measures to ensure that such devices will not endanger the operator during maintenance and replacement due to possible d.c. arcing.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

HD 588.1 S1:1991, *High-voltage test techniques — Part 1: General definitions and test requirements (IEC 60060-1:1989 + corrigendum Mar. 1990)*

EN 50521, *Connectors for photovoltaic systems — Safety requirements and tests*

EN 60068-2-78, *Environmental testing — Part 2-78: Tests — Test Cab: Damp heat, steady state (IEC 60068-2-78)*

EN 60529, *Degrees of protection provided by enclosures (IP Code) (IEC 60529)*

EN 60664-1:2007, *Insulation coordination for equipment within low-voltage systems — Part 1: Principles, requirements and tests (IEC 60664-1:2007)*

EN 61000-6-1, *Electromagnetic compatibility (EMC) — Part 6-1: Generic standards — Immunity for residential, commercial and light-industrial environments (IEC 61000-6-1)*

EN 61000-6-3, *Electromagnetic compatibility (EMC) — Part 6-3: Generic standards — Emission standard for residential, commercial and light-industrial environments (IEC 61000-6-3)*

EN 61180-1, *High-voltage test techniques for low-voltage equipment — Part 1: Definitions, test and procedure requirements (IEC 61180-1)*

EN 61643-11:2012, *Low-voltage surge protective devices — Part 11: Surge protective devices connected to low-voltage power systems — Requirements and tests methods (IEC 61643-11:2011, mod.)*

IEC 60050-151:2001, *International Electrotechnical Vocabulary — Part 151: Electrical and magnetic devices*

3 Terms, definitions and abbreviations

For the purposes of this document, the following terms, definitions and abbreviations apply.

3.1 Terms and definitions

3.1.1
Surge Protective Device
SPD
device that contains at least one nonlinear component that is intended to limit surge voltages and divert surge currents

Note 1 to entry: An SPD is a complete assembly, having appropriate connecting means.

[SOURCE: EN 61643-11:2012]

3.1.2
one-port SPD
SPD having no intended series impedance

Note 1 to entry: A one port SPD may have separate input and output connections.

[SOURCE: EN 61643-11:2012]

3.1.3
voltage switching type SPD
SPD that has a high impedance when no surge is present, but can have a sudden change in impedance to a low value in response to a voltage surge

Note 1 to entry: Common examples of components used in voltage switching type SPDs are spark gaps, gas tubes and thyristors. These are sometimes called "crowbar type" components.

[SOURCE: EN 61643-11:2012]

3.1.4
voltage limiting type SPD
SPD that has a high impedance when no surge is present, but will reduce it continuously with increased surge current and voltage

Note 1 to entry: Common examples of components used in voltage limiting type SPDs are varistors and avalanche breakdown diodes. These are sometimes called "clamping type" components.

[SOURCE: EN 61643-11:2012]

3.1.5
combination type SPD
SPD that incorporates both, voltage switching components and voltage limiting components.

Note 1 to entry: The SPD may exhibit voltage switching, limiting or both.

[SOURCE: EN 61643-11:2012]

3.1.6
modes of protection
intended current path between terminals, that contains one or more protective components, for which the manufacturer declares a protection level, e.g. + to -, + to earth, - to earth

Note 1 to entry: Additional terminals may be included within this current path.

[SOURCE: EN 61643-11:2012]

3.1.7
current branch of an SPD
intended current path, between two nodes that contains one or more protective components

Note 1 to entry: A current branch of an SPD may be identical with a mode of protection of a SPD.

Note 2 to entry: This intended current path does not include additional terminals.

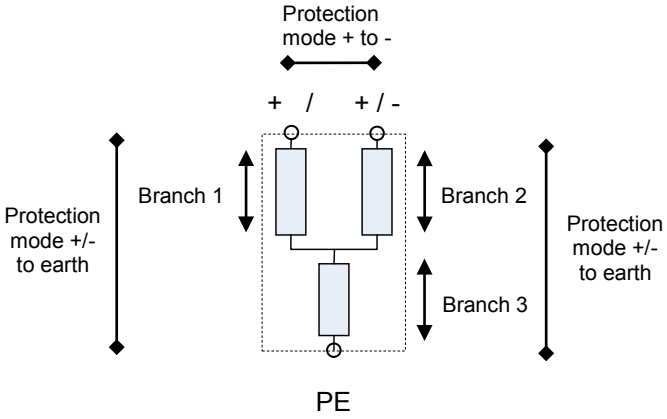

Figure 1 — Current branches vs. modes of protection of an SPD

3.1.8
nominal discharge current
I_n
crest value of the current through the SPD having a current waveshape of 8/20

[SOURCE: EN 61643-11:2012]

3.1.9
impulse discharge current for class I test
I_{imp}
crest value of a discharge current through the SPD with specified charge transfer Q and specified energy W/R in the specified time

[SOURCE: EN 61643-11:2012]

3.1.10
maximum discharge current
I_{max}
crest value of a current through the SPD having an 8/20 waveshape and magnitude according to the manufacturers specification.

Note 1 to entry: I_{max} is equal to or greater than I_n.

