

# **SLOVENSKI STANDARD**

## **SIST-TS CLC/TS 50539-12:2014**

**01-februar-2014**

**Nadomešča:**

**SIST-TS CLC/TS 50539-12:2012**

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**Nizkonapetostne naprave za zaščito pred prenapetostnimi udari - Naprave za zaščito pred prenapetostnimi udari za specifične aplikacije, vključno z enosmernimi - 12. del: Izbira in načela za uporabo - SPD, priključeni na fotonapetostne inštalacije**

Low-voltage surge protective devices - Surge protective devices for specific application including d.c. -- Part 12: Selection and application principles - SPDs connected to photovoltaic installations

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Überspannungsschutzgeräte für Niederspannung - Überspannungsschutzgeräte für besondere Anwendungen einschließlich Gleichspannung -- Teil 12: Auswahl und Anwendungsgrundsätze - Überspannungsschutzgeräte für den Einsatz in Photovoltaik Installationen

Parafoudres basse tension - Parafoudres pour applications spécifiques incluant le courant continu -- Partie 12: Principes de choix et d'application - Parafoudres connectés aux installations photovoltaïques

**Ta slovenski standard je istoveten z: CLC/TS 50539-12:2013**

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**ICS:**

27.160	Sončna energija	Solar energy engineering
29.120.50	Varovalke in druga medtokovna zaščita	Fuses and other overcurrent protection devices

**SIST-TS CLC/TS 50539-12:2014**

**en,fr,de**

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TECHNICAL SPECIFICATION  
SPÉCIFICATION TECHNIQUE  
TECHNISCHE SPEZIFIKATION

**CLC/TS 50539-12**

December 2013

ICS 29.120.50

Supersedes CLC/TS 50539-12:2010

English version

**Low-voltage surge protective devices -  
Surge protective devices for specific application including d.c. -  
Part 12: Selection and application principles -  
SPDs connected to photovoltaic installations**

Parafoudres basse tension -  
Parafoudres pour applications spécifiques  
incluant le courant continu -  
Partie 12: Principes de choix et  
d'application -  
Parafoudres connectés aux installations  
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Überspannungsschutzgeräte für  
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Gleichspannung -  
Teil 12: Auswahl und  
Anwendungsgrundsätze -  
Überspannungsschutzgeräte für den  
Einsatz in Photovoltaik-Installationen

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## Contents

Page

Foreword .....	5
1 Scope .....	6
2 Normative references .....	6
3 Terms and definitions .....	7
4 Systems and equipment to be protected .....	9
5 Overvoltages in a PV installation .....	9
6 Installation and location of SPDs .....	9
6.1 General .....	9
6.2 PV installation without external LPS .....	10
6.3 PV installation with external LPS when separation distance $s$ is kept .....	11
6.4 PV installation with external LPS when separation distance is not kept .....	13
7 Equipotential bonding .....	13
8 Surge protective devices (SPD) in PV installations .....	15
9 Requirements for the implementation of SPDs .....	15
9.1 Decision for using SPDs .....	15
9.2 Selection and installation of SPDs for application in PV installation .....	16
9.2.1 Selection of SPDs installed at the a.c. side of PV installations .....	16
9.2.2 Selection of SPDs installed at the d.c. side of PV installation .....	18
10 Maintenance .....	23
Annex A (informative) Determination of the value of $I_{imp}$ or $I_n$ for SPDs for different structures protected by a LPS according to a simplified approach .....	24
A.1 Introduction .....	24
A.2 PV installation on a building according to 6.4 .....	24
A.2.1 General .....	24
A.2.2 Case of voltage limiting and combination type SPDs (having voltage switching and limiting components in series) .....	26
A.2.3 Case of voltage switching and combination type SPDs (having voltage switching and limiting components in parallel) .....	27
A.3 Outside free field power plant PV installation according to 6.4 .....	27
A.3.1 General .....	27
A.3.2 Assumption .....	27
A.3.3 Result .....	28
Annex B (informative) Characteristic of a PV source .....	30
B.1 General .....	30
B.2 Calculation of $U_{OCMAX}$ .....	31
B.3 Calculation of $I_{SCMAX}$ .....	31
Annex C (normative) Simplified risk assessment based on EN 62305-2 .....	32
Bibliography .....	34

