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INTERNATIONAL STANDARD

Railway applications – DC surge arresters and voltage limiting devices – Part 2: Voltage limiting devices

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RAILWAY APPLICATIONS – DC SURGE ARRESTERS AND VOLTAGE LIMITING DEVICES –

Part 2: Voltage limiting devices

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International Standard IEC 62848-2 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

This document is based on EN 50526-2:2014.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
9/2492/FDIS	9/2503/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.

A list of all parts in the IEC 62848 series, published under the general title *Railway applications – DC surge arresters and voltage limiting devices*, can be found on the IEC website.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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- withdrawn,
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RAILWAY APPLICATIONS – DC SURGE ARRESTERS AND VOLTAGE LIMITING DEVICES –

Part 2: Voltage limiting devices

1 Scope

This document applies to Voltage Limiting Devices (VLDs) to be applied in DC traction systems in order to comply with protective provisions against electric shock from DC, and combined AC – DC voltages, in accordance with the IEC 62128 series, taking into account stray current provisions.

VLDs operate in such a way as to connect the track return circuit of DC railway systems to the earthing system or to conductive parts within the overhead contact line zone or current collector zone.

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.

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IEC 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*

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IEC 60085, *Electrical insulation – Thermal evaluation and designation*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60850:2014, *Railway applications – Supply voltages of traction systems*

IEC 61643-311, *Components for low-voltage surge protective devices – Part 311: Performance requirements and test circuits for gas discharge tubes (GDT)*

IEC 61992-1:2006, *Railway applications – Fixed installations – DC switchgear – Part 1: General*
IEC 61992-1:2006/AMD1:2014

IEC 61992-7:2006 (all parts), *Railway applications – Fixed installations – DC switchgear – Part 7-x: Measurement, control and protection devices for specific use in d.c. traction systems*

IEC 62128-1:2013, *Railway applications – Fixed installations – Electrical safety, earthing and the return circuit – Part 1: Protective provisions against electric shock*

IEC 62128-3:2013, *Railway applications – Fixed installations – Electrical safety, earthing and the return circuit – Part 3: Mutual Interaction of a.c. and d.c. traction systems*

IEC 62497-1, *Railway applications – Insulation coordination – Part 1: Basic requirements – Clearances and creepage distances for all electrical and electronic equipment*

IEC 62498-2, *Railway applications – Environmental conditions for equipment – Part 2: Fixed electrical installations*

IEC 62848-1:2016, *Railway applications – DC surge arresters and voltage limiting devices – Part 1: Metal-oxide surge arresters without gaps*

ISO 4287:1997, *Geometrical Product Specifications (GPS) -Surface texture: Profile method – Terms, definitions and surface texture parameters*

ISO 4892-1, *Plastics – Methods of exposure to laboratory light sources – Part 1: General guidance*

ISO 4892-2, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps*

ISO 4892-3, *Plastics – Methods of exposure to laboratory light sources – Part 3: Fluorescent UV lamps*

3 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

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3.1
voltage-limiting device
VLD
protective device whose function is to prevent existence of an impermissible high touch voltage

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[SOURCE: IEC 60050-811:2017, 811-29-41]

3.2
recoverable VLD
VLD that recovers after triggering

3.3
non-recoverable VLD
VLD remaining in its low resistance state permanently after triggering

3.4
welding shut spark gap
VLD which is triggered by electrical discharge across a gap causing a permanent short-circuit by welding shut of metallic parts

Note 1 to entry: Sometimes the term voltage fuse is used for this type of VLD.

3.5
rated current
I_r
<for a voltage-limiting device> maximum value of the direct current that may flow for the specified long term through the VLD in specified environmental conditions without exceeding the temperature rise limits

3.6
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

3.7
making capacity
I_{NSS}
<of a switching device or a fuse> value of prospective making current that a switching device is capable of making at a stated voltage under prescribed conditions of use and behaviour

Note 1 to entry: The conditions to be prescribed are dealt with in the relevant specifications.

[SOURCE: IEC 60050-441:1984, 441-17-09, modified – The beginning of the Note has been changed.]

3.8
breaking capacity
<of a voltage-limiting device> maximum current that a recoverable VLD can interrupt at a stated voltage

3.9
leakage current
I_L
<of a voltage-limiting device> current which flows through the terminals when the VLD is in open status

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3.10
lightning current impulse
$I_{imp\text{-}n}$
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

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Note 1 to entry: The time to half-value on the tail is not critical and may have any tolerance during the residual voltage type tests.

