

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Low voltage surge protective devices –  
Part 21: Surge protective devices connected to telecommunications and  
signalling networks – Performance requirements and testing methods**

**Parafoudres basse tension –  
Partie 21: Parafoudres connectés aux réseaux de signaux et de  
télécommunications – Prescriptions de fonctionnement et méthodes d'essais**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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### LOW VOLTAGE SURGE PROTECTIVE DEVICES –

#### **Part 21: Surge protective devices connected to telecommunications and signalling networks – Performance requirements and testing methods**

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**A vertical line in the margin shows where the base publication has been modified by amendments 1 and 2.**

International Standard IEC 61643-21 has been prepared by subcommittee 37A: Low-voltage surge protective devices, of IEC technical committee 37: Surge arresters.

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## INTRODUCTION

The purpose of this International Standard is to identify the requirements for Surge Protective Devices (SPDs) used in protecting telecommunication and signalling systems, for example, low-voltage data, voice, and alarm circuits. All of these systems may be exposed to the effects of lightning and power line faults, either through direct contact or induction. These effects may subject the system to overvoltages or overcurrents or both, whose levels are sufficiently high to harm the system. SPDs are intended to provide protection against overvoltages and overcurrents caused by lightning and power line faults. This standard describes tests and requirements which establish methods for testing SPDs and determining their performance.

The SPDs addressed in this International Standard may contain overvoltage protection components only, or a combination of overvoltage and overcurrent protection components. Protection devices containing overcurrent protection components only are not within the coverage of this standard. However, devices with only overcurrent protection components are covered in annex A.

An SPD may comprise several overvoltage and overcurrent protection components. All SPDs are tested on a "black box" basis, i.e., the number of terminals of the SPD determines the testing procedure, not the number of components in the SPD. The SPD configurations are described in 1.2. In the case of multiple line SPDs, each line may be tested independently of the others, but there may also be a need to test all lines simultaneously.

This standard covers a wide range of testing conditions and requirements; the use of some of these is at the discretion of the user. How the requirements of this standard relate to the different types of SPD is described in 1.3. Whilst this is a performance standard and certain capabilities are demanded of the SPDs, failure rates and their interpretation are left to the user. Selection and application principles are covered in IEC 61643-22.

If the SPD is known to be a single component device, it has to meet the requirements of the relevant standard as well as those in this standard. 2000

## LOW VOLTAGE SURGE PROTECTIVE DEVICES –

### Part 21: Surge protective devices connected to telecommunications and signalling networks – Performance requirements and testing methods

#### 1 General

##### 1.1 Scope

This International Standard is applicable to devices for surge protection of telecommunications and signalling networks against indirect and direct effects of lightning or other transient overvoltages.

The purpose of these SPDs is to protect modern electronic equipment connected to telecommunications and signalling networks with nominal system voltages up to 1 000 V (r.m.s.) a.c. and 1 500 V d.c.

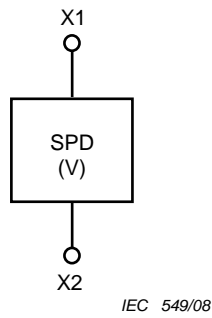
##### 1.2 SPD configurations

The SPD configurations described in this standard are shown in figure 1. Each SPD configuration is composed of one or more voltage-limiting components and may include current-limiting components.

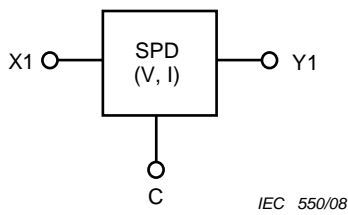
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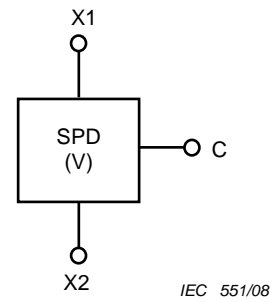
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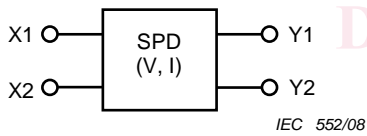
**Figure 1a – Two-terminal SPD**



