IEC 61643-21

Edition 1.0 2008-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 1
AMENDEMENT 1

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

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:
Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

- Catalogue des publications de la CEI: www.iec.ch/searchpub/cur_fut-f.htm

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,…). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: www.iec.ch/online_news/justpub

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: www.iec.ch/webstore/custserv/custserv_entry-f.htm

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:
Email: csc@iec.ch
Tél.: +41 22 919 02 11
Fax: +41 22 919 03 00

IEC 61643-21

Edition 1.0 2008-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 1
AMENDEMENT 1

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

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

PRICE CODE
CODE PRIX S

ICS 29.240; 29.240.10

ISBN 2-8318-9731-9

FOREWORD

This amendment has been prepared by subcommittee 37A: Low-voltage surge protective devices, of IEC technical committee 37: Surge arresters.

The text of this amendment is based on the following documents:

FDIS	Report on voting
37A/200/FDIS	37A/201/RVD

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

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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

Page 3

CONTENTS

Delete, on page 5, the title of Annexes B and C, and replace each by "Void".

Add the following new Annexes D and E:

Page 9

FOREWORD

Delete the references to the annexes.

Page 15

Replace the existing Figures 1a, 1b, 1c, 1d, 1e and 1f with the following new figures:

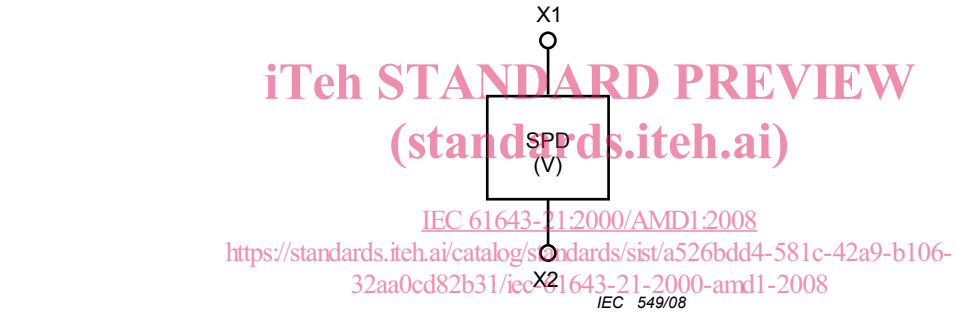


Figure 1a – Two-terminal SPD

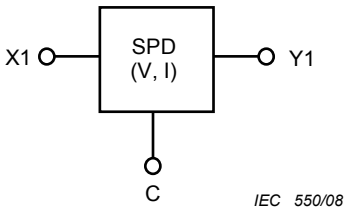


Figure 1b – Three-terminal SPD

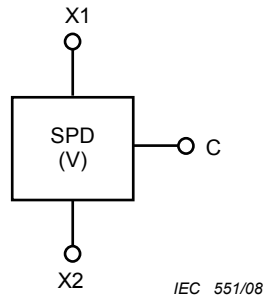


Figure 1c – Three-terminal SPD

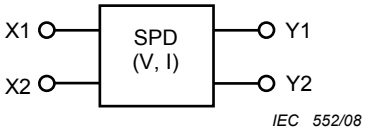


Figure 1d – Four-terminal SPD

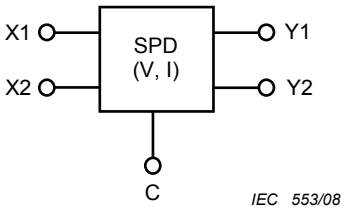
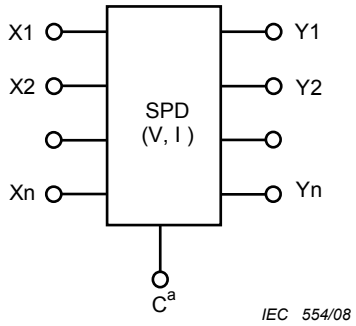


Figure 1e – Five-terminal SPD



[a] The common terminal C may not be provided.

Figure 1f – Multi-terminal SPD

Page 17

1.3 Use of this standard

Replace the existing fifth paragraph by the following:

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.

Delete the last line of this subclause.

