SLOVENSKI STANDARD
SIST EN 50546:2024

01-december-2024

Železniške naprave - Vozna sredstva - Trifazni (zunanji) napajalni sistem in konektorji za železniška vozila

Railway applications - Rolling Stock - Three-phase shore (external) supply system for rail vehicles and its connectors

Bahnanwendungen - Fahrzeuge - Dreiphasiges Fremdeinspeisungssystem für Schienenfahrzeuge und zugehörige Steckverbinder

Applications ferroviaires - Matériel roulant - Système d'alimentation à quai (externe) triphasée des véhicules ferroviaires par connecteurs

Ta slovenski standard je istoveten z: **EN 50546:2024**

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29.120.30	Vtiči, vtičnice, spojke	Plugs, socket-outlets, couplers
45.060.01	Železniška vozila na splošno	Railway rolling stock in general

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EUROPEAN STANDARD

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English Version

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European Committee for Electrotechnical Standardization
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European foreword

This document (EN 50546:2024) has been prepared by CLC/SC 9XB, “Electrical, electronic and electromechanical material on board rolling stock, including associated software”.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2025-07-29
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2027-07-29

This document supersedes EN 50546:2020 and all of its amendments and corrigenda (if any).

EN 50546:2024 includes the following significant technical changes with respect to EN 50546:2020:

a) Revision of Clause 1, Scope;

b) Revision of Clause 2, Normative references;

c) Revision of Clause 3, Terms and definitions, with reorganization of definitions;

d) Introduction of new Clause 4, System overview;

e) Introduction of new Clause 5 (revision and completion of previous Clause 4), General requirements;

f) The previous Clause 5 contents where redistributed among other clauses;

g) Updates of Clause 6, Connector requirements;

h) Updates of Clause 7, Tests;

i) Updates of the following mandatory Annexes:

   1) Annex A, Connector design 63/125 A;

   2) Annex B, Connector design 600 A;

j) New Annex C (Informative), Explanations about some protection features;

k) Bibliography, revised and corrected.

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

This document has been prepared under a standardization request addressed to CENELEC by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

This standardization project was derived from the EU-funded Research project MODTRAIN (MODPOWER). It is part of a series of standards, referring to each other. The hierarchy of the standards is intended to be as set out in Figure 1:

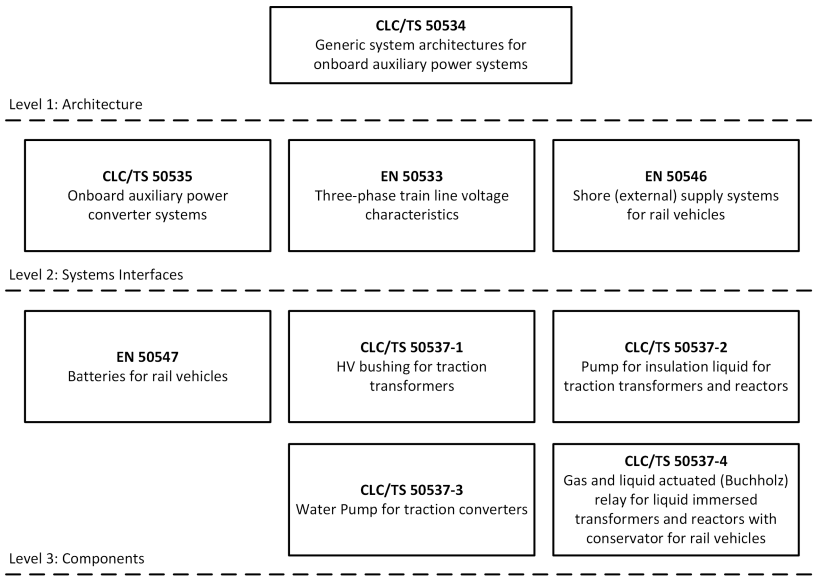

Figure 1 — Overview on the technical framework CLC/TS 50534:2010 defines the basis for other dependent standards

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Introduction

This document is part of the technical framework as given in Figure 1 and describes a 63/125 A shore supply system, the safety devices and provides requirements for the connectors. For a 600 A shore supply, this document describes the connector requirements.

