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Edition 1.1 2023-02
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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Railway applications – Rolling stock – Electrical equipment in trolley buses – Safety requirements and current collection systems

Applications ferroviaires – Matériel roulant – Équipements électriques des trolleybus – Exigences de sécurité et systèmes de captage de courants



IEC 63076:2019-09+AMD1:2023-02 CSV(en-fr)



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REDLINE VERSION

VERSION REDLINE

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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RAILWAY APPLICATIONS – ROLLING STOCK – ELECTRICAL EQUIPMENT IN TROLLEY BUSES – SAFETY REQUIREMENTS AND CURRENT COLLECTION SYSTEMS

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IEC 63076 edition 1.1 contains the first edition (2019-09) [documents 9/2530/FDIS and 9/2543/RVD] and its amendment 1 (2023-02) [documents 9/2736/CDV and 9/2807/RVC].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 63076 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

This publication is based on EN 50502:2015.

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

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RAILWAY APPLICATIONS – ROLLING STOCK – ELECTRICAL EQUIPMENT IN TROLLEY BUSES – SAFETY REQUIREMENTS AND CURRENT COLLECTION SYSTEMS

1 Scope

This document applies to electrical systems aboard vehicles of the trolley bus type, as defined in 3.1, fed with a nominal line voltage (U_n) between 600 V DC and 750 V DC.

This document defines the requirements and constructional advice, especially to avoid electrical danger to the public and to staff. Where special requirements exist for trolley buses, advice is given for mechanical and functional safety, as well as for protection against fire.

This document covers vehicles intended for public transportation. This document applies to:

– trolley buses without on-board isolation interface from the contact line,
– buses with a current rail for guidance in the road surface,
– guided buses with bipolar roof current collectors.

This document does not apply to:

a) electric driven vehicles fitted only with an internal power supply:
   1) hybrid vehicles,
   2) diesel-electric vehicles,
   3) fuel-cell vehicles,
   4) battery-powered vehicles,
b) vehicles with safe protective bonding:
   1) rubber-tyred commuter trains,
   2) guided buses with power supplied by a separate current rail,
   3) rail-guided buses with unipolar roof current collector,
c) vehicles operated outside publicly accessible areas:
   1) electrically driven lorries on motorways.

Guidance and current rails are special solutions and, at this time, are not subject to standardization, unlike trolley bus current collectors and overhead contact lines.

This document refers mainly to earthed networks, but reference is made also to galvanically insulated networks.

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 60077 (all parts), *Railway applications – Electric equipment for rolling stock*

IEC 60077-1, *Railway applications – Electric equipment for rolling stock – Part 1: General service conditions and general rules*

IEC 60322, *Railway applications – Electric equipment for rolling stock – Rules for power resistors of open construction*

IEC 60349 (all parts), *Electric traction – Rotating electrical machines for rail and road vehicles*

IEC 60479 (all parts), *Effects of current on human beings and livestock*

IEC 60479-1, *Effects of current on human beings and livestock – Part 1: General aspects*

IEC 60479-2*, Effects of current on human beings and livestock – Part 2: Special aspects*

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

IEC 60571, *Railway applications – Electronic equipment used on rolling stock*

IEC 60721-3-5, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 5: Ground vehicle installations*

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

IEC 61111, *Live working – Electrical insulating matting*

IEC 61133:2016, *Railway applications – Rolling stock – Testing of rolling stock on completion of construction and before entry into service*

IEC 61287-1, *Railway applications – Power converters installed on board rolling stock – Part 1: Characteristics and test methods*

IEC 61373, *Railway applications – Rolling stock equipment – Shock and vibration tests*

IEC 61557-2, *Electrical safety in low voltage distribution systems up to 1 000V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 2: Insulation resistance*

IEC 61557-8, *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 8: Insulation monitoring devices for IT systems*

IEC 61851 (all parts), *Electric vehicle conductive charging system*

IEC 61881 (all parts), *Railway applications – Rolling stock equipment – Capacitors for power electronics*

IEC 61991, *Railway applications – Rolling stock – Protective provisions against electrical hazards*

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

IEC 62196-1, *Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 1: General requirements*

IEC 62236 (all parts), *Railway applications – Electromagnetic compatibility*

IEC 62497-1:2010, *Railway applications – Insulation coordination – Part 1: Basic requirements – Clearances and creepage distances for all electrical and electronic equipment*
IEC 62497-1:2010/AMD1:2013

IEC 62498-1, *Railway applications – Environmental conditions for equipment – Part 1: Equipment on board rolling stock*

IEC TS 62597, *Measurement procedures of magnetic field levels generated by electronic and electrical apparatus in the railway environment with respect to human exposure*

IEC 62928, *Railway applications – Rolling stock – Onboard lithium-ion traction batteries*

IEC 62995, *Railway applications – Rolling stock – Rules for installation of cabling*

ISO 6469-3, *Electrically propelled road vehicles – Safety specifications – Part 3: Electrical safety*

ISO 16750-2, *Road vehicles – Environmental conditions and testing for electrical and electronic equipment – Part 2: Electrical loads*

ISO 16750-3, *Road vehicles – Environmental conditions and testing for electrical and electronic equipment – Part 3: Mechanical loads*

ISO 23273, *Fuel cell road vehicles – Safety specifications – Protection against hydrogen hazards for vehicles fuelled with compressed hydrogen*

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

3.1
trolley bus
vehicle with rubber tyres (with limited lateral operating range or guided) without safe protective bonding of the chassis, which operates with an electrical drive in the public area accessible to persons and galvanically powered by an external supply line (overhead contact line, current rail)

Note 1 to entry: The two poles of the supply line are either both galvanically insulated from earth or one insulated and the other earthed. This can take place at a central point or at every feed (substation).

