SLOVENSKI STANDARD
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Železniške naprave - Stabilne naprave električne vleke - Enosmerni prenapetostni odvodniki in omejilniki napetosti - 3. del: Navodilo za uporabo

Railway applications - Fixed installations - D.C. surge arresters and voltage limiting devices - Part 3 Application guide

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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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Railway applications - Fixed installations - D.C. surge arresters and voltage limiting devices - Part 3 Application guide

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This draft European Standard is submitted to CENELEC members for CENELEC enquiry.
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It has been drawn up by CLC/SC 9XC.

If this draft becomes a European Standard, CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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CENELEC

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Content

Page

Foreword

This document (prEN 50526-3:2014) has been prepared by 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'*.

This document is currently submitted to the Enquiry.

Introduction

This European Standard is in three parts.

Part 1 deals with metal oxide arresters without gaps for d.c. railway traction systems (fixed installations) and is based on EN 60099-4.

Part 2 deals with voltage limiting devices for specific use in d.c. railway traction systems (fixed installations).

Part 3 is a Guide of application of metal-oxide arresters and of voltage limiting devices.

1 Scope

This Application Guide supports the European Standards EN 50526-1 and EN 50526-2.

Guidance is offered on the following subjects.

– The selection and installation of surge arresters

– The selection and installation of voltage limiting devices as VLD-O and VLD-F.

– The arrangement of the surge arresters and VLDs

Because of differences in the established, proven methods, electric traction systems of nominal voltage 600 V – 750 V are treated separately from the systems at higher nominal voltages.

This application guide does not treat systems different from the d.c. electrified traction systems

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50122-1:2011, *Railway applications – Fixed installations – Electrical safety, earthing and bonding – Part 1: Protective provisions against electric shock*

EN 50122-2, *Railway applications – Fixed installations – Electrical safety, earthing and bonding – Part2: Provisions against the effects of stray currents caused by d.c.traction systems*

EN 50123-2:2003, *Railway applications - Fixed installations - D.C. switchgear - Part 2: D.C. circuit breakers*

EN 50123-7-1:2003, *Railway applications – Fixed installations – Part 7-1: Measurement, control and protection devices for specific use in d.c. traction systems – Application guide*

EN 50124-1:2001, *Railway applications – Insulation coordination – Part 1: Basic requirements – Clearances and creepage distances for all electrical and electronic equipment*

EN 50163: 2004, *Railway applications – Supply voltages of traction systems*

EN 50526-1:2012, *Railway applications – Fixed installations – D.C. surge arresters and voltage limiting devices – Part 1: Surge arresters*

prEN 50526-2:201X [1], *Railway applications – Fixed installations – D.C. surge arresters and voltage limiting devices – Part 2: Voltage limiting devices*

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

IEC 60050-195:1998, *International Electrotechnical Vocabulary - Chapter 195: Earthing and protection against electric shock*

IEC 60050-441:1984, *International Electrotechnical Vocabulary - Chapter 441: Switchgear, controlgear and fuses*

[1] under preparation

IEC 60050-604:1987, *International Electrotechnical Vocabulary. Chapter 604: Generation, transmission and distribution of electricity - Operation*

IEC 60050-811:1991, *International Electrotechnical Vocabulary - Chapter 811: Electric traction*

3 Terms and definitions

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

3.1
nominal voltage
U_n
designated value for a system

[SOURCE: EN 50163:2004,3.3]

3.2
highest permanent voltage
U_{max1}
maximum value of the voltage likely to be present indefinitely

[SOURCE: EN 50163:2004,3.4]

3.3
highest non-permanent voltage
U_{max2}
maximum value of the voltage likely to be present for a limited period of time

Adapted from EN 50163:2004, 3.5

3.4
rated insulation voltage
U_{Nm}
d.c withstand voltage value assigned by the manufacturer to the equipment or a part of it, characterising the specified permanent (over five minutes) withstand capability of its insulation

[SOURCE: EN 50526-1:2012, 3.4]

3.5
rated impulse withstand voltage
U_{Ni}
impulse voltage value assigned by the manufacturer to the equipment or a part of it, characterising the specified withstand capability of its insulation against transient overvoltages

[SOURCE: EN 50526-1:2012, 3.5]

3.6
overvoltage
voltage having a peak value exceeding the corresponding peak value of the highest non-permanent voltage U_{max2}

[SOURCE: EN 50526-1:2012, 3.6]