The workgroup did take notice from the many technical comments on the final version of the first edition and tried, as best as we could, to address these comments.

While drafting this edition of the document, input was received from various rolling stock manufacturers, infra structure experts, safety experts and operators.

1 Scope

The shore supply system is used while the rolling stock is standing still within depots and sidings location for providing power to the AC auxiliary loads (which can include battery charging) when the primary power supply (contact line) is not available or used.

This document:

— specifies requirements to the shore supply and to the rolling stock for safe operation on shore supply operation;

— specifies the requirements to ensure compatibility of class C0 and C1 train types as given in CLC/TS 50534:2010 systems and three-phase shore power supply systems;

— provides a complete system design for 63/125 A shore supplies including the interfaces (power and control loop) between shore supply and rolling stock;

— specifies the requirements with regards to interoperability with AC and DC fed traction systems in order to prevent undesired stray currents and adverse interaction with signalling systems when operating on shore supply;

— defines the electrical characteristics of the 63/125 A shore power supply;

— defines the 63/125 A connectors and its intermateability to provide interoperability for rolling stock that is to run across borders;

— defines the 600 A connector and its intermateability;

— can be used for other type of rail vehicles and purposes, if agreed by the manufacturer and customer

— does not apply to shore supplies to move the rolling stock;

— does not describe the 600 A shore supply system.

NOTE 1 The 600 A connector is the existing UK standard three-phase shore supply connector which has a long service history.

NOTE 2 The connectors are dimensioned using standard rolling stock cables as set out in EN 50264-3-1:2008.

NOTE 3 Examples of other usage and rail vehicles are: e.g. light rail vehicles, class A train types, traction battery charging etcetera.

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.

EN 45545-2:2020+A1:2023, *Railway applications - Fire protection on railway vehicles - Part 2: Requirements for fire behaviour of materials and components*

EN 50124-1:2017, *Railway applications - Insulation coordination - Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment*

EN 50125-1:2014, *Railway applications - Environmental conditions for equipment - Part 1: Rolling stock and on-board equipment*

EN 50153:2014,[1] *Railway applications - Rolling stock - Protective provisions relating to electrical hazards*

EN 50264-3-1:2008, *Railway applications - Railway rolling stock power and control cables having special fire performance - Part 3-1: Cables with crosslinked elastomeric insulation with reduced dimensions - Single core cables*

EN 50264-3-2:2008, *Railway applications - Railway rolling stock power and control cables having special fire performance - Part 3-2: Cables with crosslinked elastomeric insulation with reduced dimensions - Multicore cables*

EN 50467:2011, *Railway applications - Rolling stock - Electrical connectors, requirements and test methods*

EN 50533:2011,[2] *Railway applications – Three-phase train line voltage characteristics*

EN 60512-1-4:1997, *Electromechanical components for electronic equipment - Basic testing procedures and measuring methods - Part 1: General - Section 4: Test 1d: Contact protection effectiveness (scoop-proof) (IEC 60512-1-4:1997 + COR1:2000)*

EN 60529:1991,[3] *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989 + A1:1999 and A2:2013)*

EN 61373:2010, *Railway applications - Rolling stock equipment - Shock and vibration tests (IEC 61373:2010)*

EN ISO 4892-2:2013, *Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps (ISO 4892-2:2013)*

ISO 1431-1:2022, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static and dynamic strain testing*

CLC/TS 50535:2010, *Railway applications - Onboard auxiliary power converter systems*

EN 60947-5-1:2017, *Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices (IEC 60947-5-1:2016*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp/

— IEC Electropedia: available at https://www.electropedia.org/

3.1.1 System

3.1.1.1
shore supply system
system consisting of on-ground equipment and on-board equipment connected to each other

[1] As impacted by EN 50153:2014/A1:2017 and EN 50153:2014/A2:2020.
[2] As impacted by EN 50533:2011/A1:2016.
[3] As impacted by EN 60529:1991/A1:2000, EN 60529:1991/A2:2013 and EN 60529:1991/AC:2016-12.

