PD CLC/TR 50656:2016

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SPD application in conjunction with Class II equipment

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National foreword

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The UK participation in its preparation was entrusted by Technical Committee PEL/37, Surge Arresters - High Voltage, to Subcommittee PEL/37/1, Surge Arresters - Low Voltage.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Published by BSI Standards Limited 2016

ISBN 978 0 580 91543 7
ICS 29.120.50

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This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 March 2016.

Amendments/corrigenda issued since publication

Date	Text affected

TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

CLC/TR 50656

March 2016

ICS 29.120.50

English Version

SPD application in conjunction with Class II equipment

Parafoudres destinés à être utilisés avec des équipements classe II

SPD Anwendungen in Verbindung mit Schutzklasse II

This Technical Report was approved by CENELEC on 2015-12-14.

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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

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European foreword

This document (CLC/TR 50656:2016) has been prepared by CLC/TC 37A “Low voltage surge protective devices”.

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Introduction

Based on questions and requests from the field it was felt necessary to provide some guidance and instructions how and in which applications currently available SPDs according to EN 61643-11 can be correctly and safely applied in conjunction with class II equipment and in installations, where the protective measure double or reinforced insulation is applied (see HD 60364-4-41 and EN 61140).

In general current SPDs according EN 61643-11 are designed to properly protect wherever:

— basic insulation is required e.g. between active parts and the protective equipotential bonding system (PE) (the SPD bridges basic insulation in such applications);

— basic or functional insulation is required e.g. between active parts of different potential (the SPD bridges basic or functional insulation in such applications).

The requirements currently contained in EN 61643-11 do not cover requirements for SPD applications, where the SPD bridges double or reinforced insulation, like e.g. between primary and secondary side of an isolating transformer (protective separation) or between active parts and touchable conductive surfaces of class II equipment.

There are attempts to develop requirements for such SPDs, but for the time being there is no defined solution.

This document refers to HD 60364-4-41 for topics related to installation rules and to EN 62368-1 for some equipments related topics.

This document specially addresses installation issues related to street lighting.

1 Scope

In addition to CLC/TS 61643-12, this Technical Report describes the principle of erecting SPDs to be connected to 50 Hz a.c. power circuits, rated up to 1 000 V r.m.s. in conjunction with Class II equipments.

In addition to EN 61643-11, this Technical Report gives specific guidance for SPDs intended to be installed in class II equipments.

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.

EN 50539-11:2013, *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 60529, *Degrees of protection provided by enclosures (IP Code) (IEC 60529)*[1]

EN 60664-1, *Insulation coordination for equipment within low-voltage systems — Part 1: Principles, requirements and tests (IEC 60664-1)*[2]

EN 60950-1, *Information technology equipment — Safety — Part 1: General requirements (IEC 60950-1)*[3]

EN 61643-11:2012, *Low-voltage surge protective devices — Part 11: Surge protective devices connected to low-voltage power systems — Requirements and test methods (IEC 61643-11:2011)*[4]

EN 62368-1:2014, *Audio/video, information and communication technology equipment — Part 1: Safety requirements (IEC 62368-1:2014, modified)*[5]

HD 60364 (all parts), *Low-voltage electrical installations (IEC 60364, all parts)*[6]

3 Terms and definitions

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

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1 http://www.cenelec.eu/dyn/www/f?p=104:110:695920932773601::::FSP_ORG_ID,FSP_PROJECT,FSP_LANG_ID:1258025,43747,25

2 http://www.cenelec.eu/dyn/www/f?p=104:110:379108178804401::::FSP_ORG_ID,FSP_PROJECT,FSP_LANG_ID:1258497,50513,25

3 http://www.cenelec.eu/dyn/www/f?p=104:110:1457986987015001::::FSP_ORG_ID,FSP_PROJECT,FSP_LANG_ID:1257189,53711,25

4 http://www.cenelec.eu/dyn/www/f?p=104:110:592568428155801::::FSP_ORG_ID,FSP_PROJECT,FSP_LANG_ID:1258617,43963,25

5 http://www.cenelec.eu/dyn/www/f?p=104:110:785888442943801::::FSP_ORG_ID,FSP_PROJECT,FSP_LANG_ID:1257189,60205,25

6 http://www.cenelec.eu/dyn/www/f?p=104:110:437816408653901::::FSP_ORG_ID,FSP_PROJECT,FSP_LANG_ID:1257163,57623,25

3.1
SPD assembly
one SPD or a set of SPDs, in both case including all SPD disconnectors required by the SPD manufacturer, providing the required overvoltage protection for a type of system earthing

[SOURCE: IEC 60364-5-53, modified]

3.2
extraneous conductive part
conductive part not forming part of the electrical installation and liable to introduce an electric potential, generally the electric potential of a local earth

[SOURCE: IEC 60050-826]

3.3
functional earth
earthing a point or points in a system or in an installation or in equipment, for purposes other than electrical safety

[SOURCE: EN 62368-1:2014][5]

3.4
class II SPD
SPDs in which protection against electric shock does not rely on basic insulation only, but in which additional safety precautions such as double insulation or reinforced insulation are provided, there being no provision for protective earthing or reliance upon installation conditions

Note 1 to entry: Such a SPD may have a substantially continuous enclosure of metal, insulated from live parts by insulation at least equivalent to double or reinforced insulation. Such a SPD is called a metal-encased class II SPD.