Replace, on page 19, the existing Table 1 with the following new Table 1:

Table 1 – General SPD requirements

Test series [4]	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 intends for use in extended range environment
1	**General test**	6.1						
	Identification and documentation	6.1.1	A	A	A	A	A	A
	Marking	6.1.2	A	A	A	A	A	A
	Transmission tests	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
	Mechanical tests	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 [4]	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 intends 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
	Environmental tests	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 a.c. surges	6.4.3	O	O	O	O	A	A
2	**Voltage limiting tests**	6.2.1						
	Maximum continuous operating voltage (Uc)	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 [1]	6.2.1.6	A	A	A	A	A	A
	Impulse-limiting voltage [2]	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 [1]	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	A	A	A	A	A	A
3	**Current limiting tests**	6.2.2						
	Rated current	6.2.2.1	N.A.	A	A	A	N.A.	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 [3]	N.A.	A [3]
	Current reset time	6.2.2.4	N.A.	A	N.A.	A [3]	N.A.	A [3]
	Maximum interrupting voltage	6.2.2.5	N.A.	A	N.A.	A [3]	N.A.	A [3]
	Operating duty test	6.2.2.6	N.A.	A	N.A.	A [3]	N.A.	A [3]
	AC durability for current limiting function [1]	6.2.2.7	N.A.	A	N.A.	A [3]	N.A.	A [3]
	Impulse durability for current limiting function [1]	6.2.2.8	N.A.	A	N.A.	A [3]	N.A.	A [3]
4	**Acceptance tests**	6.5	O	O	O	O	O	O

A Applicable.
N.A. Not applicable.
O Optional.
[1] For each category of test impulse a new set of samples can be used.
[2] It is admissible to measure the impulse-limiting voltage 6.2.1.3 while testing impulse durability 4.2.1.6.
[3] Test not applicable if there is a linear component between its terminals.
[4] Each test series is carried out on three samples.

2 Normative references

Add the following new references:

IEC 61643-22:2004, *Low-voltage surge protective devices – Part 22: Surge protection devices connected to telecommunications and signalling networks – Selection and application principles*

ITU-T Recommendation K.55:2002, *Overvoltage and overcurrent requirements for insulation displacement connectors (IDC) terminations*

ITU-T Recommendation K.65:2004, *Overvoltage and overcurrent requirements for termination modules with contacts for test ports or SPDs*

ITU-T Recommendation O.9:1999, *Measuring arrangements to assess the degree of unbalance about earth*

Delete, on page 21, the dates from the following references:

IEC 60529, IEC 61000-4-5, IEC 61083-1 and IEC 61643-1.

Delete the following reference:

ITU-T Recommendation K.17:1988, *Tests on power-fed repeaters using solid-state devices in order to check the arrangements for protection from external interference*

3 Definitions

Replace, the existing definitions 3.8, 3.10, 3.14, 3.15 and 3.22 by the following new definitions:

3.8
surge protective device
SPD
device that restricts the voltage of a designated port or ports, caused by a surge, when it exceeds a predetermined level

NOTE 1 Secondary functions may be incorporated, such as a current-limiting to restrict a terminal current.

NOTE 2 Typically the protective circuit has at least one non-linear voltage-limiting surge protective component.

NOTE 3 An SPD is a complete assembly, having terminals to connect to the circuit conductors.

3.10
current limiting
action of an SPD, containing at least one non-linear current-limiting component, that causes currents exceeding a predetermined value to be restricted

3.14
voltage clamping type SPD
SPD that has high shunt impedance and will have a continuous reduction in impedance with increasing current in response to a voltage surge exceeding the threshold level of the SPD

NOTE Examples of components used in voltage clamping type SPDs: varistors (e.g. MOV) and avalanche breakdown diodes (ABD).

3.15
voltage switching type SPD
SPD that has a high shunt impedance and will have a sudden and large reduction in impedance in response to a voltage surge exceeding the threshold level of the SPD

NOTE Examples of components used in voltage switching type SPDs: air gaps, gas discharge tubes (GDT) and thyristor surge suppressors (TSS).

3.22
rated current
maximum current a current-limiting SPD can conduct continuously with no change in the impedance of the current-limiting components

NOTE This is also applicable to linear series components.

Add, on page 29, the following new definition 3.32:

3.32
surge (telecommunications)
temporary excessive voltage or current, or both, coupled on a telecommunication line, from an external electrical source

NOTE 1 Typical electrical sources are lightning and AC/DC power systems.

NOTE 2 Electrical source coupling can be one or more of the following; electric, magnetic, electromagnetic, conductive.

