SLOVENSKI STANDARD
SIST-TS CLC/TS 50544:2014

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Nizkonapetostni enosmerni prenapetostni odvodniki za sisteme električne vleke - Izbira in pravila uporabe za prenapetostne odvodnike

Low voltage d.c. surge protective device for traction systems - Selection and application rules for surge arresters

Parafoudres basse tension courant continu pour traction - Principes de choix et d'application pour les parafoudres

Ta slovenski standard je istoveten z: CLC/TS 50544:2010

ICS:

29.120.50	Varovalke in druga medtokovna zaščita	Fuses and other overcurrent protection devices
29.280	Električna vlečna oprema	Electric traction equipment

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TECHNICAL SPECIFICATION

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English version

Low voltage d.c. surge protective device for traction systems - Selection and application rules for surge arresters

Parafoudres basse tension courant continu pour traction - Principes de choix et d'application pour les parafoudres

Überspannungsschutzgeräte für Niederspannungs-Gleichstrom-Bahnsysteme - Auswahl und Anwendungsregeln für Überspannungsableiter

This Technical Specification was approved by CENELEC on 2009-12-25.

CENELEC members are required to announce the existence of this TS in the same way as for an EN and to make the TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

This Technical Specification was prepared by the Technical Committee CENELEC TC 37A, Low voltage surge protective devices.

It also concerns the expertise of SC 9XC, Electric supply and earthing systems for public transport equipment and ancillary apparatus (Fixed installations), of Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways.

The broad subject of overvoltage protection in d.c. traction systems need to address the approaches, requirements and definitions of several disciplines and TC's. Concerned European Standards are referenced for generic definitions.

This Technical Specification reflects the common practise of overvoltage protection in the d.c. traction community, as far as protection of equipment in the primary power supply is concerned (e.g. feeders, overhead contact lines, return circuits, power side of rolling stock).

Therefore, definitions and approaches in this Technical Specification, covering a specific application in line with EN 50526-1, are different for some aspects from the definitions and approaches in the EN 61643 series.

The text of the draft was circulated for voting in accordance with the Internal Regulations, Part 2, Subclause 11.3.3.3. and was approved by CENELEC as CLC/TS 50544 on 2009-12-25.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following date is proposed:

– latest date by which the existence of the CLC/TS has to be announced at national level (doa) 2010-06-25

This Technical Specification will be withdrawn once the SC 9XC document [1)] on the same subject is published.

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[1)] Under development at the time of issue.

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1 Scope

This Technical Specification applies to non linear metal-oxide resistor type surge arresters (MO surge arresters) without spark gaps designed to limit voltage surges on d.c. traction systems with nominal voltage up to 1 500 V.

This Technical Specification applies to protection of equipment.

Same principles for selection and application apply for MO surge arresters on d.c. traction systems with nominal voltage 3 000 V.

2 Normative references

The following referenced documents are indispensable for the application 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.

EN 50122-2	Railway applications – Fixed installations – Part 2: Protective provisions against the effects of stray currents caused by d.c. traction systems
EN 50124-1	Railway applications – Insulation coordination – Part 1: Basic requirements – Clearances and creepage distances for all electrical and electronic equipment
EN 50163	Railway applications – Supply voltages of traction systems
EN 50526-1 [1)]	Railway applications – Fixed installations – D.C. surge arresters and voltage limiting devices – Part 1: Surge arresters
EN 60071-1	Insulation co-ordination – Part 1: Definitions, principles and rules (IEC 60071-1)
EN 62305-3	Protection against lightning – Part 3: Physical damage to structures and life hazard (IEC 62305-3, mod.)

3 Terms and definitions

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

3.1 System voltages

3.1.1
nominal voltage
U_n
designated value for a system

[EN 50163]

3.1.2
highest permanent voltage
U_{max1}
maximum value of the voltage likely to be present indefinitely

[EN 50163]

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1) At draft stage.

3.1.3
highest non permanent voltage
U_{max2}
maximum value of the voltage likely to be present as highest non permanent voltage for a limited period of time

[EN 50163]

3.1.4
highest long term overvoltage
U_{max3}
voltage defined as the highest value of the long-term overvoltage for t = 20 ms. This value is independent from frequency

[EN 50163]

3.1.5
rated insulation voltage
U_{Nm}
d.c. withstand voltage value assigned by the manufacturer to the equipment or part of it, characterizing the specified permanent (over five minutes) withstand capability of its insulation

[EN 50124-1, mod.]