Note 2 to entry: The enclosure of an insulation-encased class II SPD may form a part or the whole of the supplementary insulation or the reinforced insulation.

Note 3 to entry: If a SPD with double insulation and/or reinforced insulation throughout has a protective earthing, it is class I construction,

Note 4 to entry: Class II SPD may have parts in which protection against electric shock relies on operation at safety extra-low voltage (SELV).

Note 5 to entry: Such SPDs should be marked with the symbol  .

[SOURCE: EN 60598-1:2015, modified][7]

3.5
protective earthing
earthing a point or points in a system or in an installation or in equipment for purposes of electrical safety

[SOURCE: EN 62368-1:2014, modified][5]

3.6
protective conductor
conductor provided for the purposes of safety (for example, protection against electric shock)

7

http://www.cenelec.eu/dyn/www/f?p=104:110:1827578021514001::::FSP_ORG_ID,FSP_PROJECT,FSP_LANG_ID:1257233,50934,25

Note 1 to entry: A protective conductor is either a protective earthing conductor or a protective bonding conductor.

[SOURCE: EN 62368-1:2014][5]

3.7
protective earthing conductor
protective conductor connecting a main protective earthing terminal in the equipment to an earth point in the building installation for protective earthing

[SOURCE: EN 62368-1:2014][5]

4 SPDs connected to PE for the protection of Class II equipments

4.1 General

In the four following examples, a Class II equipment is integrated into a conductive metallic housing that is connected to PE (i.e. Class I equipment), whereby the protective measures according to HD 60364-4-41:2007, Clause 411 are effective.

The three first following examples describe the recommended location and protection measures against electric shock for SPD assembly used to protect Class II equipment connected to TN, TT and IT power systems.

The forth example is dedicated to special application: metallic street lighting pole.

The SPD used in such installation shall comply with EN 61643-11.

The installation rules described in HD 60364-5-534 shall be applied, and in addition the rules related to surge protection described in CLC/TS 61643-12 are applicable.

A dedicated conductor between the PE and SPD fulfilling the HD 60364-4-41:2007, 411.3.1.1 measures against electric shock is required.

Alternatively, the metal conductive housing itself enclosing the SPD and the Class II equipment, may be used as protective conductors if they simultaneously satisfy the following three requirements:

a) their electrical continuity should be ensured by construction or by suitable connection so as to ensure protection against mechanical, chemical or electrochemical deterioration;

b) they comply with the requirement of minimum cross section area according to HD 60364-5-54:2011, 543.1

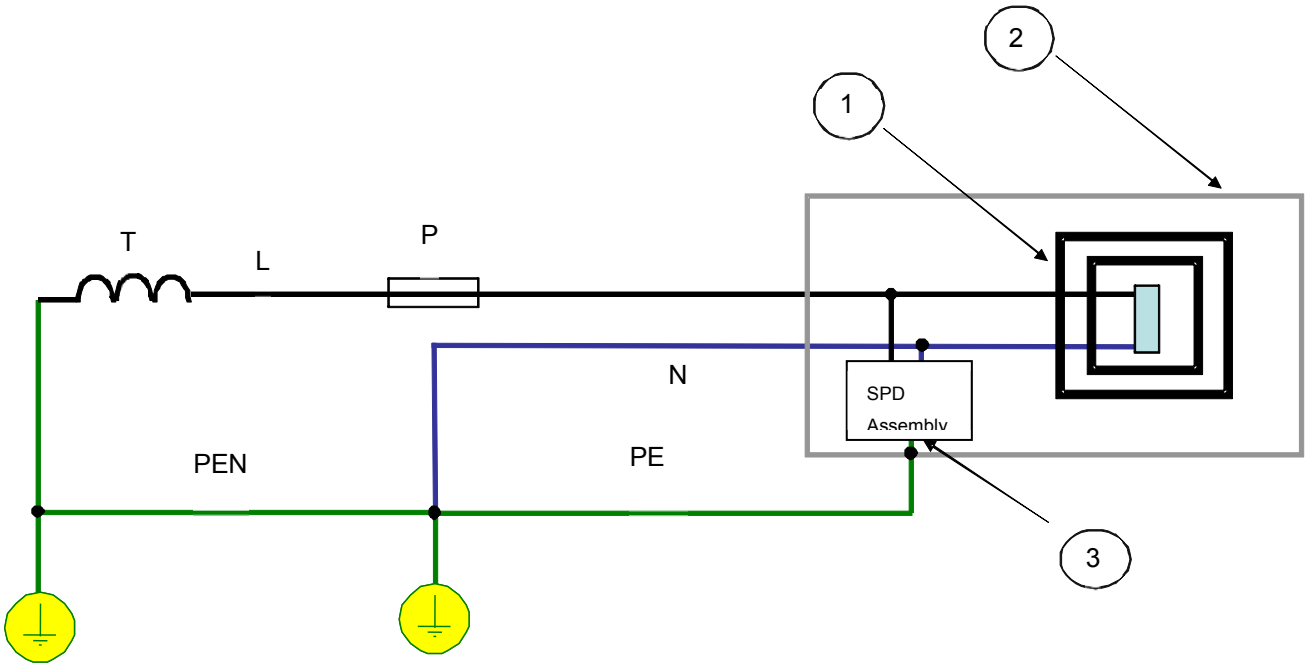
c) they should permit the connection of other protective conductors at every predetermined tap off point.

