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SIST-TS CLC/TS 50539-12:2012

01-februar-2012

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 Anwendungsrichtlinien - Überspannungsschutzgeräte für den Einsatz in Photovoltaik Installationen

SIST-TS CLC/TS 50539-12:2012
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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 50539-12:2010**

ICS:

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

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2003-01.Slovenski inštitut za standardizacijo. Razmnoževanje celote ali delov tega standarda ni dovoljeno.

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TECHNICAL SPECIFICATION

SPÉCIFICATION TECHNIQUE

TECHNISCHE SPEZIFIKATION

CLC/TS 50539-12

March 2010

ICS 29.120.50

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

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This Technical Specification was approved by CENELEC on 2009-10-30.

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CENELEC

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

Central Secretariat: Avenue Marnix 17, B - 1000 Brussels

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Ref. No. CLC/TS 50539-12:2010 E

SIST-TS CLC/TS 50539-12:2012

Foreword

This Technical Specification was prepared by the Technical Committee CENELEC TC 37A, Low voltage surge protective devices.

The text of the draft was submitted to the formal vote and was approved by CENELEC as CLC/TS 50539-12 on 2009-10-30.

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

The following date was fixed:

– latest date by which the existence of the CLC/TS has to be announced at national level (doa) 2010-04-30

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https://standards.iteh.ai/catalog/standards/sist/6f50a107-fbcc-4b6f-ba16-1b0a51aa8b55/sist-ts-clc-ts-50539-12-2012

SIST-TS CLC/TS 50539-12:2012

Contents

Page

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Figures

SIST-TS CLC/TS 50539-12:2012
https://standards.iteh.ai/catalog/standards/sist/6f50a107-fbcc-4b6f-ba16-1b0a51aa8b55/sist-ts-clc-ts-50539-12-2012

Tables

SIST-TS CLC/TS 50539-12:2012

1 Scope

This Technical Specification deals with the protection of PV installations against overvoltages. It deals with the protection of the PV installation against surge overvoltages induced by direct and indirect lightning strikes.

If such a PV installation is connected to an AC-supply system this document is applicable as a complement of HD 60364-4-443, HD 60364-5-534 and HD 60364-7-712 and also CLC/TS 61643-12. Surge protective devices (SPD) installed on the AC side shall comply with EN 61643-11.

NOTE 1 Due to the very specific electrical setup of PV installations on the DC side, only surge protective devices especially dedicated to PV installations shall be used to protect the DC side of such installations.

NOTE 2 Taking into account the sensitivity and of the setting up of the photovoltaic modules, a detailed attention must be paid to the protection of the structure itself (building) against direct effects of the lightning; this subject is covered by EN 62305 series.

2 Normative references

The following referenced documents are indispensable for the application 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.

EN 50164 series, *Lightning Protection Components (LPC)*

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

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EN 60904-3, *Photovoltaic devices – Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data* (IEC 60904-3)

SIST-TS CLC/TS 50539-12:2012
https://standards.iteh.ai/catalog/standards/sist/6f50a107-fbcc-4b6f-ba16-1b0d51aaa805/sist-ts-clc-ts-50539-12-2012

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

EN 61643-11:2002 + A11:2007, *Low-voltage surge protective devices – Part 11: Surge protective devices connected to low-voltage power systems – Requirements and tests* (IEC 61643-1:1998, mod. + corrigendum Dec. 1998, mod.)

CLC/TS 61643-12:2006, *Low-voltage surge protective devices – Part 12: Surge protective devices connected to low-voltage power systems – Selection and application principles* (IEC 61643-12:2002, mod.)

EN 61643-21:2001, *Low voltage surge protective devices – Part 21: Surge protective devices connected to telecommunications and signalling networks – Performance requirements and testing methods* (IEC 61643-21:2000 + corrigendum Mar. 2001)

CLC/TS 61643-22:2006, *Low-voltage surge protective devices – Part 22: Surge protective devices connected to telecommunications and signalling networks – Selection and application principles* (IEC 61643-22:2004, mod.)

EN 62305-2:2006, *Protection against lightning – Part 2: Risk management* (IEC 62305-2:2006)

HD 60364-4-443:2006, *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 60364-4-44:2001/A1:2003, mod.)

HD 60364-5-534:2008, *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 60364-5-53:2001/A1:2002 (Clause 534), mod.)

