IEC 61643-12

Edition 3.0 2020-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Low-voltage surge protective devices –
Part 12: Surge protective devices connected to low-voltage power systems – Selection and application principles

Parafoudres à basse tension –
Partie 12: Parafoudres connectés aux réseaux à basse tension – Principes de choix et de mise en œuvre

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LOW-VOLTAGE SURGE PROTECTIVE DEVICES –

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FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 61643-12 has been prepared by subcommittee 37A: Low-voltage surge protective devices, of IEC technical committee 37: Surge arresters.

This third edition cancels and replaces the second edition published in 2008. This edition constitutes a technical revision.

NOTE The following differing practice of a less permanent nature exists in the USA: In the USA, SPDs tested to Class I tests are not required. This exception applies to the entire document.

This edition includes the following significant technical changes with respect to the previous edition:

a) Scope: Deleted reference to 1 500 V dc
b) Added or revised some definitions
c) Added new clause 4 on Need for protection

d) Added new information on disconnecting devices
e) Revised Characteristics of SPD
f) Revised List of parameters for SPD selection
g) Added new information on Measured Limiting Voltage
h) Added or revised some Annexes

The text of this International Standard is based on the following documents:

FDIS	Report on voting
37A/341/FDIS	37A/347/RVD

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61643 series, published under the general title *Low-voltage surge protective devices*, can be found on the IEC website.

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

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

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

0.1 General

Surge protective devices (SPDs) are used to protect, under specified conditions, electrical systems and equipment against various overvoltages and impulse currents, such as lightning and switching surges.

SPDs shall be selected according to their environmental conditions and the acceptable failure rate of the equipment and the SPDs.

This document provides information to the user about characteristics useful for the selection of an SPD.

This document provides information to evaluate the need for using SPDs in low-voltage systems, with reference to IEC 62305, Parts 1 to 4 and the IEC 60364 series. It also provides information on selection and coordination of SPDs, while taking into account the entire environment in which they are applied. Examples include: equipment to be protected and system characteristics, insulation levels, overvoltages, method of installation, location of SPDs, coordination of SPDs, end of life behaviour of SPDs and equipment failure consequences.

IEC 62305-2 provides a general method for evaluating the risk due to surges and lightning. IEC 60364-4-44 provides a simplified way of evaluating the risk posed to electrical installations.

Guidance on requirements for product insulation coordination is provided by IEC 60664 series. Requirements for safety (fire, overcurrent and electric shock) and installation are provided by IEC 60364 series.

The IEC 60364 series provide direct information for contractors on the installation of SPDs. IEC TR 62066 contains more information on the scientific background of surge protection.

0.2 Keys to understanding the structure of this document

The list below summarizes the structure of this document and provides a summary of the information covered in each clause and annex. The main clauses provide basic information on the factors used for SPD selection. Readers who wish to obtain more detail on the information provided in Clauses 4 to 7 should refer to the relevant annexes.

Clause 1 describes the scope of this document.

Clause 2 lists the normative references where additional information may be found.

Clause 3 provides definitions useful for the understanding of this document.

Clause 4 is an introduction to the risk of surges (considerations of when the use of SPDs is beneficial).

Clause 5 addresses the parameters of systems and equipment important for SPD selection. In addition to the stresses created by lightning, those created by the network itself are described, namely temporary overvoltages and switching surges.

Clause 6 lists the electrical parameters for the selection of an SPD and provides explanations regarding these parameters. These are related to those given in IEC 61643-11.

Clause 7 is the core of this document. It relates the stresses coming from the network (as discussed in Clause 5) to the characteristics of the SPD (as discussed in Clause 6). It also outlines how the protection by SPDs may be affected by its installation. The different steps for the selection of an SPD are presented, including coordination when more than one SPD is used in an installation (details about SPD coordination may be found in Annex F).

Annex A deals with information given with inquiries and explains the testing procedures used in IEC 61643-11.

Annex B provides examples of the relationship between two important parameters of SPDs, U_c and U_p, in the specific case of Metal Oxide Varistors (MOV) and also examples of the relationship between U_c and the nominal voltage of the network.

Annex C supplements the information given in Clause 5 on surge voltages in low-voltage systems.

Annex D deals with the sharing of lightning current between different earthing systems used to determine the SPD rating in case of direct lightning current.

Annex E deals with temporary overvoltages due to faults in the high-voltage system.

Annex F supplements the information given in Clause 7 on coordination rules when more than one SPD is used in a system.

Annex G provides specific examples on the use of this document.

Annex H provides specific examples of the use of the risk analysis given in Clause 4.

Annex I supplements the information given in Clause 5 about system stresses.

Annex J supplements the information given in Clause 7 on the application of SPDs in various low-voltage systems criteria for selection of SPDs.

Annex K discusses differences between immunity level and insulation withstand of electrical equipment.

Annex L provides practical examples of SPD installation as used in some countries.

Annex M discusses problems of coordination with equipment having both signaling and power terminals.

Annex N provides information on withstand of fuses in surge conditions.

Annex O provides practical methods for testing system level immunity.

Annex P provides test application to SPDs with multiple components.

LOW-VOLTAGE SURGE PROTECTIVE DEVICES –

Part 12: Surge protective devices connected to low-voltage power systems – Selection and application principles

1 Scope

This part of IEC 61643 describes the principles for the selection, operation, location and coordination of SPDs to be connected to 50/60 Hz AC power circuits, and equipment rated up to 1 000 V RMS.

These devices contain at least one non-linear component and are intended to limit surge voltages and divert surge currents.

NOTE 1 Additional requirements for special applications are also applicable, If required.

NOTE 2 IEC 60364 and IEC 62305-4 are also applicable.

NOTE 3 This document deal only with SPDs and not with surge protection components (SPC) integrated inside equipment.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60364-4-44:2007, *Low-voltage electrical installations – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances*

IEC 60364-5-53, *Low-voltage electrical installations – Part 5-53: Selection and erection of electrical equipment – Devices for protection for safety, isolation, switching, control and monitoring*

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

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

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

IEC 61643-32, *Low-voltage surge protective devices – Part 32: Surge protective devices connected to the d.c. side of photovoltaic installations – Selection and application principles*

IEC 61643-11:2011, *Low-voltage surge protective devices – Part 11: Surge protective devices connected to low-voltage power systems – Requirements and test methods*

IEC 62305-1:2010, *Protection against lightning – Part 1: General principles*

IEC 62305-2, *Protection against lightning – Part 2: Risk management*

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

IEC 62475:2010, *High-current test techniques – Definitions and requirements for test currents and measuring systems*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

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: IEC 61643-11:2011, 3.1.1]

3.1.2
continuous operating current
I_c
current flowing through each mode of protection of the SPD when energized at the maximum continuous operating voltage (U_c) for each mode

3.1.3
maximum continuous operating voltage
U_c
Maximum RMS voltage which may be continuously applied to the SPD's mode of protection

Note 1 to entry The U_c value covered by this document may exceed 1 000 V.

[SOURCE: IEC 61643-11:2011, 3.1.11]

3.1.4
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 is equal or exceed 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 II and/or I, respectively;
- the measured limiting voltage up to U_{OC} determined for the combination wave generator for test Class III.

[SOURCE: IEC 61643-11:2011, 3.1.14, modified note to entry]