Additional requirements are given in HD 60364-5-54:2011, 543.2 and 543.3.

Nevertheless, an additional functional bounding connection as short as possible can be used to ensure a better surge protection provided by the SPD.

In the following pictures, the overcurrent protection is only shown if it is required as protective measure against electrical shock.

4.2 TN System



Key

T transformer

P protection measures against electric shock (i.e. Fuse or Breaker). Automatic disconnection according to HD 60364-4-41:2007, 411.4

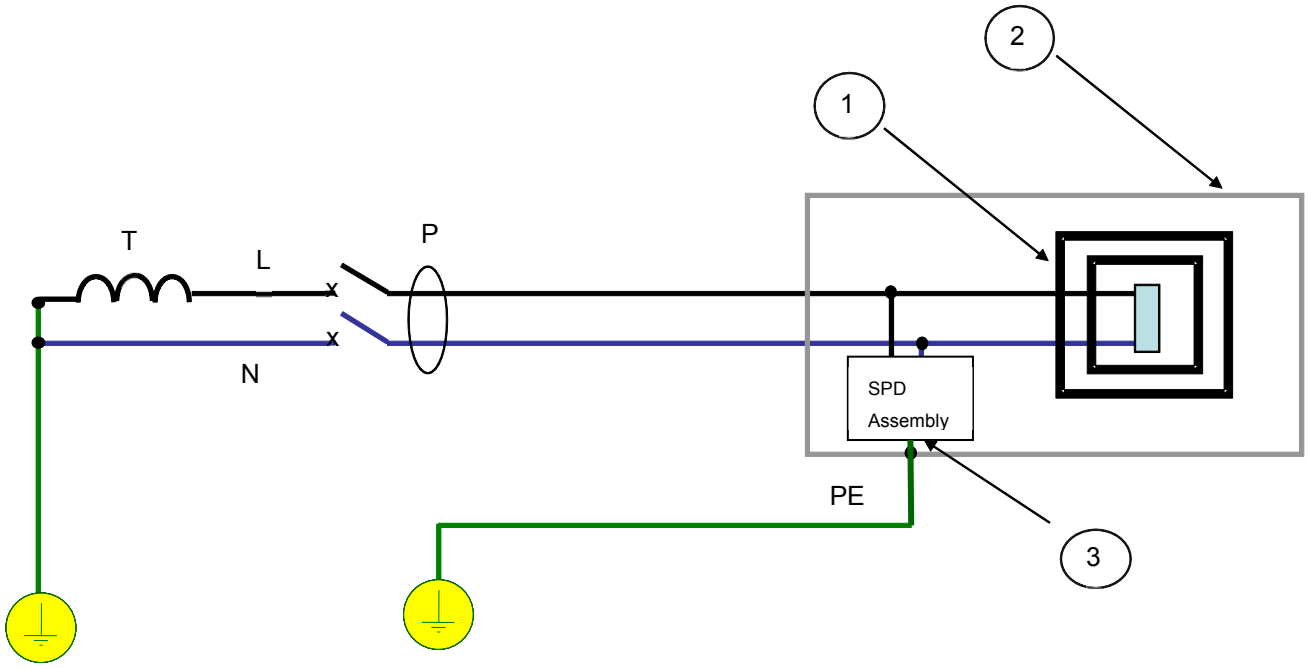
1 class II equipment

2 conductive housing

3 direct connection to PE

Figure 1 — Example of SPDs connected to PE protecting Class II equipments in TN System

4.3 TT System



Key

T transformer

P protection measures against electric shock. (i.e. RCD) Automatic disconnection according to HD 60364-4-41:2007, 411.5