SIST-TS CLC/TS 50539-12:2012

HD 60364-7-712:2005, *Electrical installations of buildings – Part 7-712: Requirements for special installations or locations – Solar photovoltaic (PV) power supply systems* (IEC 60364-7-712:2002)

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-installation
erected equipment of a PV power supply system

3.2
lightning protection system
LPS
complete system used to reduce physical damage due to lightning flashes to a structure

NOTE It consists of both external and internal lightning protection systems.

[EN 62305-1:2006, Definition 3.40]

3.3
surge protective device
SPD
device that is intended to limit transient overvoltages and divert surge currents. It contains at least one non-linear component

[EN 61643-11:2002, Definition 3.1]

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https://standards.iteh.ai/catalog/standards/sist/6f50a107-fbcc-4b6f-ba16-1b0a51aa8b55/sist-ts-clc-ts-50539-12-2012

3.4
external lightning protection system
part of the LPS consisting of an air-termination system, a down-conductor system and an earth-termination system

3.5
separation distance
distance between two conductive parts at which no dangerous sparking can occur

[EN 62305-3:2006, Definition 3.28]

3.6
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

[EN 62305-3:2006, Definition 3.23]

3.7
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

[EN 62305-3:2006, Definition 3.24]

3.8
bonding conductor
conductor connecting separated conductive parts to LPS

[EN 62305-3:2006, Definition 3.25]

SIST-TS CLC/TS 50539-12:2012

3.9
standard test conditions
STC
test conditions specified in EN 60904-3 for PV cells and PV modules

3.10
open circuit voltage under standard test conditions
$U_{OC\ STC}$
voltage under standard test conditions across an unloaded (open) PV module, PV string, PV array, PV generator or on the DC side of the PV-inverter

3.11
short-circuit current under standard test conditions
$I_{SC\ STC}$
short-circuit current of a PV module, PV string, PV array or PV generator under standard test conditions

4 Systems and equipment to be protected

When evaluating an PV-installation with regard to the use of an SPD, two factors need to be considered:

- the characteristics of the low-voltage power distribution system on which it will be used, including expected types and levels of overvoltage and current;
- the characteristics of the equipment requiring protection.

4.1 Overvoltages in a PV installation

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

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- caused by direct strike to the external lightning protection system (LPS) of the building or lightning flashes nearby the buildings and/or PV installations,
- caused by direct strikes and lightning induced currents distributed into the electrical network,
- transmitted from the distribution network. and being of atmospheric origin (lightning) and/or due to operations,
- caused by variations of the electric field due to the lightning.

4.2 Installation and location of SPDs

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

- the flash ground density or keraunic level 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 on SPDs depends on

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

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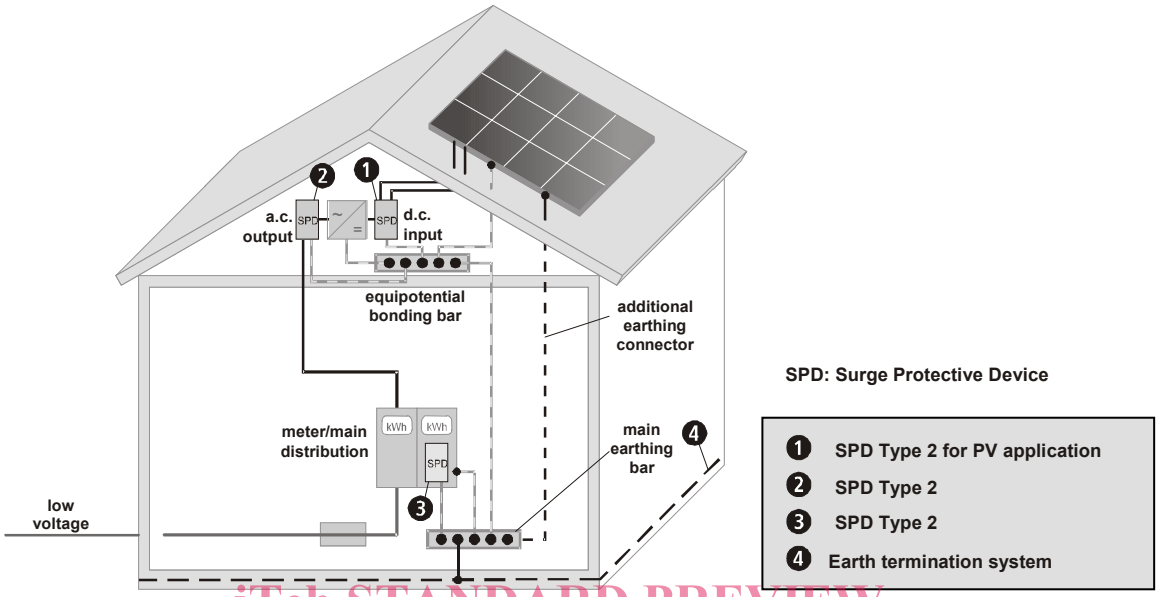
For further detail on external LPS and separation distance requirements see EN 62305-3.

