IEC 61643-351

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Components for low-voltage surge protective devices – Part 351: Performance requirements and test methods for telecommunications and signalling network surge isolation transformers (SIT)

Composants pour parafoudres basse tension – Partie 351: Exigences de performance et méthodes d'essai pour les transformateurs d'isolement contre les surtensions dans les réseaux de signalisation et de télécommunications

IEC 61643-351:2016-10(en-fr)

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COMPONENTS FOR LOW-VOLTAGE SURGE PROTECTIVE DEVICES –

Part 351: Performance requirements and test methods for telecommunications and signalling network surge isolation transformers (SIT)

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International Standard IEC 61643-351 has been prepared by subcommittee 37B: Specific components for surge arresters and surge protective devices, of IEC technical committee 37: Surge arresters.

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

FDIS	Report on voting
37B/155/FDIS	37B/156/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 *Components for low-voltage surge protective devices*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

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- withdrawn,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.

INTRODUCTION

This part of IEC 61643 covers surge isolation transformers whose rated impulse withstand voltage coordinates with the expected surge environment of the installation. This type of surge protective component, SPC, isolates and attenuates transient voltages in conjunction with current diverting components (e.g. GDT, MOV, etc.) or surge protective devices (SPDs). It can be used in SPDs.

COMPONENTS FOR LOW-VOLTAGE SURGE PROTECTION –

Part 351: Performance requirements and test methods for telecommunications and signalling network surge isolation transformers (SIT)

1 Scope

Surge isolation transformers (SITs) are used for signal transformer applications with signal levels up to 400 V peak to peak. SITs are transformers, with or without an internal-winding screen, with a rated impulse withstand voltage greater than the peak voltage of the expected common-mode surge environment. SITs are applicable to components for surge protection against indirect and direct effects of lightning or other transient overvoltage. SITs are used to mitigate the onward propagation of common-mode voltage surges. This part of IEC 61643 defines test circuits and test methods for determining and verifying the SIT surge parameters. Preferred performance values for key parameters are given.

This part of IEC 61643 does not cover SIT operation under differential-mode lightning surge conditions.

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 60721-3-3, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 3: Stationary use at weatherprotected locations*

IEC TR 60664-2-1:2011, *Insulation coordination for equipment within low-voltage systems – Part 2-1: Application guide – Explanation of the application of the IEC 60664 series, dimensioning examples and dielectric testing*

3 Terms, definitions, symbols, abbreviations and acronyms

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 isolation transformer
SIT
isolation transformer which has high impulse withstand voltage with/without electric screen between input and output windings

3.1.2
electric screen
ES
screen of conductive material intended to reduce the penetration of an electric field into a given region

[SOURCE: IEC 60050-151:2001, 151-13-10]

3.1.3
breakdown
failure, at least temporarily, of the insulating properties of an insulating medium under electric stress

[SOURCE: IEC TR 61340-1:2012, 3.4]

3.1.4
component type
manufacturer's type of a component, e.g. its product name

3.1.5
clearance
shortest distance in air between two conductive parts

[SOURCE: IEC TR 60664-2-1:2011, 3.4]

3.1.6
creepage distance
shortest distance along the surface of a solid insulating material between two conductive parts

[SOURCE: IEC TR 60664-2-1:2011, 3.7]

3.1.7
guarded measurement
measurement technique in a three terminal network that allows the direct impedance between two terminals to be measured correctly by applying a compensating voltage to the third terminal that removes the shunting effects of any impedances to the third terminal

3.1.8
insulation resistance
resistance under specified conditions between two conductive elements separated by insulating materials

[SOURCE: IEC TS 61994-4-2:2011, 3.10]

3.1.9
impulse withstand voltage
highest peak value of impulse voltage of prescribed form and polarity which does not cause breakdown of insulation under specified conditions

[SOURCE: IEC TR 60664-2-1:2011, 3.15]

3.1.10
isolating transformer
transformer with protective separation between the input and output windings

[SOURCE: IEC 60065:2014, 2.7.1]

3.1.11
insulation
that part of an electrotechnical product which separates the conducting parts at different electrical potentials

[SOURCE: IEC TR 60664-2-1:2011, 3.17]

3.1.12
insulation coordination
mutual correlation of insulation characteristics of electrical equipment taking into account the expected micro-environment and other influencing stresses