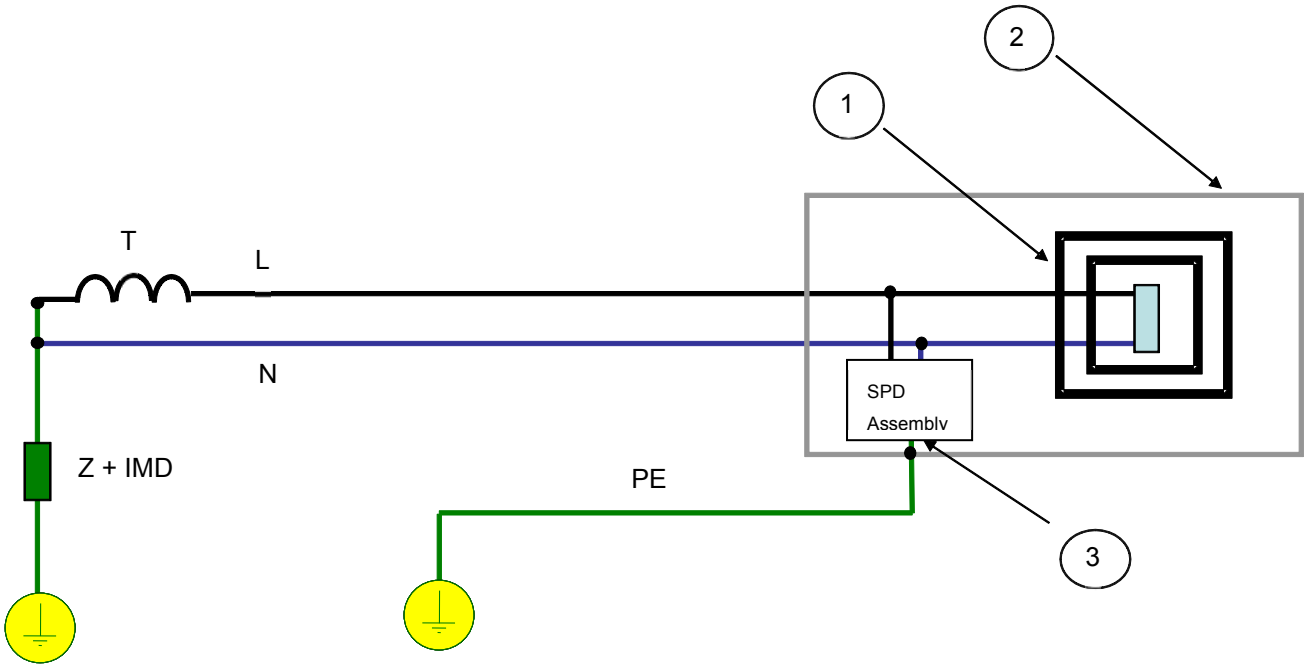
1 class II equipment

2 conductive housing

3 direct connection to PE

Figure 2 — Example of SPDs connected to PE protecting Class II equipments in TT System

4.4 IT System

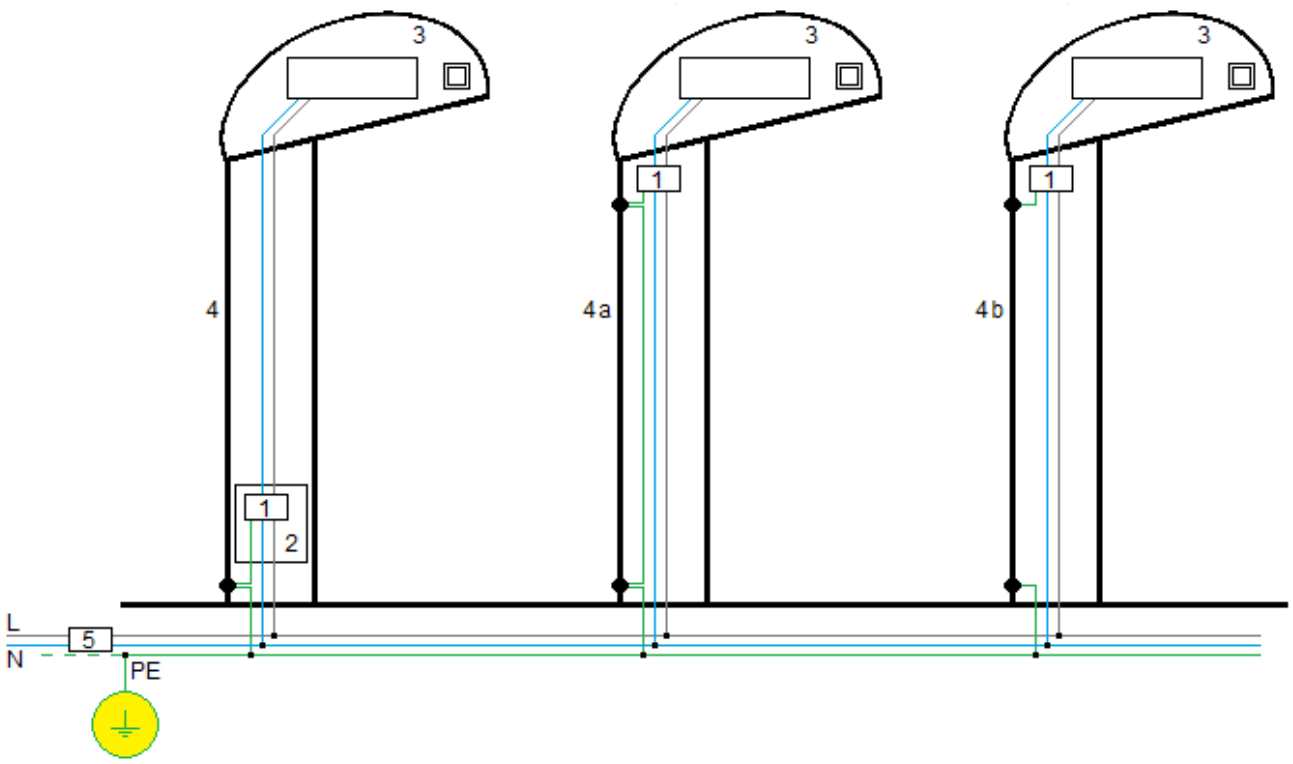


Key

T	transformer
Z	high Impedance
IMD	insulation Monitoring Device
1	class II equipment
2	conductive housing
3	direct connection to PE

Figure 3 — Example of SPDs connected to PE protecting Class II equipments in IT System

4.5 Example of lighting pole surge protection connected to PE



Key

1 SPD
2 Junction box
3 Class II head light (may have a metallic outer surface)
4 Conductive housing (a: not fulfilling and b: fulfilling the PE requirements)
5 Protection measures against electric shock depending on system (See 4.2 and 4.3)

Figure 4 — Example of SPDs connected to PE protecting Class II head luminary

The SPD can be located in connection volume of the Class II head light where double or reinforced insulation is achieved between the SPD and the light head.