[SOURCE: EN 61643-11:2012]

3.1.11
maximum continuous operating voltage for PV application
U_{CPV}
maximum d.c. voltage which may be continuously applied to the SPDs mode of protection

3.1.12
continuous operating current for PV application
I_{CPV}
current flowing between active lines of the SPD when energised at U_{CPV}, when connected according to the manufacturer's instructions

3.1.13
residual current
I_{PE}
current flowing through the PE terminal of the SPD while energised at U_{CPV} when connected according to the manufacturer's instructions

[SOURCE: EN 61643-11:2012]

3.1.14
follow current
***I*$_f$**
peak current supplied by the electrical power system and flowing through the SPD after a discharge current impulse

Note 1 to entry: The follow current is significantly different from the continuous operating current I_{CPV}.

[SOURCE: EN 61643-11:2012]

3.1.15
rated load current
***I*$_L$**
maximum continuous rated d.c. current that can be supplied to a resistive load connected to the protected output of an SPD

[SOURCE: EN 61643-11:2012]

3.1.16
voltage protection level
***U*$_p$**
maximum voltage to be expected at the SPD terminals due to an impulse stress with defined voltage steepness and an impulse stress with a discharge current with given amplitude and waveshape

Note 1 to entry: The voltage protection level is given by the manufacturer and should not be exceeded by the measured limiting voltage, determined for front-of-wave sparkover (if applicable) and the measured limiting voltage, determined from the residual voltage measurements at amplitudes up to I_n and/or I_{imp} for test classes I and II.

[SOURCE: EN 61643-11:2012]

3.1.17
measured limiting voltage
highest value of voltage that is measured across the terminals of the SPD during the application of impulses of specified waveshape and amplitude

[SOURCE: EN 61643-11:2012]

3.1.18
residual voltage
***U*$_{res}$**
crest value of voltage that appears between the terminals of an SPD due to the passage of discharge current

[SOURCE: EN 61643-11:2012]

3.1.19
1,2/50 voltage impulse
voltage impulse with a nominal virtual front time of 1,2 μs and a nominal time to half-value of 50 μs

Note 1 to entry: Clause 6 of HD 588.1 S1:1991 defines the voltage impulse definitions of front time, time to half-value and waveshape tolerance.

[SOURCE: EN 61643-11:2012]

3.1.20
8/20 current impulse
current impulse with a nominal virtual front time of 8 μs and a nominal time to half-value of 20 μs

Note 1 to entry: Clause 8 of HD 588.1 S1:1991 defines the current impulse definitions of front time, time to half-value and waveshape tolerance.

[SOURCE: EN 61643-11:2012]

3.1.21
thermal stability
SPD is thermally stable if, after heating up during the operating duty test, its temperature decreases with time while energised at specified maximum continuous operating voltage and at specified ambient temperature conditions

[SOURCE: EN 61643-11:2012]

3.1.22
degradation (of performance)
undesired permanent departure in the operational performance of equipment or a system from its intended performance

[SOURCE: EN 61643-11:2012]

3.1.23
short-circuit current rating
I_{SCPV}
maximum prospective short-circuit current from the power system for which the SPD, in conjunction with the disconnectors specified, is rated

[SOURCE: EN 61643-11:2012]

3.1.24
SPD disconnector (disconnector)
device for disconnecting an SPD, or part of an SPD, from the power system in the event of SPD failure

Note 1 to entry: This disconnecting device is not required to have isolating capability for safety purposes. It is to prevent a persistent fault on the system and is used to give an indication of an SPD's failure. Disconnectors can be either internal (built in) or , external (required by the manufacturer) or both. There may be more than one disconnector function, for example an over-current protection function and a thermal protection function. These functions may be in separate units.

[SOURCE: EN 61643-11:2012]

3.1.25
degree of protection of enclosure
IP
classification preceded by the symbol IP indicating the extent of protection provided by an enclosure against access to hazardous parts, against ingress of solid foreign objects and possibly harmful ingress of water

[SOURCE: EN 61643-11:2012]

3.1.26
type test
conformity test made on one or more items representative of the production

[SOURCE: IEC 60050-151:2001, 151-16-16]

3.1.27
routine test
test made on each SPD or on parts and materials as required to ensure that the product meets the design specifications

[SOURCE: IEC 60050-151:2001, 151-16-17]

3.1.28
acceptance tests
contractual test to prove to the customer that the item meets certain conditions of its specification

[SOURCE: IEC 60050-151:2001, 151-16-23]

3.1.29
Impulse test classification

3.1.29.1
class I tests
tests carried out with the impulse discharge current I_{imp}, with an 8/20 current impulse with a crest value equal to the crest value of I_{imp}, and with a 1,2/50 voltage impulse

[SOURCE: EN 61643-11:2012]

3.1.29.2
class II tests
tests carried out with the nominal discharge current I_n, and the 1,2/50 voltage impulse

[SOURCE: EN 61643-11:2012]

3.1.30
sparkover voltage or trigger voltage of a voltage switching SPD
maximum voltage value at which the sudden change from high to low impedance starts for a voltage switching SPD

[SOURCE: EN 61643-11:2012]

3.1.31
specific energy for class I test
W/R
energy dissipated by a unit resistance of 1 Ω with the impulse discharge current I_{imp}

Note 1 to entry: This is equal to the time integral of the square of the current ($W/R = \int i^2 dt$).