NOTE EN 62305-3 defines external LPS isolated from the structure. In the present Technical Specification, the term “insulated” has been used to avoid misinterpretation.

Examples for installation of SPDs for the different cases are shown in Figure 1 to Figure 4.



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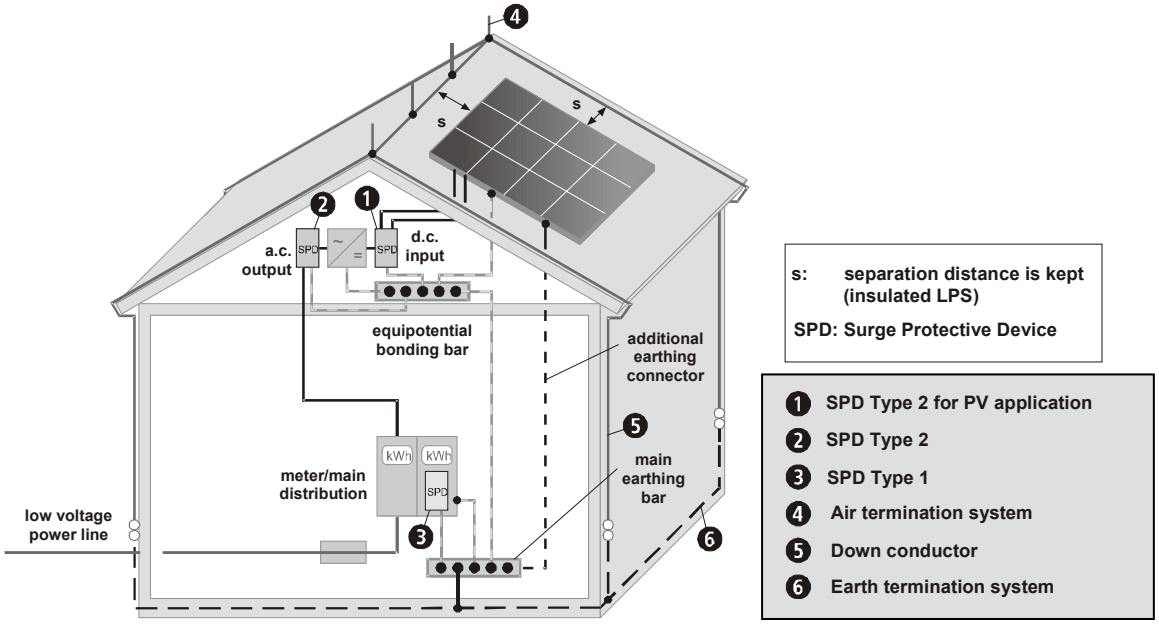
NOTE If the distance between the main distribution board and the inverter is greater than 10 m two sets of Type 2 SPDs are required in location 2 and 3 (see 4.6.1.3). Two sets of Type 2 SPDs (not represented in the figure) are also required in location 1 if the distance between the PV-panels and the inverter is greater than 10 m (see 4.6.2.4).

SIST-TS CLC/TS 50539-12:2012
https://standards.iteh.ai/catalog/standards/sist/01b0a107-4bce-4e0f-8af8-1b0a51aa8b55/sist-ts-clc-ts-50539-12-2012