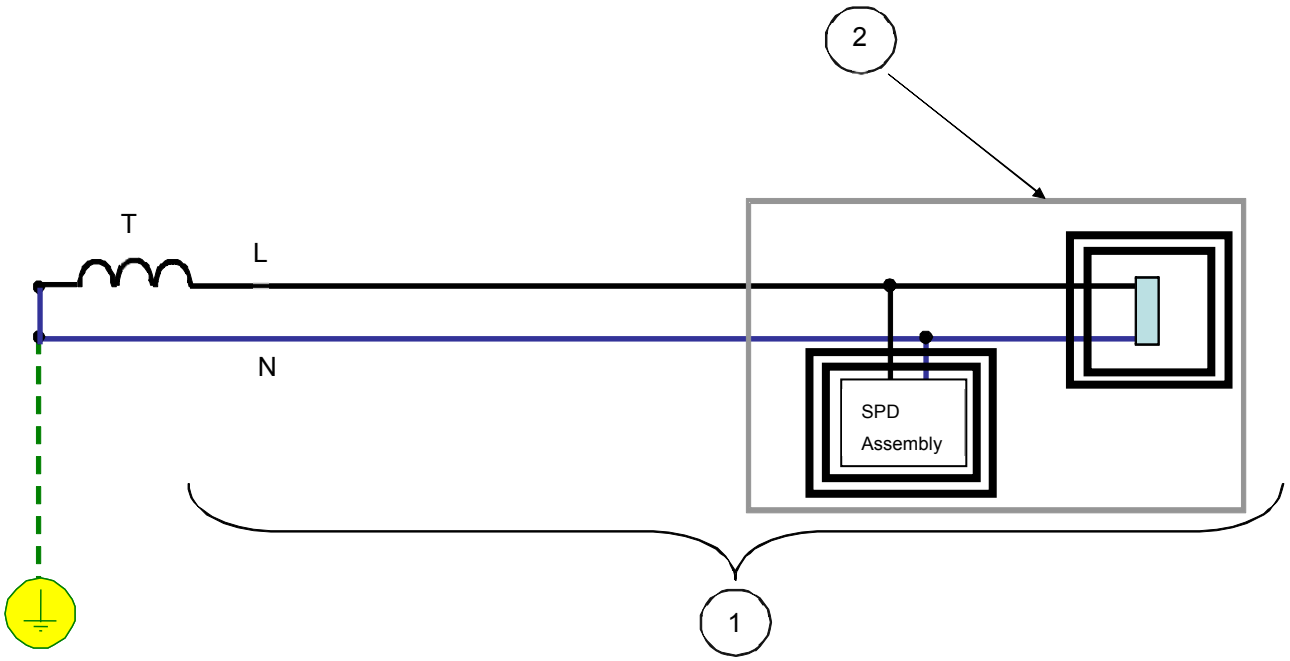
5 SPDs not connected to PE for the protection of Class II equipments

5.1 General

The SPD used in such installation shall comply with EN 61643-11 and in addition should fulfill the requirements from Clause 6 if the SPD itself is not part of the class II equipment.

The installation rules described in HD 60364-5-534 shall be applied, and in addition the rules related to surge protection described in CLC/TS 61643-12 are applicable.

5.2 Examples



Key

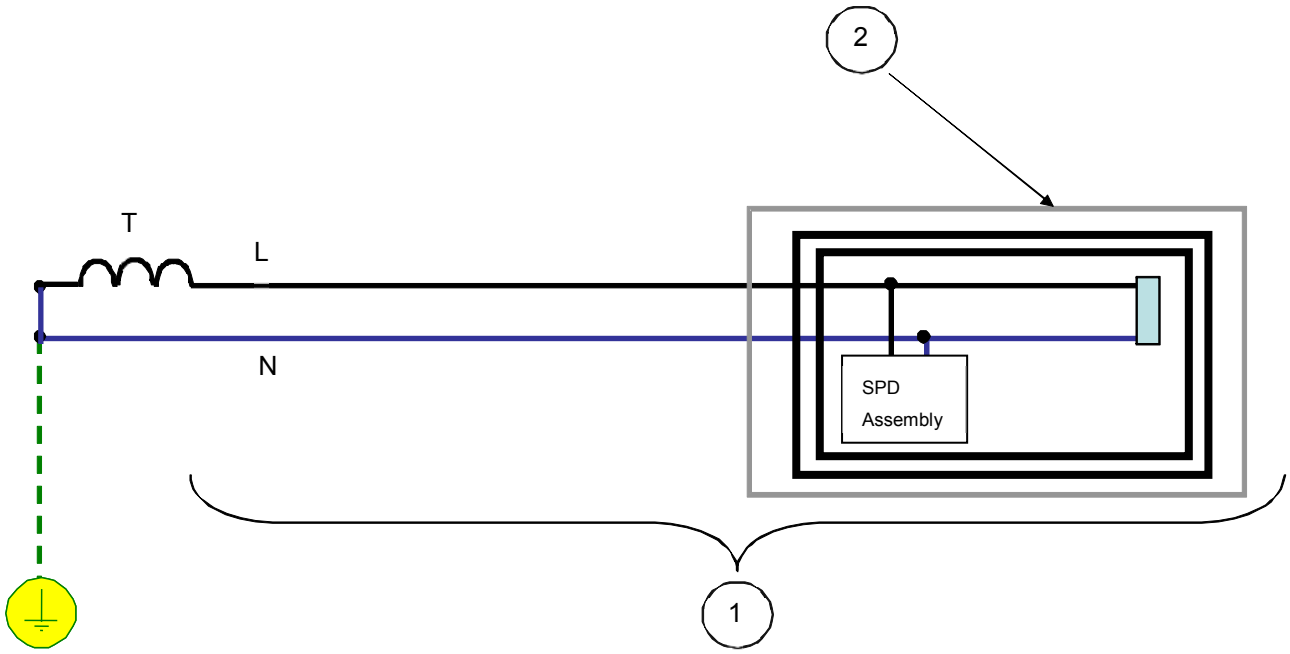
T transformer

1 class II equipment including cable according to HD 60364-4-41:2007, Clause 412. No additional protective measure against electric shock

