



# SLOVENSKI STANDARD

## oSIST prEN 50546:2023

01-september-2023

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### 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: **prEN 50546:2023**

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#### ICS:

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

**oSIST prEN 50546:2023**

**en**



EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**DRAFT**  
**prEN 50546**

June 2023

ICS 29.120.30; 45.060.01

Will supersede EN 50546:2020; EN  
50546:2020/AC:2021-09

English Version

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

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

Bahnanwendungen - Fahrzeuge - Dreiphasiges  
Fremdeinspeisungssystem für Schienenfahrzeuge und  
zugehörige Steckverbinder

This draft European Standard is submitted to CENELEC members for enquiry.  
Deadline for CENELEC: 2023-09-22.

It has been drawn up by CLC/SC 9XB.

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.

This draft European Standard was established by CENELEC in three official versions (English, French, German).

A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



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

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

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## European foreword

This document (prEN 50546:2023) has been prepared by CLC/SC 9XB, “Electrical, electronic and electromechanical material on board rolling stock, including associated software”.

The following dates are proposed:

- latest date by which the existence of this document has to be announced at national level (doa) dor + 6 months
- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) dor + 12 months
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) dor + 36 months (to be confirmed or modified when voting)

This document will supersede EN 50546:2020.

prEN 50546:2023 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 63A/125A;
  - 2) Annex B, Connector design 600A;
- j) New Annex C (Informative), Explanations about some protection features
- k) Bibliography, revised and corrected.

This document has been prepared under a Standardization Request given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s) / Regulation(s).

For the relationship with EU Directive(s) / Regulation(s), see informative Annex ZZ, which is an integral part of this document.

## prEN 50546:2023 (E)

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:

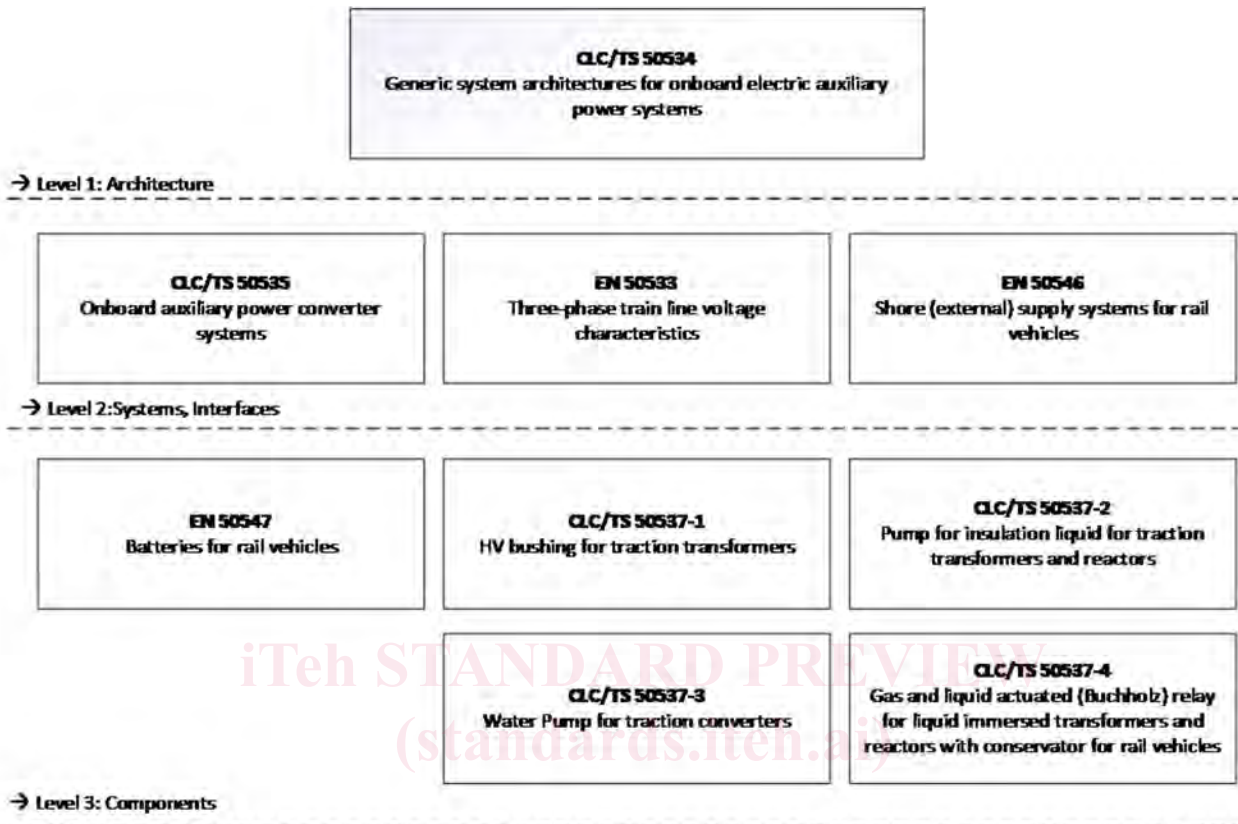


Figure 1 — Overview on the technical framework CLC/TS 50534 defines the basis for other dependent standards