[SOURCE: EN 61643-11:2012]

3.1.32
prospective short-circuit current of a power supply
***I*P**
current which would flow at a given location in a circuit if it were short-circuited at that location by a link of negligible impedance

[SOURCE: EN 61643-11:2012]

3.1.33
status indicator
device that indicates the operational status of an SPD, or a part of an SPD

Note 1 to entry: Such indicators may be local with visual and/or audible alarms and/or may have remote signalling and/or output contact capability.

[SOURCE: EN 61643-11:2012]

3.1.34
output contact
contact included in a circuit separate from the main circuit of an SPD, and linked to a disconnector or status indicator

[SOURCE: EN 61643-11:2012]

3.1.35
multipole SPD
type of SPD with more than one mode of protection, or a combination of electrically interconnected SPDs offered as a unit

[SOURCE: EN 61643-11:2012]

3.1.36
total discharge current
***I*Total**
current which flows through the earth conductor of a multipole SPD during the total discharge current test

Note 1 to entry: The aim is to take into account cumulative effects that occur when multiple modes of protection of a multipole SPD conduct at the same time.

Note 2 to entry: I_{Total} is particularly relevant for SPDs tested according to test class I, and is used for the purpose of lightning protection equipotential bonding according to EN 62305 series.

[SOURCE: EN 61643-11:2012]

3.1.37
voltage for clearance determination
***U*max**
highest measured voltage during surge applications according to 7.4.4 for clearance determination

[SOURCE: EN 61643-11:2012]

3.1.38
Open Circuit Mode
OCM
behaviour of a device that disconnects under overload condition

3.1.39
Short-Circuit Mode
SCM
behaviour of a device that turns to a short circuit like state under overload condition

3.2 Abbreviations

Table 1 below provides the list of abbreviations used in this document.

Table 1 — List of Abbreviations

Abbreviation	Description	Definition/clause
General abbreviations		
DUT	device under test	General
IP	degree of protection of enclosure	3.1.25
SPD	surge protective device	3.1.1
W/R	specific energy for class I test	3.1.31
T1, T2	product marking for test classes I and II	6.1.2
OCM	Open Circuit Mode	3.1.38
SCM	Short-Circuit Mode	3.1.39
Abbreviations related to Voltage		
U_{CPV}	maximum continuous operating voltage	3.1.11
U_p	voltage protection level	3.1.16
U_{res}	residual voltage	3.1.18
U_{max}	voltage for clearance determination	3.1.37
Abbreviations related to Current		
I_{imp}	impulse discharge current for class I test	3.1.9
I_{max}	maximum discharge current	3.1.10
I_n	nominal discharge current for class II test	3.1.8
I_f	follow current	3.1.14
I_L	rated load current	3.1.15
I_{SCPV}	short-circuit current rating	3.1.23
I_{CPV}	continuous operating current for PV application	3.1.12
I_P	prospective short-circuit current of the power supply	3.1.32
I_{PE}	residual current at U_{CPV}	3.1.13
I_{Total}	total discharge current for multipole SPD	3.1.36

4 Service conditions

4.1 Voltage

The voltage applied continuously between the terminals of the Surge Protective Device (SPD) shall not exceed its maximum continuous operating voltage U_{CPV}.

4.2 Air pressure and altitude

Air pressure is 80 kPa to 106 kPa. These values represent an altitude of +2 000 m to -500 m respectively.

4.3 Temperatures

– normal range: –5 °C to +40 °C

NOTE 1 This range addresses SPDs for indoor use in weather protected locations having neither temperature nor humidity control and corresponds to the characteristics of external influences code AB4 in HD 60364-5-51.

– extended range: –40 °C to +70 °C

NOTE 2 This range addresses SPDs for outdoor use in non weather protected locations.

4.4 Humidity

– normal range: 5 % to 95 %

NOTE 1 This range addresses SPDs for indoor use in weather protected locations having neither temperature nor humidity control and corresponds to the characteristics of external influences code AB4 in HD 60364-5-51.

– extended range: 5 % to 100 %

NOTE 2 This range addresses SPDs for outdoor use in non weather protected locations.

5 Classification

The manufacture shall classify the SPDs in accordance with the following parameters.

5.1 SPD design

5.1.1 Voltage switching

5.1.2 Voltage limiting

5.1.3 Combination

5.2 Types 1 and 2 SPDs - Class I and II tests

Information required for class I and class II tests is given in Table 2.

Table 2 — Tests of types 1 and 2 SPDs

Type of SPD	Tests	Required information	Test procedures (see subclauses)
Type 1	Class I	I_{imp}	7.2.2; 7.2.3; 7.2.4
Type 2	Class II	I_n	7.2.3; 7.2.4

5.3 Location

5.3.1 Indoor

SPDs intended for use in enclosures and/or inside buildings or shelters.

SPDs installed in outdoor enclosures or shelters are considered for indoor use.