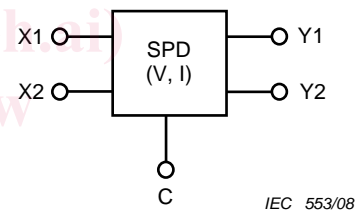
**Figure 1b – Three-terminal SPD**



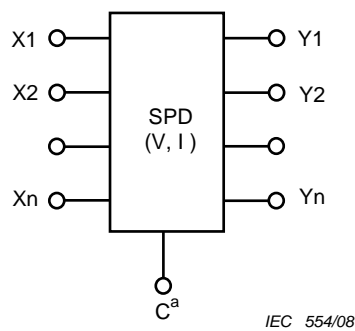
**Figure 1c – Three-terminal SPD**



**Figure 1d – Four-terminal SPD**



**Figure 1e – Five-terminal SPD**



**Figure 1f – Multi-terminal SPD**

<sup>a</sup> The common terminal C may not be provided.

**Key**

- V            voltage-limiting component
- V, I        voltage-limiting components or a combination of voltage-limiting and current-limiting components
- X1, X2...Xn line terminals
- Y1, Y2...Yn protected line terminals
- C            common terminal

**Figure 1 – SPD configurations**

### 1.3 Use of this standard

This standard considers two basic types of SPD.

The first type of SPD contains at least one voltage-limiting component and no current-limiting component(s) in a housing. All the SPD configurations of figure 1 can be of this type. These SPDs shall satisfy the requirements of 5.1, 5.2.1 and 5.3 (see table 1). The SPDs shown in figures 1b, 1d, 1e and 1f may contain a linear component between the line terminal and the corresponding protected line terminal. These SPDs shall also satisfy the applicable requirements of 5.2.2.

The second type of SPD contains both voltage-limiting and current-limiting components in a housing. SPD configurations shown in figures 1b, 1d, 1e, and 1f are applicable for SPDs with both voltage-limiting and current-limiting components. This type of SPD shall satisfy the requirements of 5.1, 5.2.1, 5.2.2 and 5.3 (see table 1). Configurations of protective devices having only current-limiting components are covered in annex A.

SPDs may need to satisfy additional requirements depending on the application. The additional requirements are described in 5.2.3 and 5.4 (see table 1).

Subclause 5.2.3 provides transmission tests that SPDs may need to conform to, depending on their communication and signalling application. Selection of the applicable transmission tests from 5.2.3 shall be made, based on the intended application of the SPDs. Table 1 provides general guidance on how to select the applicable transmission tests.

Subclause 5.4 provides the environmental requirements when the SPDs are intended only for use in uncontrolled environments as described in 4.1. SPDs shall satisfy these requirements after an agreement between the user and the manufacturer. Table 1 provides examples of what requirements different types of SPD shall satisfy.

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Table 1 – General SPD requirements

Test series <sup>d</sup>	Requirement – Test	Sub-clause	Type of SPD					
			SPD with only voltage-limiting function	SPD with both voltage-limiting and current-limiting functions	SPD with voltage-limiting function and linear component between its terminals	SPD having both voltage-limiting and current-limiting functions with enhanced transmission capabilities	SPD having only voltage-limiting function but intended for use in extended range environment	SPD having both voltage-limiting and current-limiting functions but intended for use in extended range environment
1	<b>General test</b>	6.1						
	Identification and documentation	6.1.1	A	A	A	A	A	A
	Marking	6.1.2	A	A	A	A	A	A
	<b>Transmission tests</b>	6.2.3						
	Capacitance	6.2.3.1	A	O	O	O	A	O
	Insertion loss	6.2.3.2	O	A	A	A	O	A
	Return loss	6.2.3.3	O	O	O	A	O	O
	Longitudinal balance	6.2.3.4	O	O	O	A	O	O
	Bit Error Ratio (BER)	6.2.3.5	O	O	O	O	O	O
	Near-end crosstalk (NEXT)	6.2.3.6	O	O	O	A	O	O
	<b>Mechanical tests</b>	6.3						
	Terminals and connectors	6.3.1	A	A	A	A	A	A
	General testing procedure	6.3.1.1	A	A	A	A	A	A
	Terminals with screws	6.3.1.2	A	A	A	A	A	A
	Screwless terminals	6.3.1.3	A	A	A	A	A	A
	Insulating pierced connections	6.3.1.4	A	A	A	A	A	A
	Pull-out-test on SPD terminals designed for single-core conductors	6.3.1.4.1	A	A	A	A	A	A
	Pull-out-test on SPD terminals designed for multi-core cables and cords	6.3.1.4.2	A	A	A	A	A	A
	Mechanical strength (mounting)	6.3.2	A	A	A	A	A	A