[SOURCE: IEC 60099-4:2014, 3.31]

3.11
high current impulse
$I_{imp\text{-}high}$
peak value of discharge current having a 4/10 µs or 8/20 µs impulse shape which is used to test the ability of the VLD to withstand direct lightning strikes from the dielectric point of view

3.12
high charge impulse
$I_{imp\text{-}hc}$
crest value of a high charge impulse through the VLD with specified charge transfer Q and specified energy W/R in the specified time

Note 1 to entry: A crest value of a high charge impulse having a 10/350 µs waveshape is also a commonly known expression.

3.13
triggering voltage
U_T
voltage at which a VLD becomes conductive

3.14
nominal triggering voltage
U_{Tn}
voltage at which the VLD becomes conductive when a DC voltage is applied for long term

Note 1 to entry: This voltage is used to identify the VLD.

3.15
instantaneous triggering voltage
U_{Ti}
minimum triggering voltage at which the VLD becomes conductive shortly after its application

Note 1 to entry: A maximum delay of 5 ms is taken in this document.

3.16
non-triggering voltage
U_W
maximum voltage below which the VLD will not trigger for any duration of the applied voltage

3.17
residual voltage of a VLD
U_{res}
<of a voltage-limiting device> value of voltage that appears between the terminals of the VLD during the passage of a specified current

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3.18
combined voltage
voltage having significant AC and DC components

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3.19
response time
T_R
<of a voltage-limiting device> time between the application of a voltage until VLD becomes conductive

3.20
degree of protection
extent of protection provided by an enclosure against access to hazardous parts, against ingress of solid foreign objects and/or against ingress of water and verified by standardized test methods

[SOURCE: IEC 60529:1989, 3.3]

3.21
IP Code
coding system to indicate the degree of protection provided by an enclosure against access to hazardous parts, ingress of solid foreign objects, ingress of water and to give an additional information in connection with such protection

[SOURCE: IEC 60529:1989, 3.4]

4 Classes of VLD

This document identifies the properties and the technology of a VLD using the classes of VLD which are defined in Table 1.

Table 1 – Classes of voltage-limiting device

Class	Method for switching between the high and low resistance status	Auxiliary power supply necessary for normal operation	Polarity	Maximum response time T_R	Recoverable or not	Able to interrupt the current in the VLD
1	Welding shut of metallic parts	No	Bidirectional	5 ms	Can be recoverable in some conditions[a]	No
2.1	Triggering of thyristors	No	Unidirectional	5 ms (for voltages equal to or higher than U_{TI})	Yes	Passive at natural zero crossing of current
2.2	Triggering of thyristors	No	Bidirectional	5 ms (for voltages equal to or higher than U_{TI})	Yes	Passive at natural zero crossing of current
3.1	Contactor only	Yes	Bidirectional	Voltage dependent and not exceeding the limits given in IEC 62128-1:2013, 9.3.2.2 or IEC 62128-3:2013, 7.2 through 7.5	Yes	Yes
3.2	Contactor only	Yes	Bidirectional	Voltage dependent and not exceeding the limits given in IEC 62128-1:2013, 9.3.2.3, IEC 62128-3:2013, 7.6	Yes	Yes
3.3	Contactor only	Yes	Bidirectional	Specified by the manufacturer or the purchaser	Yes	Yes
4.1	Combination of thyristors and contactor	Yes	Bidirectional	For voltages up to U_{TI}, voltage dependent and not exceeding the limits given in IEC 62128-1:2013, 9.3.2.2 or IEC 62128-3:2013, 7.2 through 7.5. For voltages equal to or higher than U_{Ti} 5 ms.	Yes	Yes
4.2	Combination of thyristors and contactor	Yes	Bidirectional	For voltages up to U_{TI}, voltage dependent and not exceeding the limits given in IEC 62128-1:2013, 9.3.2.3, IEC 62128-3:2013, 7.6. For voltages equal to or higher than U_{Ti} 5 ms	Yes	Yes
4.3	Combination of thyristors and contactor	Yes	Bidirectional	Specified by the manufacturer or the purchaser	Yes	Yes

NOTE IEC 62128-1 defines two functionalities for VLDs, VLD-O and VLD-F. In this document a discrimination is not necessary.

[a] For transient low currents associated with low energy dissipation no welding shut may occur.

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5 Characteristics and requirements of the VLDs

5.1 Marking

VLDs shall be identified by the following minimum information which shall appear on the rating plate (nameplate):

– manufacturer's name or trademark and manufacture type designation;