## Figures

Figure 1 – Current branches vs. modes of protection of an SPD.....	9
Figure 2 – Installation of SPDs in case of PV installation without external LPS .....	10
Figure 3 – Installation of SPDs in case of a building with external LPS when separation distance $s$ is kept ....	11
Figure 4 – Installation of SPDs in case of a building with external LPS when separation distance $s$ is kept – Installation with data acquisition and control system.....	12
Figure 5 – Installation of SPDs in case of PV installation with external LPS when separation distance $s$ is not kept.....	13
Figure 6 – Building with external LPS: Dimensions of all equipotential bonding conductors are $6 \text{ mm}^2$ except the one indicated in the figure (earthing of the SPD Type 1 located at the origin of installation).....	14
Figure 7 – Building with external LPS: Dimensions of equipotential bonding conductors in case of a non-isolated LPS .....	15
Figure 8 – Installation of SPDs on the a.c.-side and short distance between origin of installation and PV-inverter ( $E < 10 \text{ m}$ ).....	17
Figure 9 – Installation of SPDs on the a.c.-side and long distance between origin of installation and PV-inverter ( $E > 10 \text{ m}$ ).....	17
Figure 10 – Example of an overvoltage protection on d.c. side of a PV installation .....	19
Figure 11 – I-configuration.....	21
Figure 12 – U-configuration.....	21
Figure 13 – L-configuration.....	21
Figure 14 – $\Delta$ -configuration .....	21
Figure 15 – Y-configuration .....	22
Figure 16 – Single mode SPDs to be connected in Y-configuration .....	22
Figure A.1 – Example of a structure with two external down conductors to determine the value of the discharge current for the selection of SPDs .....	25
Figure A.2 – Example of a structure of an extended PV installation – Free field PV power plant with multiple earthing and a meshed earthing system.....	28
Figure B.1 – Principle of a PV current source .....	30
Figure B.2 – V/I characteristic of a non-linear PV current source .....	30
Figure C.1 – L calculation.....	33

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**Tables**

Table 1 – Impulse withstand voltage $U_w$ for equipment between PV generator and inverter .....	19
Table A.1 – Values of $I_{10/350}$ and $I_{8/20}$ for voltage limiting and combination type SPDs (having voltage switching and limiting components in series) .....	26
Table A.2 – Values of $I_{imp}$ for voltage switching and combination type SPDs (having voltage switching and limiting components in parallel) .....	27
Table A.3 – Values of $I_{10/350}$ and $I_{8/20}$ for SPDs intended to be used in free field PV power plant with multiple earthing and a meshed earthing system.....	29
Table C.1 – Calculation of the critical length $L_{crit}$ .....	32

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## Foreword

This document (CLC/TS 50539-12:2013) has been prepared by CLC/TC 37A "Low voltage surge protective devices".

This document supersedes CLC/TS 50539-12:2010.

CLC/TS 50539-12:2013 includes the following significant technical changes with respect to CLC/TS 50539-12:2010:

- a) scope and definitions have been revised to align CLC/TS 50539-12 with EN 50539-11;
- b) structure of the document has been revised for better clarification;
- c) only Type 1 d.c. SPDs can be used for cases described in 6.4;
- d) multi-earthed solar systems have been introduced for SPD selection and for current sharing calculation;
- e) Table 1 (impulse withstand) has been introduced;
- f) current sharing in Annex A has been revised;
- g) Annex B has been created;
- h) risk assessment has been introduced in Annex C.

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 Technical Specification describes the principles for selection, location, coordination and operation of SPDs to be connected to PV installations. The d.c. side is rated up to 1 500 V d.c. and the a.c. side, if any, is rated up to 1 000 V rms 50 Hz.

The electrical installation starts from a PV generator or a set of interconnected PV modules with their cables, provided by the PV generator manufacturer, up to the user installation or the utility supply point.

For PV installations including batteries, additional requirements will be necessary.

NOTE 1 HD 60364-7-712, CLC/TS 61643-12 and EN 62305-4 are also applicable.

NOTE 2 This Technical Specification deals only with SPDs, and not with SPDs components integrated inside equipment.

## 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.

CLC/TS 61643-12, *Low-voltage surge protective devices – Part 12: Surge protective devices connected to low-voltage power distribution systems – Selection and application principles* (IEC 61643-12)

EN 50539-11, *Low-voltage surge protective devices – Surge protective devices for specific application including d.c. – Part 11: Requirements and tests for SPDs in photovoltaic applications*

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

EN 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test* (IEC 61000-4-5)

EN 61643-11, *Low-voltage surge protective devices – Part 11: Surge protective devices connected to low-voltage power systems – Requirements and tests methods* (IEC 61643-1)

EN 61643-21, *Low voltage surge protective devices – Part 21: Surge protective devices connected to telecommunications and signalling networks – Performance requirements and testing methods* (IEC 61643-21)

EN 62305-2:2012, *Protection against lightning – Part 2: Risk management* (IEC 62305-2:2010, mod.)