3.1.6
rated impulse voltage
U_{Ni}
impulse voltage value assigned by the manufacturer to the equipment or a part of it, characterizing the specified withstand capability of its insulation against transient overvoltages

[EN 50124-1]

3.1.7
overvoltage
any voltage having a peak value exceeding the corresponding peak value (including recurrent overvoltages) of maximum steady-state voltage at normal operating conditions

[EN 50124-1]

3.1.8
long-term overvoltage
overvoltage higher than U_{max2} lasting typically more than 20 ms, due to low impedance phenomena e.g. a rise in substation primary voltage

[EN 50163]

3.1.9
transient overvoltage
short duration overvoltage of a few milliseconds or less due to current transfers

[EN 50124-1]

3.1.10
switching overvoltage
transient overvoltage at any point of the system due to specific switching operation or fault

[EN 50124-1]

3.1.11
lightning overvoltage
transient overvoltage at any point of the system due to a specific lightning discharge

[EN 50124-1]

3.2 Arrester

3.2.1
surge protective device
SPD
device that is intended to limit transient overvoltages and divert surge currents. It contains at least one nonlinear component

[EN 61643-11]

3.2.2
voltage limiting type SPD
SPD that has a high impedance when no surge is present, but will reduce it continuously with increased surge current and voltage. Common examples of components used as nonlinear devices are varistors and suppressor diodes. These SPDs are sometimes called “clamping type”

[EN 61643-11]

3.2.3
surge arrester
device intended to limit transient overvoltages to a specified level

NOTE Surge arrester, or shorter “arrester”, is a more general term for metal-oxide surge arrester (see 3.2.4). Surge arresters contain one or more nonlinear metal-oxide resistors (MO resistor). A nonlinear metal-oxide resistor (MO resistor) is the same as a variable metal-oxide resistor (MO varistor).

[EN 50526-1]

3.2.4
metal-oxide surge arrester without gaps
arrester having non-linear metal-oxide resistors connected in series and/or in parallel without any integrated series or parallel spark gaps

[EN 60099-4]

3.2.5
maximum continuous operating voltage of an arrester
U_c
designated permissible value of d.c. voltage that may be applied continuously between the arrester terminals

[EN 60099-4, mod.]

3.2.6
rated voltage of an arrester
U_r
voltage by which the arrester is designated. For d.c. traction systems the rated voltage is the maximum continuous operating voltage

[EN 60099-4, mod.]

3.2.7
charge transfer capability
maximum charge per impulse that can be transferred during the charge transfer test and during the operating duty test

[EN 50526-1, mod.]

3.2.8
discharge current of an arrester
impulse current which flows through the arrester

[EN 50526-1]

3.2.9
nominal discharge current of an arrester
I_n
peak value of lightning current impulse which is used to classify an arrester

[EN 60099-4]

3.2.10
high current impulse of an arrester
peak value of discharge current having a 4/10 µs impulse shape

[EN 60099-4]

3.2.11
steep current impulse
current impulse with a virtual front time of 1 µs with limits in the adjustment of equipment such that the measured values are from 0,9 µs to 1,1 µs, and the virtual time to half value on the tail shall be not longer than 20 µs

[EN 60099-4]

3.2.12
lightning current impulse
8/20 current impulse with limits on the adjustment of equipment such that the measured values are from 7 µs to 9 µs for the virtual front time and from 18 µs to 22 µs for the time to half value on the tail

[EN 60099-4]

3.2.13
direct lightning current impulse
impulse defined by the charge Q and the peak value of the current impulse I_{imp}

[EN 50526-1]

3.2.14
long duration current impulse
rectangular impulse which rises rapidly to maximum value, remains substantially constant for a specified period and then falls rapidly to zero

[EN 60099-4]

3.2.15
switching current impulse of an arrester
the peak value of discharge current having a virtual front time greater than 30 µs but less than 100 µs and a virtual time to half value on the tail of roughly twice the virtual front time

[EN 60099-4]

3.2.16
continuous current of an arrester
I_c
current flowing through the arrester when energized at the continuous operating voltage

[EN 60099-4]

3.2.17
reference current of an arrester
I_{ref}
d.c. current defined by the manufacturer used to determine the reference voltage of the arrester

[EN 60099-4, mod.]

3.2.18
reference voltage of an arrester
U_{ref}
d.c. voltage applied to the arrester to obtain the reference current

[EN 60099-4, mod.]

3.2.19
residual voltage of an arrester
U_{res}
peak value of voltage that appears between the terminals of an arrester during the passage of discharge current

[EN 60099-4]

4 Systems and equipment to be protected

4.1 General

Electrical traction d.c. systems should be protected against overvoltages by surge arresters. Main field of application are in substations, at sectioning posts and at singular points along the contact lines.

The terminations of the insulated cables connected to the contact line system and the electronic apparatuses connected to the return pole of the rectifier in the substations should be protected by surge arresters.

4.2 Substations

An important element of a lightning protection concept is the protection of the line feeders and return conductors in the substations with arresters (see Figure 1). The arresters have the following functions.

- The arresters A1, which are connected in the substation between the feeder circuit-breakers (cable connection) and the return circuit, reduce the overvoltages at the feeder circuit-breakers and the rectifiers, inclusive of their measuring and monitoring devices, in case of positive lightning strokes. In case of negative lightning strokes the diodes of the rectifier are conductive, but this does not endanger the elements.

- The arrester A2 between the return circuit and the structure earth is to limit overvoltages of the running rails. The arrester A2 is also important in case of direct lightning strokes into the running rails, e.g. if lines above earth have a conductor rail. The arrester A2 is not intended for protection against electric shock coming from impermissible rail potential.

NOTE Protection against electric shock is considered in EN 50526-2. When arresters A2 and protective devices as per EN 50526-2 are used at the same place, a coordination of both low voltage protective devices is needed (under consideration).