2 conductive housing may be unintentionally earthed (not a part of class II)

NOTE In this figure, the SPD is mounted into a separate Class II enclosure or provides itself a housing that complies with Class II requirements.

Figure 5 — Example of SPDs to be installed in installation with Class II equipments only (any type of earthing system)



Key

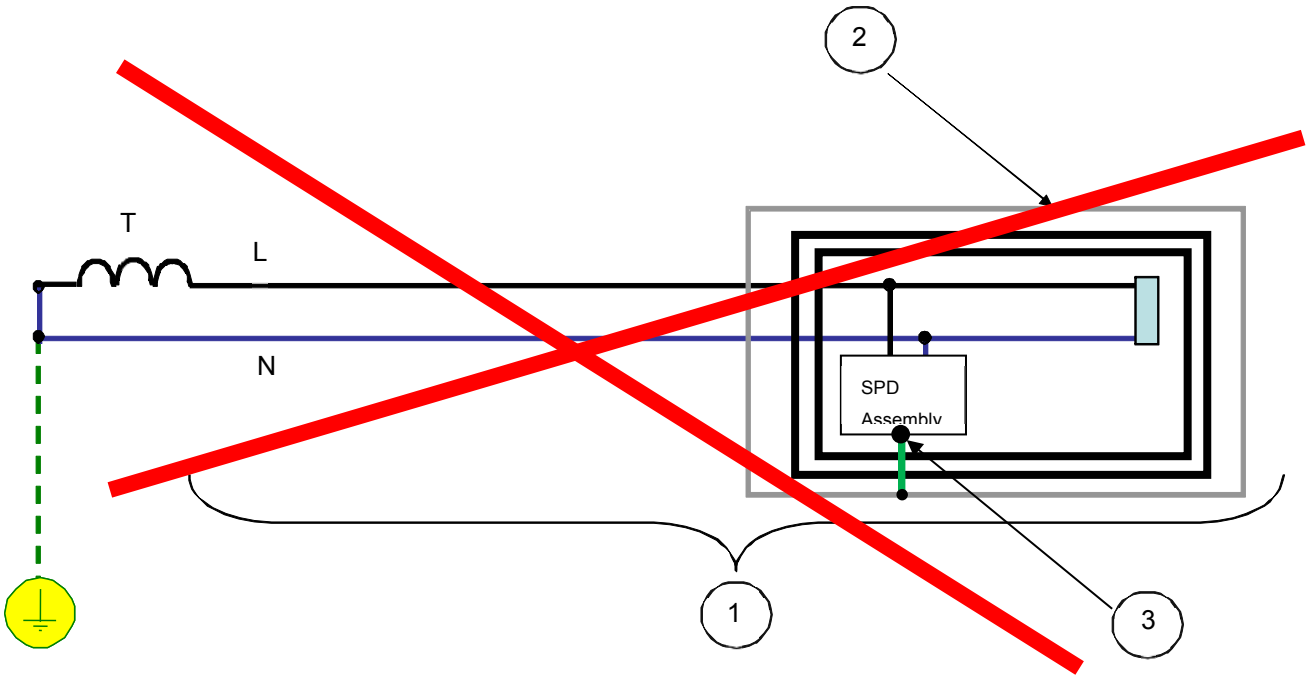
T transformer

1 class II equipment including cable according to HD 60364-4-41:2007, Clause 412. No additional protective measure against electric shock

2 conductive housing may be unintentionally earthed (not a part of class II)

NOTE In this figure, the SPD is mounted into the class II enclosure of the equipment to be protected.

Figure 6 — Example of SPDs to be installed in installation with Class II equipments only (any type of earthing system)



Key

T transformer

1 class II equipment including cable according to HD 60364-4-41:2007, Clause 412. No additional protective measure against electric shock

2 conductive housing may be earthed unintentionally (not a part of class II)

3 PE terminal of the SPD

Figure 7 —Example of SPDs with an unacceptable connection to an extraneous conductive part which itself does not have a definite connection to PE (any type of earthing system)

PE terminal of SPD should not be connected to extraneous conductive parts (e.g. street lighting poles, metal shells of class II luminaires) which themselves are not provided with a reliable connection to PE and protection by automatic disconnection of supply.

Extraneous conductive part of SPD can be connected to other extraneous conductive parts of Class II equipement (e.g. street lighting poles, metal shells of class II luminaires) if the SPD complies with 6.2.1.2 only.

6 Additional requirements for SPDs to comply with equipment class II design rules (Double or reinforced insulation)

6.1 General

Double or reinforced insulation is a protective measure in which

— basic protection is provided by basic insulation, and fault protection is provided by supplementary insulation, or

— basic and fault protection is provided by reinforced insulation between live parts and accessible parts.