EN 62305-4, *Protection against lightning – Part 4: Electrical and electronic systems within structures* (IEC 62305-4)

HD 60364-4-443, *Electrical installations of buildings – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances – Clause 443: Protection against overvoltages of atmospheric origin or due to switching* (IEC 60364-4-44)

HD 60364-5-534, *Low-voltage electrical installations – Part 5-53: Selection and erection of electrical equipment – Isolation, switching and control – Clause 534: Devices for protection against overvoltages* (IEC 60364-5-53)

ITU-T Recommendation K.20, *Resistibility of telecommunication equipment installed in a telecommunications centre to overvoltages and overcurrents*



ITU-T Recommendation K.21, *Resistibility of telecommunication equipment installed in customer premises to overvoltages and overcurrents*

### 3 Terms and definitions

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

#### 3.1

##### **PV generator**

assembly of PV arrays connected to one input of the inverter

#### 3.2

##### **PV-installation**

erected equipment of a PV power supply system

#### 3.3

##### **open-circuit maximum voltage**

$U_{OC\ MAX}$

maximum voltage across an unloaded (open) PV generator, PV string, PV array or on the d.c. side of the PV inverter

Note 1 to entry: Calculation of  $U_{OC\ MAX}$  is performed in Annex B.

#### 3.4

##### **lightning protection system**

##### **LPS**

complete system used to reduce physical damage due to lightning flashes to a structure

Note 1 to entry: It consists of both external and internal lightning protection systems.

[SOURCE: EN 62305-1:2011, 3.42] [SIST-TS CLC/TS 50539-12:2014  
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#### 3.5

##### **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, 3.1.1]

#### 3.6

##### **external lightning protection system**

part of the LPS consisting of an air-termination system, a down-conductor system and an earth-termination system

[SOURCE: EN 62305-1:2002, 3.43]

#### 3.7

##### **separation distance**

##### **s**

distance between two conductive parts at which no dangerous sparking can occur

[SOURCE: EN 62305-3:2011, 3.28, modified — abbreviation 's' is added]

**3.8****lightning equipotential bonding****EB**

bonding to the LPS of separated conductive parts, by direct connections or via surge protective devices, to reduce potential differences caused by lightning current

[SOURCE: EN 62305-3:2011, 3.23]

**3.9****bonding bar**

metal bar on which metal installations, external conductive parts, electric power and telecommunication lines, and other cables can be bonded to an LPS

[SOURCE: EN 62305-3:2011, 3.24]

**3.10****bonding conductor**

conductor connecting separated conductive parts to LPS

[SOURCE: EN 62305-3:2011, 3.25]

**3.11****standard test conditions****STC**

test conditions specified in EN 60904-3 for PV cells and PV generators

**3.12****open circuit voltage under standard test conditions** **$U_{OC\ STC}$** 

voltage under standard test conditions across an unloaded (open) PV generator, PV string, PV array or on the d.c. side of the PV inverter

**3.13****short-circuit current under standard test conditions** **$I_{SC\ STC}$** 

short-circuit current of a PV generator, PV string or PV array under standard test conditions

**3.14****external LPS isolated from the structure to be protected**

LPS with an air-termination system and down-conductor system positioned in such a way that the path of the lightning current has no contact with the structure to be protected

Note 1 to entry: In an isolated LPS, dangerous sparks between the LPS and the structure are avoided.

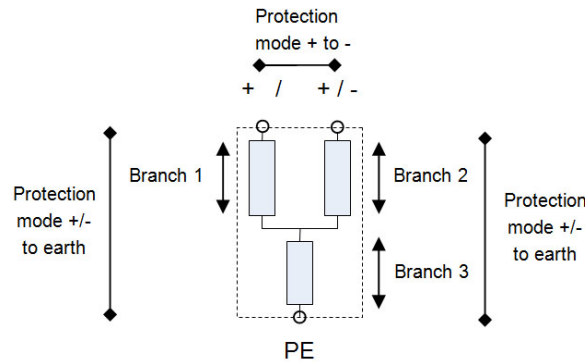
[SOURCE: EN 62305-3:2011, 3.3]

**3.15****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**

[SOURCE: EN 50539-11:2013, 3.1.7]

## 4 Systems and equipment to be protected

Overvoltages can destroy, degrade or cause malfunction of a PV installation. Therefore, PV installations shall be protected in presence of overvoltage risk. The most sensitive parts of the equipment should first be protected: the inverter and the control/monitoring equipment, the PV generator and the wiring (installation itself).