4.1.1 Normal service conditions

Replace the existing text of 4.1.1 as follows:

4.1.1.1 Air pressure and altitude

Air pressure is 80 kPa to 106 kPa. These values represent an altitude of +2 000 m to –500 m respectively.

4.1.1.2 Ambient temperature

- normal range: –5 °C to +40 °C

NOTE 1 This range normally addresses SPDs for indoor use. This corresponds to code AB4 in IEC 60364-5-51.

- extended range: –40 °C to +70 °C

NOTE 2 This range normally addresses SPDs for outdoor use in non weather-protected locations, class 3K7 in IEC 60721-3-3.

- storage range: –40 °C to +70 °C

NOTE 3 All values beyond will be specified by the manufacturer.

4.1.1.3 Relative humidity

- normal range: 5 % to 95 %

NOTE 1 This range normally addresses SPDs for indoor use. This corresponds to code AB4 in IEC 60364-5-51.

- extended range: 5 % to 100 %

NOTE 2 This range normally addresses SPDs for outdoor use in non weather-protected locations (e.g. SPD is contained in a weather proofed enclosure).

Page 31

4.3 SPD testing

Replace the first two paragraphs of this subclause by the following:

The SPDs covered by this standard shall be tested using the connections or terminations that are used when the SPDs are installed in the field. Also, the measurements shall be made at the connections or terminations of the SPDs. For those that are intended to be used with a base or connector, that base or connector shall be part of the tests.

For telecommunication applications ITU-T gives requirements in the K-series for protection holders (K.65) and termination modules (K.55).

When a base is used for testing, the measurements shall be made as close as possible to the terminals of the SPD. Oscilloscopes used for measurements shall be in accordance with IEC 61083-1.

NOTE For oscilloscope settings, see Annex D.

SPDs of Figures 1c, 1e and 1f may have a common current path (including protective components or just internal connections) that conducts the total impulse current. The manufacturer shall state the maximum value of impulse current for this current path. This value of impulse current may be less than *n* times the maximum current capability of each line terminal, where *n* equals the number of line terminals.

These SPDs shall have all of their line terminals tested simultaneously with respect to the common terminal.

Page 35

5.2.1.1 Maximum continuous operating voltage (U_c)

Replace the existing text of this subclause by the following:

The manufacturer shall state the maximum continuous operating voltage for the SPD appropriate for the application such as AC rms or DC.

Compliance shall be checked in accordance with 6.2.1.1.

Page 39

5.2.3 Transmission requirements

Replace the existing text of this subclause by the following:

The SPD, in addition to the requirements of 5.2.1 and 5.2.2, may need to conform to specific requirements of 5.2.3 depending on its communication and signalling application (for example, voice, data, and video). Table 1 provides guidance in the selection of applicable transmission tests.

Page 47

6.2.1.3 Impulse-limiting voltage

Replace the first paragraph of this subclause by the following:

The SPDs shall be tested using one impulse selected from category C of Table 3 and applied to the appropriate terminals. The current level shall be selected based on the energy capability of the SPD as determined in the impulse durability test (see 6.2.1.6). Both impulse-limiting voltage and impulse durability tests shall be performed with the same impulse. Values listed in Table 3 are minimum requirements, other surge current ratings can be found in standards e.g. ITU-T recommendations.

Replace the fourth paragraph of this subclause by the following:

Measure the voltage limitation for each impulse without load. The maximum voltage measured at the appropriate terminals shall not exceed the specified voltage protection level (U_p). Sufficient time shall be allowed between impulses to prevent accumulation of heat. It is understood that different SPDs will have different thermal characteristics, and consequently will require different times between impulses.

For detail impulse recorders settings refer to Annex D.

Page 49

Replace the existing Table 3 by the following new table:

Table 3 – Voltage and current waveforms for impulse-limiting voltage

Category	Type of test	Open-circuit voltage [a]	Short-circuit current	Minimum number of applications	Terminals to be tested
A1	Very slow rate of rise	≥ 1 kV Rate of rise from 0,1 kV/µs to 100 kV/s	10 A, 0,1 A/µs to 2 A/µs, ≥ 1 000 µs (duration)	Not applicable (NA)	X1 – C X2 – C X1 – X2 [b]
A2	AC	Select a test from Table 5		Single cycle	
B1	Slow rate of rise	1 kV 10/1000	100 A, 10/1000	300	
B2		1 kV to 4 kV 10/700	25 A to 100 A 5/300	300	
B3		≥ 1 kV 100 V/µs	10 A to 100 A 10/1 000	300	
C1	Fast rate of rise	0,5 kV to < 2 kV 1,2/50	0,25 kA to < 1 kA 8/20	300	
C2		2 kV to 10 kV 1,2/50	1 kA to 5 kA 8/20	10	
C3		≥ 1 kV 1 kV/µs	10 A to 100 A 10/1 000	300	
D1	High energy	≥ 1 kV	0,5 kA to 2,5 kA 10/350	2	
D2		≥ 1 kV	0,6 kA to 2,0 kA 10/250	5	

[a] An open-circuit voltage different from 1 kV may be used. However, it must be sufficient to operate the SPD under test.