## Introduction

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

iTeh STANDARD PREVIEW  
(standards.iteh.ai)

[oSIST prEN 50546:2023](https://standards.iteh.ai/catalog/standards/sist/6bbe6ea5-d89d-4d67-b0e0-a7abf76cf238/osist-pren-50546-2023)

<https://standards.iteh.ai/catalog/standards/sist/6bbe6ea5-d89d-4d67-b0e0-a7abf76cf238/osist-pren-50546-2023>



## prEN 50546:2023 (E)

## 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 systems and three-phase shore power supply systems;
- provides a complete system design for 63A/125A 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 shore power supply;
- defines intermateable connectors for the 63A/125A and 600A systems to provide interoperability for rolling stock that is to run across borders;
- 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 600A shore supply system.

NOTE 1 The 600A 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, *Railway applications - Fire protection on railway vehicles - Part 2: Requirements for fire behavior of materials and components*

EN 50122-1:2022, *Railway applications - Fixed installations - Electrical safety, earthing and the return circuit - Part 1: Protective provisions against electric shock*

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, *Railway applications - Rolling stock - Protective provisions relating to electrical hazards*

EN 50155:2021, *Railway applications - Rolling stock - Electronic equipment*

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<sup>1</sup>, *Railway applications - Three-phase train line voltage characteristics Railway applications – Three-phase train line voltage characteristics*

CLC/TS 50534:2010, *Railway applications - Generic system architectures for onboard electric auxiliary power systems*

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)*

EN 60529:1991<sup>2</sup>, *Degrees of protection provided by enclosures (IP Code) (IEC 60529)*

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*

<sup>1</sup> As impacted by EN 50533:2011/A1:2016.

<sup>2</sup> As impacted by EN 60529:1991/A1:2000, EN 60529:1991/A2:2013 and EN 60529:1991/AC:2016-12.

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

### 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:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

##### 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

###### 3.1.1.2

###### three-phase shore power supply

three-phase a.c. 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 “three-phase shore power supply”]

###### 3.1.1.3

###### 3AC train line

<rolling stock> three-phase a.c. 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

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

**3.1.2.5****fixed connector**

connector for attachment to a rigid surface

[SOURCE: IEC 60050-581:2008, 581-26-07]

**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

Note 1 to entry: Where the term ‘contact diameter’ is used in this document for the male contact, it refers to the diameter of the active part.

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

**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]

**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 (connector) impulse voltage**

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. “impulse” has been added in the definition and “by the manufacturer” has been deleted.]

**3.1.3.3****impulse withstand voltage**

highest peak value of impulse voltage of prescribed form and polarity which does not cause breakdown of insulation under specified conditions

[SOURCE: IEC 60050-442:2015, 442-09-18]

#### 3.1.3.4

##### 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 has been omitted.]

#### 3.1.3.5

##### Safety Extra Low Voltage

##### SELV

AC voltage the r.m.s. 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 1 to entry: Ripple-free qualifies conventionally an r.m.s. 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.

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

#### 3.1.3.6

##### 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]

#### 3.1.3.7

##### phase sequence

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

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

#### 3.1.3.8

##### clearance

shortest distance in air between two conductive parts

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

#### 3.1.3.9

##### creepage distance

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

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

**3.1.3.10****direct contact**

electric contact of human beings or livestock with live parts

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

**3.1.3.11****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]

**3.1.3.12****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]

**3.1.3.13****protective-equipotential-bonding**

equipotential bonding for the purposes of safety

[SOURCE: EN 50153:2014, 3.1.2.26]

**3.1.3.14****main equipotential busbar****MEB**

busbar where the equipotential conductors terminate

[SOURCE: EN 50122-1:2022, 3.2.7]

**3.2 Abbreviations**

AC	alternating current
BAT	battery
DC	direct current
EFMD	earth fault monitoring device
EMI	Electro Magnetic Interference
FBS	Flat Battery Start
IT	Isolation Terra
MCB	Miniature Circuit Breaker
MEB	main equipotential busbar
NA	not applicable
PE	protective-equipotential-bonding
RCBO	Residual Current Breaker with Overload protection
SELV	Safety Extra Low Voltage