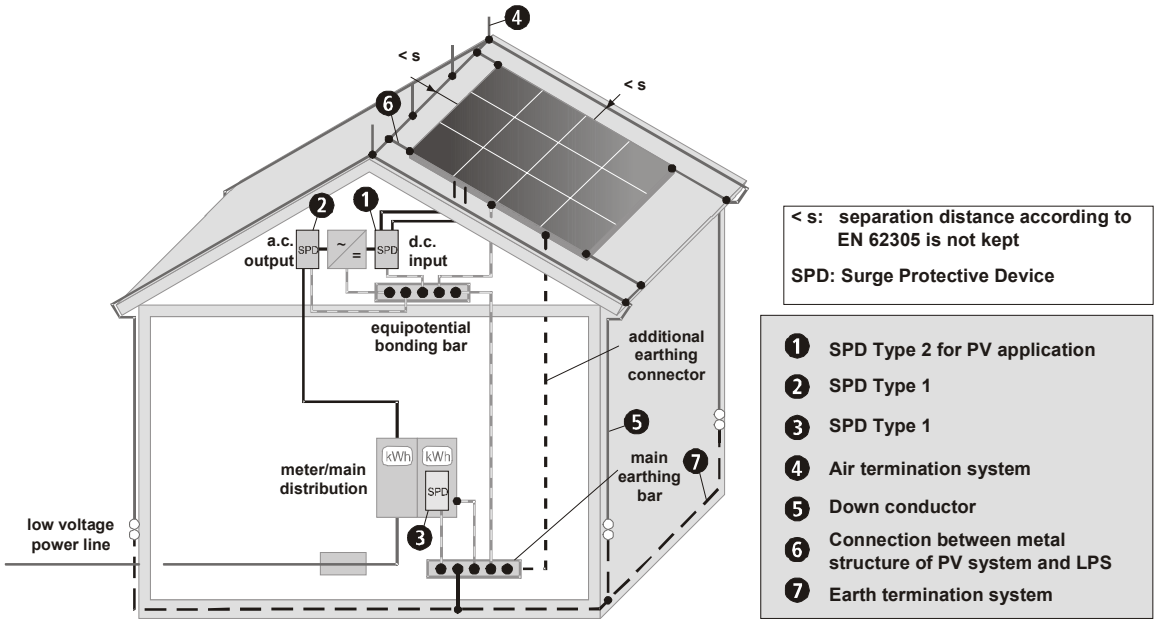
Figure 1 – Possible installation of SPDs in case of a building without external LPS



NOTE If the distance between the main distribution board and the inverter is greater than 10 m two sets of SPDs are required in location 2 and 3 (see 4.6.1.3). The SPD in location 3 shall be of Type1. Two sets of Type 2 SPDs (not represented in the figure) are also required in location 1, if the distance between the PV-panels and the inverter is greater than 10 m (see 4.6.2.4).

Figure 2 – Possible installation of SPDs in case of a building with external LPS when separation distance s is kept

SIST-TS CLC/TS 50539-12:2012



NOTE If the distance between the main distribution board and the inverter is greater than 10 m two sets SPDs are required in location 2 and 3 (see 4.6.1.3). Two sets of SPDs are also required in location 1 (not represented in the figure) if the distance between the PV-panels and the inverter is greater than 10 m (see 4.6.2.4). In that case AC and DC conductors act as parallel conductors to the equipotential bonding conductors. Therefore all SPDs shall be Type 1.

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Figure 3 – Possible installation of SPDs in case of a building with external LPS when separation distance s is not kept

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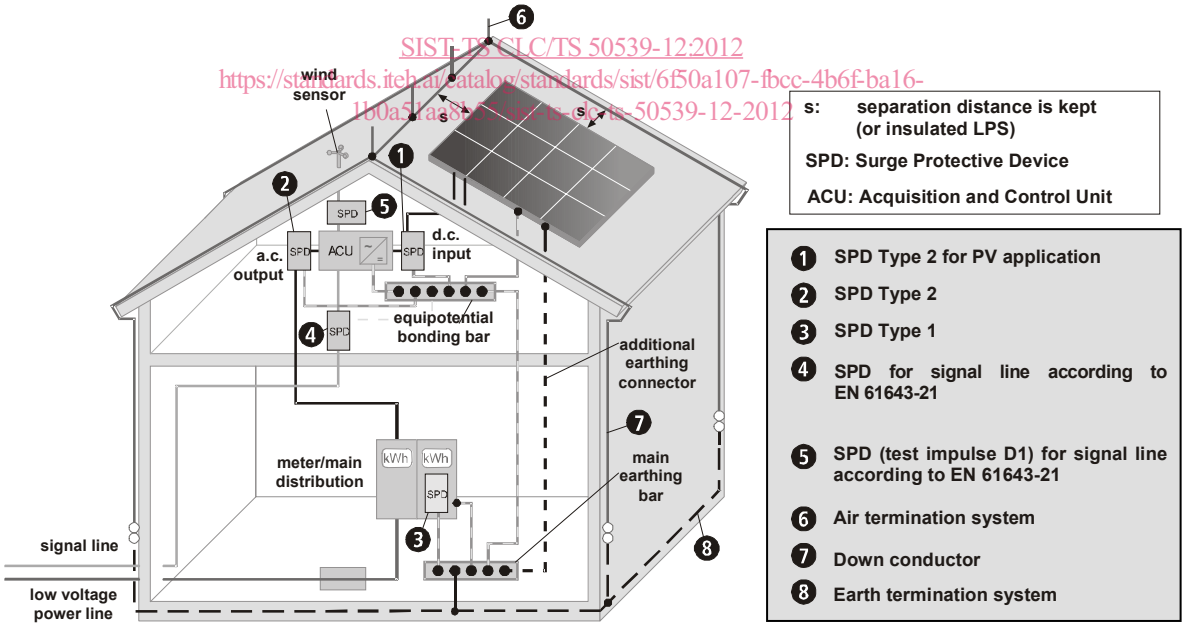

NOTE For optimum inverter overvoltage protection it is recommended to add a direct earthing connection between SPD and inverter.