3.1.1.2
three-phase shore power supply
three-phase AC voltage system involving three or four wire (including neutral wire) distribution

[SOURCE: CLC/TS 50534:2010, 3.1.18, modified – replaced “3AC voltage system” with “three-phase shore power supply”]

3.1.1.3
3AC train line
<rolling stock> three-phase AC voltage systems involving three or four wire (including neutral wire) distribution

[SOURCE: CLC/TS 50534:2010, 3.1.18, modified – replaced “3AC voltage system” with “3AC train line”]

3.1.1.4
shore supply connection system
system consisting of the fixed connector(s), the free connector(s) and the associated cables

3.1.1.5
shore supply cable
cable with connector(s) connecting the three-phase shore power supply to the rolling stock

Note 1 to entry: The shore supply cable provides connectivity for all contact pins in the connector(s).

3.1.2 Connection

3.1.2.1
connector
device providing connection and disconnection to a suitable mating component

Note 1 to entry: A connector has one or more contact elements

Note 2 to entry: Connectors covered by this document are not intended to be connected and disconnected under electrical load.

[SOURCE: IEC 60050-581:2008,581-26-01 – Note 2 to entry has been added]

3.1.2.2
intermateable
pertaining to each of two components when they feature identical dimensions for electrical and dimensional interfaces

[SOURCE: IEC 60050-581:2008, 581-24-07]

3.1.2.3
mating cycle
cycle of operation of a connector
one connection and one disconnection of the connector mating halves

[SOURCE: IEC 60050-581:2008, 581-21-06, modified – The preferred term “cycle of (connector) operation” has been replaced by “mating cycle” and the admitted term “cycle of operation of a connector” has been added. The word ‘insertion’ has been replaced with ‘connection’ and the word ‘withdrawal’ has been replaced by ‘disconnection’. The word “mating” has been added to “halves” for clarity.]

3.1.2.4
free connector
connector for attachment to a free end of a cable

Note 1 to entry: Is a mobile connector, with male or female contacts, to be coupled to a fixed connector.

[SOURCE: IEC 60050-581:2008, 581-26-10, modified – ‘of a cable’ and Note 1 to entry added for clarity]

3.1.2.5
fixed connector
connector for attachment to a rigid surface

Note 1 to entry: Is a connector, with male or female contacts, to be mounted on rigid surface.

[SOURCE: IEC 60050-581:2008, 581-26-07, Note 1 to entry added for clarity]

3.1.2.6
shore supply connector
connector dedicated to the shore supply system

3.1.2.7
contact
<in a connector> conductive element in a connector (including means for a cable termination) that mates with a corresponding element to provide an electric path

[SOURCE: EN 50467:2011, 3.8]

3.1.2.8
crimped connection
permanent connection made by the application of pressure inducing the deformation or reshaping of the barrel around the conductor of a cable

Note 1 to entry: In some cases, the deformation or reshaping of the barrel can affect the form of the conductor.

[SOURCE: IEC 60050-461:2008, 461-19-01]

3.1.2.9
male contact
pin contact
contact element intended to make electric engagement on its outer surface for mating with the inner surface of another contact element

[SOURCE: IEC 60050-581:2008, 581-22-08, modified – The preferred term “pin contact” and the admitted term “male contact” have been inverted.]

3.1.2.10
female contact
socket contact
contact element intended to make electric engagement on its inner surface for mating with the outer surface of another contact element

Note 1 to entry: In English, the term “socket contact” does not imply that socket contacts are always mounted in a socket (IEC 60050-151:2001, 151-12-20) nor that sockets have only socket contacts.