NOTE This protective measure is intended to prevent the appearance of dangerous voltage on the accessible parts of electrical equipment through a fault in the basic insulation.

The protective measure by double or reinforced insulation is applicable in all situations, unless some limitations are given in the corresponding Part 7 of HD 60364 or HD 384. Installation rules of HD 60364 apply.

6.2 Requirements for basic protection (protection against direct contact) and fault protection (protection against indirect contact)

6.2.1 Class II SPD

6.2.1.1 General

Where the protective measure double or reinforced insulation is used for SPD or SPD assembly these should comply with the following requirements.

6.2.1.2 Double and reinforced insulation

6.2.1.2.1 General requirements

Double or reinforced insulation applies between any touchable surfaces and internal live parts.

Creepage distance for doubled insulation is the sum of the values of the basic and of the supplementary insulation which make up the double insulation system.

Creepage distance for reinforced insulation shall be twice the creepage distances for basic insulation according to EN 61643-11:2012, Table 16 for a.c. SPDs or EN 50539-11:2013, Table 13.

Air clearance for double or reinforced insulation shall be twice the air clearance for basic insulation requested from EN 60664-1.

This applies to wiring connecting the SPD as well.

Such SPDs or SPD assemblies, should be marked by the symbol ⧈ (see pictogram IEC 60417-5172 for Class II equipment).

6.2.1.2.2 Touchable conductive part of class II SPDs

Accessible conductive parts should be separated by double or reinforced insulation, e.g. live parts and the body or primary and secondary circuits.

For the bridging of double or reinforced insulation, refer to EN 62368-1 or EN 60950-1.

6.2.1.2.3 Compliance shall be ensured with the degree of protection against electric shock in accordance with IP2XC according to EN 60529

Compliance is checked by inspection and measurement using the relevant probe.

6.2.1.2.4 It should not be possible to remove Parts of class II SPD which serve as supplementary insulation or reinforced insulation without a tool

Compliance is checked by inspection and by manual test.

Lining metal enclosures with a coating of lacquer or with any other material in the form of a coating which can be easily removed by scraping is not considered to meet this requirement.

6.2.1.3 SPDs having basic insulation only should have supplementary insulation applied externally to the SPD and the supplementary insulation should comply with 6.2.2

Such SPDs should not be marked with the symbol ⧈.

SPDs or SPD assembly having uninsulated live parts should have reinforced insulation applied in the process of installation complying with 6.2.2; such insulation being recognized only where constructional features prevent the application of double insulation.

NOTE The symbol  will preferably be fixed in a visible position on the exterior and interior of the enclosure. See pictogram IEC 60417–5019: Protective earth (ground).

6.2.2 Enclosures

The SPD or SPD assembly should be contained in an insulating enclosure affording at least the degree of protection IPXXB or IP2X.

The following requirements apply as specified:

— the insulating enclosure should not be traversed by conductive parts likely to transmit a potential and

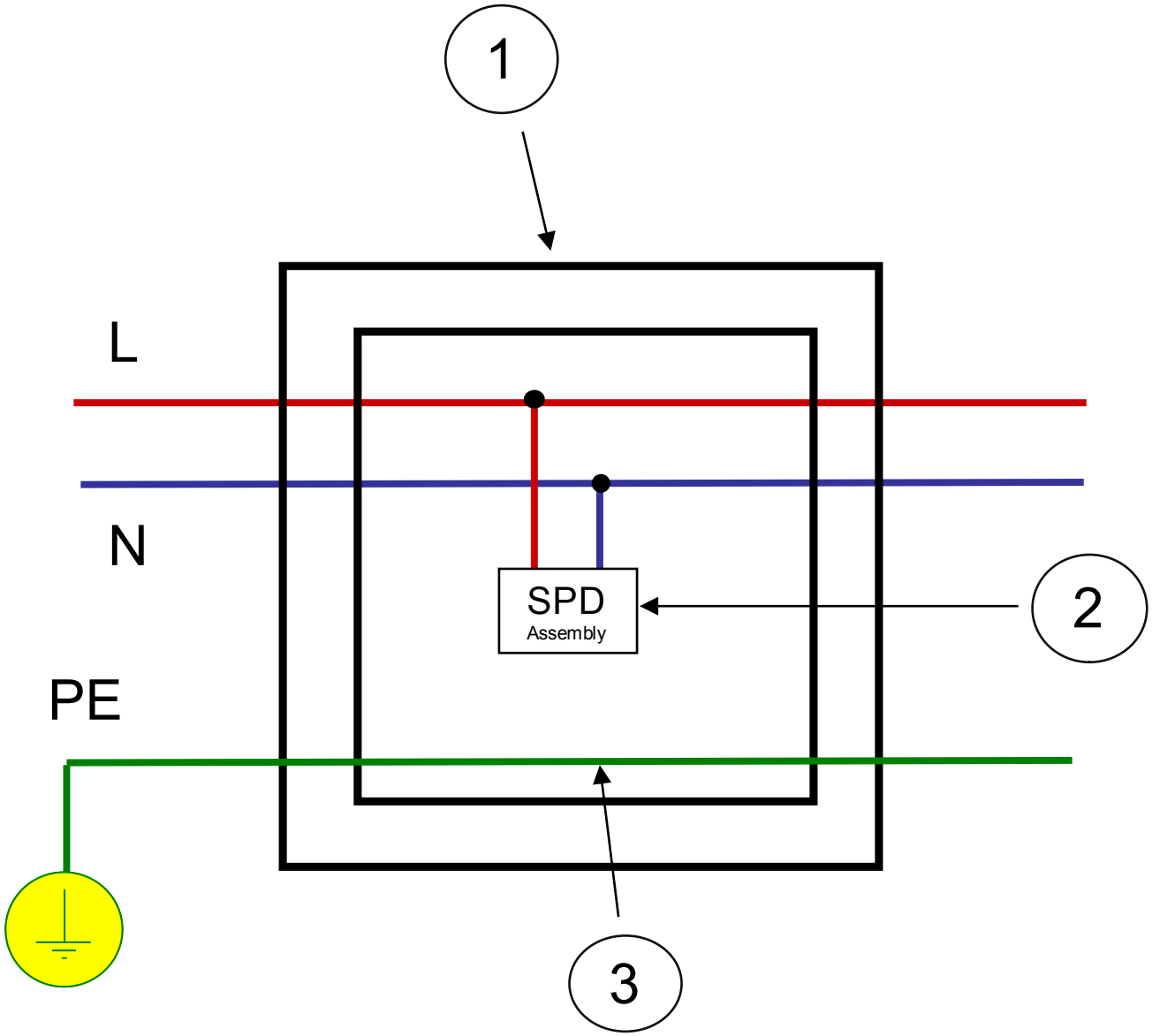
— the insulating enclosure should not contain any screws or other fixing means of insulating material which might need to be removed, or are likely to be removed, during installation and maintenance and whose replacement by metallic screws or other fixing means could impair the enclosure`s insulation.