Figure 4 – Possible installation of SPDs in case of a building with external LPS when separation distance s is kept – Installation with data acquisition and control system

SIST-TS CLC/TS 50539-12:2012

4.3 Equipotential bonding

When the equipotential bonding conductors can be considered as a down conductor its minimum cross section is 50 mm² copper or equivalent.

When the equipotential bonding conductors may carry partial lightning currents its minimum cross section is 16 mm² copper or equivalent.

When the equipotential bonding conductors may carry only induced lightning currents its minimum cross section is 6 mm² copper or equivalent.

The minimum cross section of the bonding conductor connecting internal metallic installation to the bonding bar is 6 mm² copper or equivalent.

The minimum cross section of the bonding conductor connecting different bonding bars and of conductors connecting the bars to the earth termination system is 16 mm² copper or equivalent in case of PV system not connected to the LPS.

The components used in the equipotential bonding system in presence of an LPS shall comply with the EN 50164 series.

When a PV array is protected by a LPS, the minimum separation distance s between the LPS and the metal structure of the PV array should be kept to prevent partial lightning currents flowing via the PV array structure. Minimum cross sections of equipotential bonding conductors should be as shown Figure 5, as required by HD 60364-5-54, CLC/TS 61643-12 and EN 62305-3.

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https://standards.iteh.ai/catalog/standards/sist/6f50a107-fbcc-4b6f-ba16-1b0a51aa8b55/sist-ts-clc-ts-50539-12-2012

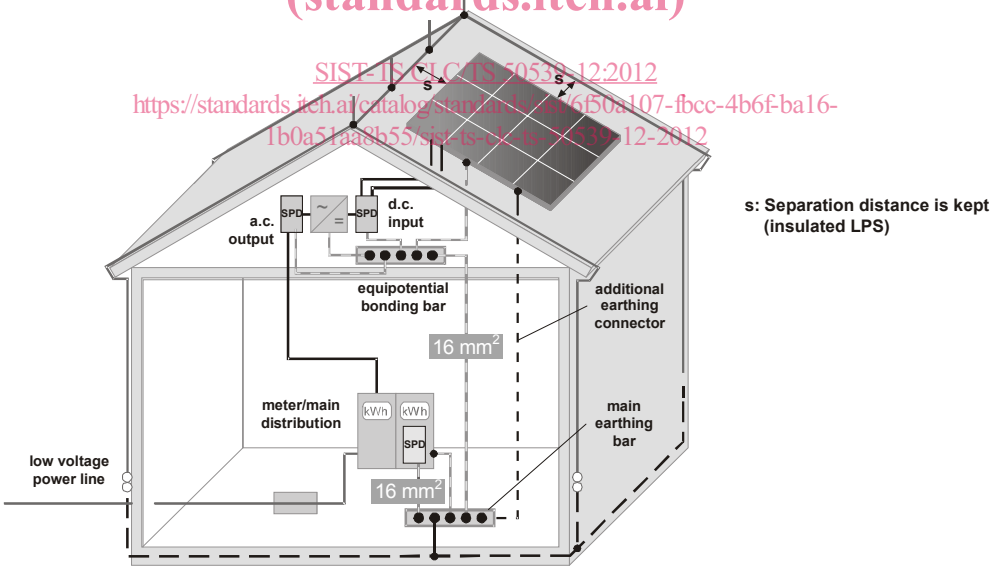

Figure 5 – Building with external LPS –
Dimensions of all equipotential bonding conductors are 6 mm² except the one indicated in the figure (earthing of the Type 1 SPD located at the origin of installation)

When a PV array is protected by a LPS and when the separation distance s cannot be kept, a direct connection between the external LPS and the metallic structure of the PV-generator should be provided. This connection should withstand partial lightning currents. Minimum cross sections of equipotential bonding conductors should be as shown Figure 6, as required by HD 60364-5-54, CLC/TS 61643-12 and EN 62305-3.