[SOURCE: IEC 60050-581:2008, 581-22-06, modified – The preferred term “socket contact” and the admitted term “female contact” have been inverted. “IEC 60050-151:2001” has been added in Note 1 to entry]

3.1.2.11
pilot contact
auxiliary electric contact for use in a control, signalling, monitoring or interlock circuit

[SOURCE: EN-IEC 60309-1:2022, 3.25 modified – replaced the word ”function” with “circuit”]

3.1.2.12
interlock circuit
circuit linking mechanical, electric or other devices, for example through auxiliary contacts, intended to make the operation of a piece of apparatus dependent on the condition or position of one or more others

[SOURCE: IEC 60050-811:2017, 811-25-13]

3.1.2.13
coding contact
<shore supply system> control contact for the system to know which current is available from the three-phase shore power supply

3.1.2.14
last make first break
contact that is the last to make a connection when the free connector is connected into the fixed connector and the first to break the connection when the free connector is disconnected from the fixed connector

3.1.3 Electrical

3.1.3.1
rated voltage
<of connector> value of voltage assigned to the connector and to which operation and performance characteristics are referred

3.1.3.2
rated impulse voltage
<of connector> impulse voltage value assigned to the connector, characterizing the specified withstand capability of its insulation against transient overvoltages

[SOURCE: IEC 60050-581:2008, 581-21-18, modified – Specific use has been added. In the definition “impulse’ has been added. “by the manufacturer” has been deleted.]

3.1.3.3
rated current
<of connector> value of the electric current in a connector used for specification purposes, established for the operating condition in which the electric current is present continuously

[SOURCE: IEC 60050-581:2008, 581-21-05, modified – The specific use has been added. The second part of the definition “and simultaneously in all contacts of the connector being wired with the largest specified conductor, while the ambient temperature near the connector is maintained at 40 °C” has been removed. The Note to entry has been omitted.]

3.1.3.4
Safety Extra-Low Voltage
SELV
AC voltage the RMS value of which does not exceed 50 V or ripple-free DC voltage the value of which does not exceed 120 V, between conductors, or between any conductor and reference earth, in an electric circuit which has galvanic separation from the supplying electric power system by such means as a separate-winding transformer

Note 1 to entry: Maximum voltage lower than 50 V AC or 120 V ripple-free DC can be specified in particular requirements, especially when direct contact with live parts is allowed.

Note 2 to entry: The voltage limit should not be exceeded at any load between full load and no-load when the source is a safety isolating transformer.

Note 3 to entry: Ripple-free qualifies conventionally an RMS ripple voltage not more than 10 % of the DC component; the maximum peak value does not exceed 140 V for a nominal 120 V ripple-free DC system and 70 V for a nominal 60 V ripple-free DC system.

Note 4 to entry: The values given are according to EN 50153:2014, Table 1 Band II.

[SOURCE: IEC 60050-851:2008, 851-15-08]

3.1.3.5
SELV system
electric system in which the voltage cannot exceed the value of extra-low voltage:

— under normal conditions and

— under single fault conditions, including earth faults in other electric circuits

Note 1 to entry: SELV is the abbreviation for Safety Extra-Low Voltage.

[SOURCE: IEC 60050-195:2021, 195-06-28]

3.1.3.6
phase sequence
order in which the voltages successively reach their maximum positive values between supply conductors

[SOURCE: IEC 60034-8:2007, 3.13]

3.1.3.7
clearance
shortest distance in air between two conductive parts

[SOURCE: IEC 60050-581:2008, 581-27-76]

3.1.3.8
creepage distance
shortest distance along the surface of a solid insulating material between two conductive parts

[SOURCE: IEC 60050-581:2008, 581-21-23]

3.1.3.9
direct contact
electric contact of human beings or livestock with live parts

[SOURCE: IEC 60050-195:2021, 195-06-03]

3.1.3.10
indirect contact
electric contact of human beings or livestock with exposed-conductive-parts that have become live under fault conditions

[SOURCE: IEC 60050-195:2021, 195-06-04]

3.1.3.11
exposed-conductive-part
conductive part of equipment that can be touched and that is not live under normal conditions, but that can become live when basic insulation fails

[SOURCE: IEC 60050-195:2021, 195-06-10]