Where parts or covers in the insulating enclosure can be removed without the use of a tool or key, all conductive parts which are accessible if these parts or covers are removed should be behind an insulating barrier (providing a degree of protection not less than IPXXB or IP2X) preventing persons from coming unintentionally into contact with those conductive parts. This insulating barrier should be removable only by use of a tool or key.

As shown in Figure 8, provision may be made for connecting protective conductors in order to serve other items of electrical equipment whose supply circuit also runs through the enclosure. Inside the enclosure, PE conductors entering the enclosure and their terminals should be insulated as though they were live parts, and their terminals should be marked as PE terminals. Internal circuitry of the SPD should not be connected to such PE terminal.

Exposed-conductive-parts and intermediate parts should not be connected to a protective conductor.

The enclosure should not adversely affect the operation of the equipment protected in this way.



Key

1 class II Enclosure
2 class I SPD
3 run-through Protective Conductor (PE)

Figure 8 — Class I SPD in Class II enclosure with run-through PE

Annex A
(normative)

Test to establish whether a conductive part may cause an electric shock

A.1 General

In order to determine whether a conductive part is a live part which may cause an electric shock, the SPD is operated at rated supply voltage and nominal frequency and the following tests are conducted:

A.2 In order to determine whether a conductive part is a live part which may cause an electric shock, the device under test (DUT) is operated at rated voltage and nominal supply frequency. A conductive part is not a live part if the requirements of A.3 or A.4 are met.

NOTE The purpose of this annex is to establish if a conductive part may cause an electric shock, if touched. It does not give response about the kind and level of insulation used.

For the tests according A.3 and A.4

One pole of the supply of the DUT should be at earth potential.

If no explicit designation of the supply voltage polarity is marked on the DUT, the test is done with both supply voltage polarities.

The measurements are proceeded

- between the part concerned and any accessible conductive part;
- between the part concerned and earth.

A.3 The voltage is measured by using a measuring circuit consisting of a non-inductive resistance of 50 kΩ.

The voltage should not exceed 35 V a.c. peak or 60 V ripple free d.c.

A.4 Where the voltage measured according A.3 exceeds the limit value, the touch-current should not exceed:

- for a.c.: 0,7 mA (peak)
- for d.c.: 2,0 mA

Compliance is checked by using the measuring network from Figure A.1.

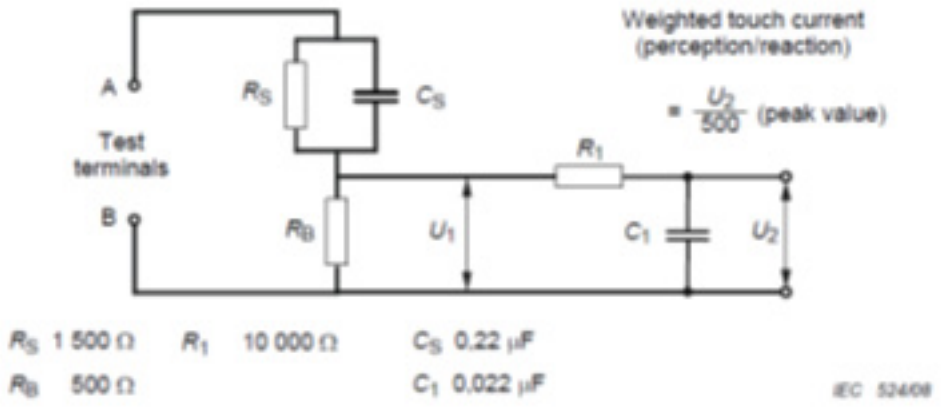


Figure A.1 — Measuring network, touch current weighted for perception or reaction

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