[b] X1 – X2 terminals shall be tested only if it is required.

NOTE 1 For the verification of U_p, one of the above impulse waveform of category C is mandatory and A, B and D are optional. Unless otherwise specified, apply 5 positive and 5 negative pulses.

NOTE 2 For impulse reset, select test from category B, C and D. Unless otherwise specified, apply 3 positive and 3 negative pulses.

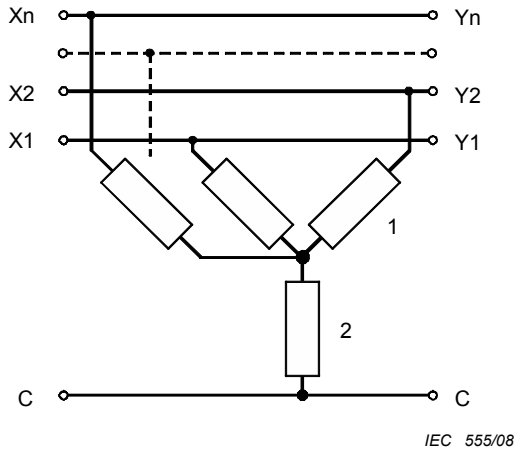
NOTE 3 For impulse durability measurement, one impulse waveform of category C is mandatory and A1, B and D are optional.

NOTE 4 Values listed in Table 3 are minimum requirements; other surge current ratings are possible and can also be found in other standards e.g. ITU-T K series – Recommendations.

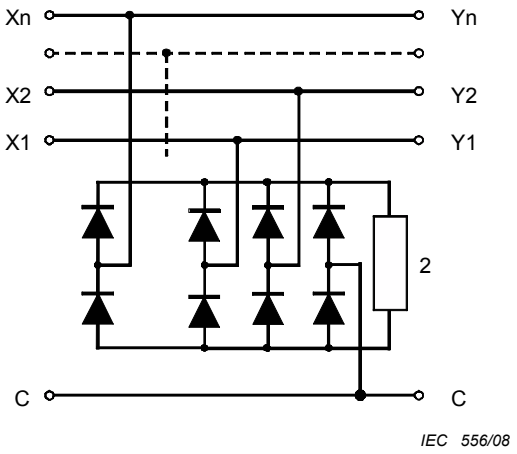
Add the following text (including new Figure 16) immediately after Table 3:

Simultaneous surge on all protected conductors

Multi-line SPDs may use a common protective element for the ground return of the total impulse current . Two examples are shown in Figure 16. All the protected lines shall have an impulse current equal to total impulse current divided by number of lines. applied simultaneously to verify that the common protective element had adequate current capability. After this test the SPD shall not be degraded. This test also verifies that the internal connections of the SPD have adequate current capability.



Star protection circuit



Diode steering bridge

Key

X1, X2, Xn,	line terminals	1	individual protective element
Y1, Y2, Yn,	protected line terminals	2	common protective element
C	common		

Figure 16 – Examples of multi-line SPDs with a common protective element

The requirements of the current distributor (coupling network) shown in Figure 4 are as follows:

– The coupling network shall not influence the test impulse. All parameters of the surge waveform according to 4.4 apply to the output terminals of the coupling network.

– The front time and the pulse duration shall be verified at the output terminals of the coupling network for surge voltages (open circuit) and surge currents (short-circuit).

– The surge waveform of the short-circuit current can be measured with the aid of a torroidal current transformer or a current monitoring resistor.

– Preferably resistors should be used for the coupling network.

– The current sharing in each conductor of the distributor has to be tested individually with the other conductors shorted before connection to the respective test specimen is made. The results of this test does not mean that the currents will be equally shared when the SPD is in the circuit.

– During the simultaneous test it will be verified that the common protective element was exposed to the total impulse current without failure of any surge protective components.