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## 5 Overvoltages in a PV installation

Overvoltages can be found under several conditions in a PV installation. They may be

- caused by direct strike (S1) to the external lightning protection system (LPS) of the building or lightning flashes nearby (S2) the buildings and/or PV installations,
- caused by direct strikes (S3) and lightning induced currents (S4) distributed into the electrical network,
- transmitted from the distribution network due to operations (switching).

NOTE S1, S2, S3 and S4 are abbreviations used in EN 62305 series (sources of damage).

The protection requirements within this document are based on the assumption that the cable interconnecting the d.c. components of the PV installation is sufficiently protected from direct lightning either by appropriate routing or by shielding, e.g. use of appropriate cable management system.

## 6 Installation and location of SPDs

### 6.1 General

According to CLC/TS 61643-12 and EN 62305 series, installation and location of SPDs for protection of PV installations depends on multiple factors, the main ones being

- the flash ground density of the location,

- the presence of overhead lines,
- the characteristics of the low-voltage power distribution system (e.g. overhead network or not) and of the equipment to be protected,
- if protection measures are needed to protect the PV-installation against direct lightning impacts with an external LPS.

When installations are protected by an external LPS, the requirements for SPD selection depends on

- the selected class of the LPS (see Annex A: simplified method),
- if the separation distance  $s$  is kept between the LPS and the PV installation (isolated LPS) or not kept (non-isolated LPS).

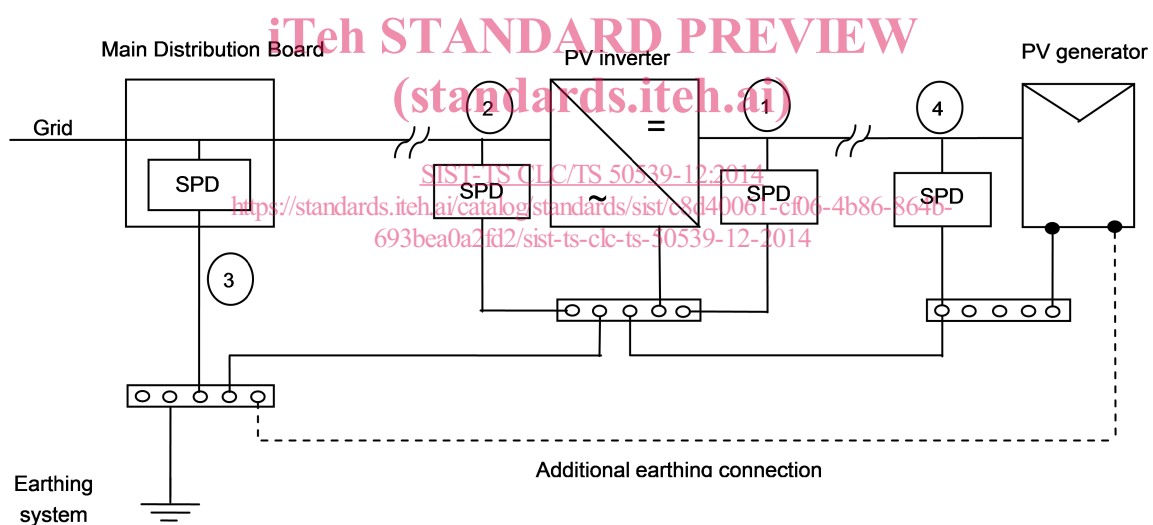
For further detail on external LPS and separation distance requirements, see EN 62305-3.

NOTE The separation distance  $s$  is typically less than 1 m.

All SPDs installed on the same line have to be coordinated (see CLC/TS 61643-12).

Examples for installations of SPDs for the different cases are shown in Figure 2 to Figure 5.

## 6.2 PV installation without external LPS



### Key

- 1 SPD PV type 2 according to EN 50539-11
- 2 SPD type 2 according to EN 61643-11
- 3 SPD as required in HD 60364-5-534 and according to EN 61643-11
- 4 SPD PV type 2 according to EN 50539-11

**Figure 2 – Installation of SPDs in case of PV installation without external LPS**

In general, one set of SPDs on the d.c. side and one set of SPDs on the a.c. side of the inverter should be installed as close as possible to the inverter.

The SPD in location 2 is not needed (see 9.2.1.4) if the distance between the SPD in location 2 (main distribution board) and the inverter is less than 10 m. In this case, only one SPD is required in location 2 (main distribution board).