3.2
current-collection system
whole of the components, generally mounted on the vehicle's roof, having the task of taking the current from the overhead contact lines to supply the equipment of the vehicle, both in standing and in running conditions

3.3
mass
<for trolley bus> conductive part of an electrical component that is accessible and that is not energized in normal conditions, but can become energized in fault conditions

Note 1 to entry: The equipment defined in 5.4.1 as normal bus vehicle components are not included in this term.

Note 2 to entry: The conductive parts of the chassis and of the bodywork are defined as the vehicle mass.

3.4
intermediate mass
conductive part between two insulating parts of double-insulated equipment (protection, enclosure, etc.), which shall not be accessible to the public

3.5
basic insulation
<for trolley bus> insulation for personal safety, between the electric parts that are subject to energization and the intermediate mass, to provide basic protection against electric shock

3.6
supplementary insulation
<for trolley bus> insulation for personal safety between the intermediate mass and the vehicle mass

3.7
double insulation
insulation comprising both basic insulation and supplementary insulation

[SOURCE: IEC 60050-195:1998, 195-06-08]

3.8
functional insulation
<for trolley bus> insulation not for personal safety, with lower requirements, that ensures the function of the vehicle

Note 1 to entry: To some extent, the design is specified in the product standards.

3.9
nominal voltage
U_{n}
<for railways> designated value for a system to which the general characteristics are referred

3.10
rated voltage range
U_{Ne}
<for trolley bus> voltage range that, together with rated current, defines the use of the equipment and to which the applicable tests and the utilization categories are referred

3.11
highest permanent voltage
U_{max1}
maximum value of the voltage likely to be present indefinitely

[SOURCE: IEC 60850:2014, 3.4]

3.12
rated insulation voltage
U_{Nm}
<for trolley bus> value to which the dielectric test voltages and the creepage distances are referred and which cannot, in any case, be lower than U_{Ne}

Note 1 to entry: When no value is defined by the purchaser for U_{Nm}, the highest permanent voltage U_{max1} given by IEC 60850 is due to be assumed.

3.13
power-frequency test voltage
U_a
RMS value of sinusoidal power-frequency voltage that the insulation of the given equipment can withstand during tests made under specified conditions and for a specified duration

[SOURCE: IEC 60050-614:2016, 614-03-22]

3.14
highest non-permanent voltage
U_{max2}
maximum value of the voltage likely to be present for a limited period of time

[SOURCE: IEC 60850:2014, 3.5]

3.15
overvoltage
<for railways> any voltage having a peak value exceeding the corresponding peak value of maximum steady-state voltage at normal operating conditions

[SOURCE: IEC 60850:2014, 3.6]

3.16
long-term overvoltage
overvoltage higher than U_{max2}, lasting typically for more than 20 ms, due to low-impedance phenomena, for example a rise in substation primary voltage

[SOURCE: IEC 60850:2014, 3.7, modified – Note1 to entry has been removed.]

3.17
highest long-term overvoltage
U_{max3}
voltage defined as the highest value of the long-term overvoltage for t = 20 ms

[SOURCE: IEC 60850:2014, 3.8, modified – The second sentence has been removed.]

3.18
dewirement
sudden and permanent detachment of one or both poles of the trolley from the overhead contact line(s) while the trolley bus is running

3.19
overhead contact line
catenary
contact line that is placed above or beside the upper limit of the vehicle's clearance, which supplies traction units with electrical energy via roof-mounted current collection equipment

Note 1 to entry: The characteristics of the overhead contact line are to be made known to the manufacturer, together with the type of service, the environmental conditions and the road profile. Mechanical properties are given in IEC 60913, minimum heights are given in IEC 62128-1.

[SOURCE: IEC 60050-811:2017, 811-33-02 – modified – Note 1 to entry has been added]

3.20
rated impulse 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

Note 1 to entry: U_{Ni} is higher than or equal to the working peak voltage.

[SOURCE: IEC 62497-1:2010, 3.4.7]

4 Voltages and classification of the voltage bands

4.1 Voltages

4.1.1 General

The voltage definitions used in this document are those of IEC 60850 and IEC 62497-1, where the following applies to direct voltage networks in compliance with IEC 60850.

4.1.2 Operating voltages

The equipment shall operate at the voltages, for overhead contact line systems, specified in Table 1.

Table 1 – Nominal voltages and their permissible limits in values and duration

Nominal voltage U_n V DC	Rated voltage range U_{Ne} V DC	Highest permanent voltage U_{max1} V DC	Highest non-permanent voltage U_{max2} V DC
600	400 to 720	720	800
750	500 to 900	900	1 000

NOTE In France, Belgium and the United Kingdom, different national regulations (IEC 60850) apply, which, however, do not apply to trolley buses.

For vehicle wash plants, in accordance with IEC 62128-1, the maximum allowed voltage is 120 V DC (voltage band II). In this case, the vehicle washing plant is not part of the workshop where the maximum allowed voltage is 60 V DC (voltage band I).

4.1.3 Insulation voltages and test voltages

Insulation in accordance with IEC 62497-1 shall be designed and tested with reference to the following voltages shown in Table 2.

~~**Table 2 – Insulation voltages and power frequency test voltages**~~

~~Nominal voltage~~ ~~U_n~~ ~~V DC~~	~~Rated insulation voltage~~ ~~U_{Nm}~~ ~~V DC~~	~~Power frequency test voltage~~ ~~U_a~~ ~~V DC~~
~~600~~	~~≥ 720~~	~~refer to IEC 62497-1:2010, Table B.1~~
~~750~~	~~≥ 900~~	