3.7
transient overvoltage
short duration overvoltage of a few (up to 20 ms) milliseconds or less associated with a transient regime. Two particular transient overvoltages are defined: switching overvoltage and lightning overvoltage

[SOURCE: EN 50526-1:2012, 3.7]

3.8
switching overvoltage
U_{so}
transient overvoltage at any point of the system due to specific switching operation or fault

[SOURCE: EN 50526-1:2012, 3.8]

3.9
lightning overvoltage
transient overvoltage at any point of the system due to a lightning discharge

[SOURCE: EN 50124-1:2001,1.3.3.2.2]

3.10
surge arrester
device intended to limit the transient overvoltages to a specified level

[SOURCE: EN 50526-1:2012, 3.10]

3.11
metal-oxide surge arrester
arrester having non-linear metal-oxide resistors connected in series and/or in parallel without any integrated series or parallel spark gaps

[SOURCE: EN 50526-1:2012, 3.11]

3.12
continuous operating voltage of an arrester
U_c
designated permissible d.c. voltage value that may be applied continuously between the arrester terminals

[SOURCE: EN 50526-1:2012, 3.12]

3.13
rated voltage of an arrester
U_r
voltage by which the arrester is designated

Note 1 to entry: Because of the particular nature of the d.c. electrical installation dealt with, the rated voltage of a d.c. arrester coincides with the continuous operating voltage.

[SOURCE: EN 50526-1:2012, 3.13]

3.14
lightning impulse protection level
U_{pl}
the maximum residual voltage for the nominal discharge current;

[SOURCE: EN 50526-1:2012, 3.15]

3.15
switching impulse protection level
U_{ps}
maximum residual voltage at the specified switching impulse current

[SOURCE: EN 50526-1:2012, 3.16]

3.16
charge transfer capability
Q_T
maximum charge per impulse that can be transferred during the charge transfer test and during the operating duty test

[SOURCE: EN 50526-1:2012, 3.17]

3.17
discharge current of an arrester
impulse current which flows through the arrester

[SOURCE: EN 50526-1:2012, 3.18]

3.18
nominal discharge current of an arrester
I_n
peak value of lightning current impulse which is used to classify an arrester

[SOURCE: EN 50526-1:2012, 3.19]

3.19
high current impulse of an arrester
peak value of discharge current having a 4/10 µs impulse shape which is used to test the stability of the arrester on direct lightning strokes

[SOURCE: EN 50526-1:2012, 3.20]

3.20
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 is not longer than 20 µs

[SOURCE: EN 50526-1:2012, 3.21]

3.21
lightning current impulse
8/20 µs 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

[SOURCE: EN 50526-1:2012, 3.22]

3.22
direct lightning current impulse
impulse defined by the charge Q and the peak value of the current impulse I_{imp}

[SOURCE: EN 50526-1:2012, 3.23]

3.23
switching current impulse of an arrester
I_{sw}
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

[SOURCE: EN 50526-1:2012, 3.24]

3.24
porcelain-housed arrester
arrester using porcelain as housing material, with fittings and sealing systems

[SOURCE: EN 50526-1:2012, 3.30]

3.25
polymer-housed arrester
arrester using polymeric and/or composite materials for housing

[SOURCE: EN 50526-1:2012, 3.31]

3.26
flashover
disruptive discharge over a solid surface

[SOURCE: EN 50526-1:2012, 3.44]

3.27
impulse
unidirectional wave of voltage or current which without appreciable oscillations rises rapidly to a maximum value and falls – usually less rapidly – to zero with small, if any, excursions of opposite polarity

Note 1 to entry: The parameters which define a voltage or current impulse are polarity, peak value, front time and time to half value on the tail.

[SOURCE: EN 50526-1:2012, 3.45]

3.28
voltage-limiting device
VLD
protective device whose function is to prevent existence of an impermissible high touch voltage

[SOURCE: EN 50122-1:2011, 3.1.20]

3.29
recoverable VLD
VLD that recovers after triggering

[SOURCE: prEN 50526-2 201X, 3.2]

3.30
non-recoverable VLD
VLD remaining in its low resistance state permanently after triggering

[SOURCE: prEN 50526-2:201X, 3.3]

3.31
Welding-shut spark gap
voltage fuse
VLD which triggers by electrical discharge across a gap causing a permanent short-circuit by melting of metallic parts