[SOURCE: IEC TR 60664-2-1:2011, 3.18]

3.1.13
overvoltage
any voltage having a peak value exceeding the corresponding peak value of maximum steady-state voltage at normal operating conditions

[SOURCE: IEC TR 60664-2-1:2011, 3.21]

3.1.14
lightning overvoltage
transient overvoltage at any point of the system due to a specific lightning discharge

[SOURCE: IEC 60664-1:2007, 3.7.4]

3.1.15
thermal equilibrium
variation of less than 1 K between any two out of three consecutive measurements made at an interval of 5 min

[SOURCE: IEC 61810-1:2014, 3.3.13]

3.1.16
thermal resistance
quotient of the temperature difference between two specified points or regions and the heat flow between these two points or regions under conditions of thermal equilibrium

Note 1 to entry: For most cases, the heat flow can be assumed to be equal to the power dissipation.

[SOURCE: IEC 62590:2010, 3.9.1]

3.1.17
microclimate
climatic condition at the place where a component is installed in the product

Note 1 to entry: Only the inside product maximum air temperature (classes X1 to X7) and, optionally, the maximum air humidity class (classes Y1 to Y4) are taken into account.

[SOURCE: IEC 60721-3-9:1993, 3.1, modified – addition of Note 1 to entry]

3.1.18
virtual front time
T_1
<of a voltage impulse> 1/0,6 times the interval T between the instants when the impulse is 30 % and 90 % of the peak value

SEE: Figure A.1

[SOURCE: IEC 60060-1:2010, 7.1.18, modified]

3.1.19
virtual origin
O_1
<of the impulse voltage waveform> instant at which a straight line drawn through the 30 % and 90 % amplitude values crosses the time axis

SEE: Figure A.1

[SOURCE: IEC 60060-1:2010, 7.1.19, modified]

3.1.20
virtual time to half-value
T_2
interval of time between the instant of virtual origin O_1 and the instant when the voltage or current has decreased to half the peak value

SEE: Figure A.1

3.1.21
designation of an impulse shape
combination of two numbers, the first representing the virtual front time (T_1) and the second the virtual time to half-value on the tail (T_2)

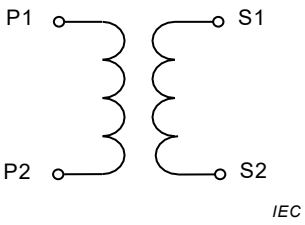
Note 1 to entry: It is written as T_1/T_2, both in microseconds, the sign "/" having no mathematical meaning.

[SOURCE: IEC 60099-4:2014, 3.13]

3.2 Symbols

For the purposes of this document, the following symbols apply.

Figure 1 shows the symbol for a two-winding SIT.



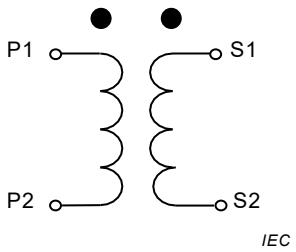
Key

P1: Primary winding terminal 1 S1: Secondary winding terminal 1

P2: Primary winding terminal 2 S2: Secondary winding terminal 2

Figure 1 – Symbol for two-winding SIT

Figure 2 shows the symbol for a two-winding SIT with instantaneous voltage polarity indicators, similar to the S00843 symbol of IEC 60617 made with terminal connections.



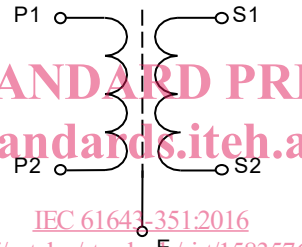
Key

P1: Primary winding terminal 1 S1: Secondary winding terminal 1

P2: Primary winding terminal 2 S2: Secondary winding terminal 2

Figure 2 – Symbol for a two-winding SIT with polarity indication

Figure 3 shows the symbol for a two-winding SIT with an electric screen between the windings, similar to the S00853 symbol of IEC 60617 made with terminal connections.