Table 1 (continued)

Test series <sup>d</sup>	Requirement – Test	Sub-clause	Type of SPD					
			SPD with only voltage-limiting function	SPD with both voltage-limiting and current-limiting functions	SPD with voltage-limiting function and linear component between its terminals	SPD having both voltage-limiting and current-limiting functions with enhanced transmission capabilities	SPD having only voltage-limiting function but intended for use in extended range environment	SPD having both voltage-limiting and current-limiting functions but intended for use in extended range environment
	Resistance to ingress of solid objects and to harmful ingress of water	6.3.3	A	A	A	A	A	A
	Protection against direct contact	6.3.4	A	A	A	A	A	A
	Fire resistance	6.3.5	A	A	A	A	A	A
	<b>Environmental tests</b>	6.4						
	High temperature and humidity endurance	6.4.1	O	O	O	O	A	A
	Environmental cycling with impulse surges	6.4.2	O	O	O	O	A	A
	Environmental cycling with AC surges	6.4.3	O	O	O	O	A	A
2	<b>Voltage limiting tests</b>	6.2.1						
	Maximum continuous operating voltage (U <sub>c</sub> )	6.2.1.1	A	A	A	A	A	A
	Insulation resistance	6.2.1.2	A	A	A	A	A	A
	Impulse durability for voltage limiting function <sup>a</sup>	6.2.1.6	A	A	A	A	A	A
	Impulse-limiting voltage <sup>b</sup>	6.2.1.3	A	A	A	A	A	A
	Impulse reset switching types	6.2.1.4	A	A	A	A	A	A
	AC durability for voltage limiting function <sup>a</sup>	6.2.1.5	O	O	O	O	O	O
	Blind spot test multi stage SPD	6.2.1.8	A	A	A	A	A	A
	Overstressed fault mode	6.2.1.7	O	O	O	O	O	O
3	<b>Current limiting tests</b>	6.2.2						
	Rated current	6.2.2.1	A <sup>e</sup>	A	A	A	A <sup>e</sup>	A
	Series resistance	6.2.2.2	N.A.	A	A	A	N.A.	A
	Current response time	6.2.2.3	N.A.	A	N.A.	A <sup>c</sup>	N.A.	A <sup>c</sup>
	Current reset time	6.2.2.4	N.A.	A	N.A.	A <sup>c</sup>	N.A.	A <sup>c</sup>
	Maximum interrupting voltage	6.2.2.5	N.A.	A	N.A.	A <sup>c</sup>	N.A.	A <sup>c</sup>
	Operating duty test	6.2.2.6	N.A.	A	N.A.	A <sup>c</sup>	N.A.	A <sup>c</sup>
	AC durability for current limiting function <sup>a</sup>	6.2.2.7	N.A.	A	N.A.	A <sup>c</sup>	N.A.	A <sup>c</sup>
	Impulse durability for current limiting function <sup>a</sup>	6.2.2.8	N.A.	A	N.A.	A <sup>c</sup>	N.A.	A <sup>c</sup>
4	<b>Acceptance tests</b>	6.5	O	O	O	O	O	O