[SOURCE: prEN 50526-2:201X, 3.4]

3.32
rated current
I_r
maximum value of the direct current that may flow permanently through the VLD in specified environmental conditions

[SOURCE: prEN 50526-2:201X, 3.5]

3.33
short time withstand current
I_W
current that a VLD can carry in closed status, during a specified short time under prescribed conditions of use and behaviour

[SOURCE: prEN 50526-2:201X, 3.6]

3.34
breaking capacity
maximum current that a recoverable VLD can interrupt at a stated voltage

[SOURCE: IEC 60050441:1984,17-08]

3.35
residual voltage
U_{res}
a) peak value of voltage that appears between the terminals of an arrester during the passage of discharge current

b) value of voltage that appears between the terminals of the VLD during the passage of a specified current

[SOURCE: EN 50526-1:2012, 3.27] and [SOURCE: prEN 50526-2:201X, 3.17]

3.36
structure earth
construction made of metallic parts or construction including interconnected metallic structural parts, which can be used as an earth electrode

[SOURCE: EN 50122-1:2011, 3.2.4]

3.37
open connection
connection of conductive parts to the return circuit by a voltage-limiting device which makes a conductive connection either temporarily or permanently if the limited value of the voltage is exceeded

[SOURCE: EN 50122-1:2011, 3.2.12]

3.38
return circuit
all conductors which form the intended path for the traction return current

EXAMPLE Conductors may be:

– running rails,

– return conductor rails,

– return conductors,

– return cables.

[SOURCE: EN 50122-1:2011, 3.3.1]

3.39
rail potential
U_{RE}
voltage occurring between running rails and earth

[SOURCE: EN 50122-1:2011, 3.3.7]

3.40
(traction) substation
installation to supply a contact line system and at which the voltage of a primary supply system, and in certain cases the frequency, is transformed to the voltage and the frequency of the contact line

[SOURCE: EN 50122-1:2011, 3.4.2]

3.41
(traction) switching station
installation from which electrical energy can be distributed to different feeding sections or from which different feeding sections can be switched on and off or can be interconnected

[SOURCE: EN 50122-1:2011, 3.4.3]

3.42
Normal operation
operation without fault condition on the line

Note 1 to entry: In this standard normal operation includes also degraded mode (loss of one or several substations)

3.43
fault (or fault condition)
non intended condition caused by short-circuit. The time duration is terminated by the correct function of the protection devices and circuit breakers

Note 1 to entry: For the relevant fault duration the correct operation of protection devices and circuit breakers is taken into account.

Adapted from EN 50122-12011, 3.4.5

3.44
internal overvoltage
an overvoltage in the system resulting from switching or from a fault in the system itself

[SOURCE: IEC 60050-604:1987, 03-31]

3.45
short-circuit
accidental or intentional conductive path between two or more conductive parts forcing the electric potential differences between these conductive parts to be equal to or close to zero

[SOURCE: IEC 60050-195:1998,04-11]

3.46
stray current
part of the current caused by a d.c.-traction system which follows paths other than the return circuit

Adapted from EN 50122-1:2011, 3.6.3

3.47
overhead contact line
OCL

contact line placed above (or beside) the upper limit of the vehicle gauge and supplying vehicles with electric energy through roof-mounted current collection equipment

[SOURCE: IEC 60050-811:1991, 33-02]

3.48
conductor rail
contact line made of a rigid metallic section or rail, mounted on insulators located near the running rails

[SOURCE: EN 50119:2009, 3.1.7]

3.49
overhead contact line zone
OCLZ
zone whose limits are in general not exceeded by a broken overhead contact line

[SOURCE: EN 50122-1:2011, 3.5.9]

3.50
current collector zone
CCZ
zone whose limits are in general not exceeded by an energized collector no longer in contact with the contact line or broken collector and its fragments

[SOURCE: EN 50122-1:2011, 3.5.10]

4 General considerations

4.1 General

Surge arresters are intended to protect power equipment from the lightning overvoltages. A surge arrester can be used also in order to protect electronic equipment against high transient voltages in the circuits to which the equipment is connected. See EN 50526-1 for the product specification.

VLDs are intended to protect persons from impermissible touch voltages between conductive parts caused by train operating currents or faults. When selecting a VLD, it should be considered whether the required function is VLD-F, or VLD-O or both as described in EN 50122-1. This is a question for the system design. See prEN 50526-2 for the product specification.