Key

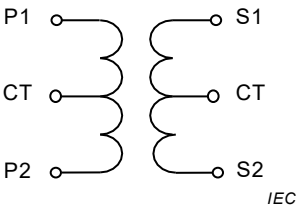
P1: Primary winding terminal 1 S1: Secondary winding terminal 1

P2: Primary winding terminal 2 S2: Secondary winding terminal 2

E : Earth terminal (electric screen terminal)

Figure 3 – Symbol for a two-winding SIT with electric screen

Figure 4 shows the symbol for a SIT centre tapped windings, similar to the S00855 symbol of IEC 60617 made with two centre tapped windings and terminal connections. When testing is done with shorted windings the centre tap is also connected to the short, other testing is done without any connection to the centre tap terminal.



Key

P1: Primary winding terminal 1 S1: Secondary winding terminal 1

P2: Primary winding terminal 2 S2: Secondary winding terminal 2

CT: Centre tap terminal

Figure 4 – SIT with centre tapped windings

3.3 Abbreviations and acronyms

For the purposes of this document, the following abbreviations and acronyms apply.

ES	electric screen
ICT	information and communications technology
IR	insulation resistance
rms	root-mean-square
SIT	surge isolation transformer
SPD	surge protective device

4 Service conditions

4.1 Temperature range

Normal range: −20 °C to 40 °C

Extended range: This range is decided based on agreement between manufacturer and user.

4.2 Humidity

Not exceeding 90 %.

4.3 Altitude

Normal range: Not exceeding 1 000 m.

Extended range: This range is decided based on agreement between manufacturer and user.

4.4 Microclimate

When microclimate conditions apply, use one of the classes given in Table 1.

Table 1 – Classification of microclimate condition

High air temperature severity °C	Class	Typical component temperature range °C	Product application
55	X1		
70	X2	0 to 70	Commercial
85	X3	−40 to 85	Industrial
100	X4		
125	X5	−55 to 125	Military
155	X6	−65 to 150	Storage[a]
200	X7		

[a] Storage temperature rating verification is outside the scope of this document. See IEC 60068-2-1:2007 and IEC 60068-2-2:2007.

5 SIT surge conditions

5.1 SIT surge mitigation

An SIT couples a service across the transformer insulation by magnetic induction. When common-mode surges occur on the incoming service the insulation is voltage-stressed. The insulation has three physical paths:

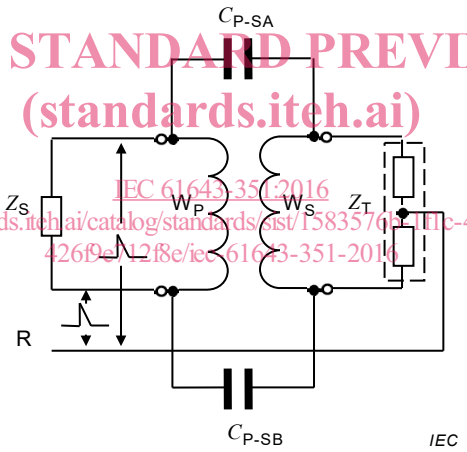
a) solid insulation – insulation material interposed between the two-windings;

b) creepage distance;

c) clearance.

Clearance distances shall be set so that the maximum expected voltage difference does not break down the clearance. Creepage distances shall be set so that the maximum expected voltage difference and pollution degree do not cause surface flashover or breakdown (tracking). Solid insulation thickness shall be set so that the maximum expected voltage difference does not cause breakdown.

The higher frequency components of a surge impulse will be electrostatic coupled by SIT internal-winding capacitance (shown as $C_{P\text{-}SA}$ + $C_{P\text{-}SB}$) from one winding to the other (see Figure 5).



Key

W_P:	Primary winding	$C_{P\text{-}SA}$, $C_{P\text{-}SB}$:	Primary to secondary capacitance, paths A and B
W_S:	Secondary winding		
Z_T:	Terminating or load impedance	R:	Reference plane or point
Z_S:	Service source impedance		

Figure 5 – Common-mode surge conditions for SIT

To reduce internal-winding capacitance, a conducting electric screen can be used between the windings (see Figure 6). The electric screen decouples most of the winding capacitance (shown as $C_{P\text{-Screen A}}$, $C_{P\text{-Screen B}}$, $C_{S\text{-Screen A}}$ and $C_{S\text{-Screen B}}$), leaving a much smaller value of internal-winding capacitance (shown as $C_{P\text{-}SA}$ + $C_{P\text{-}SB}$).