SLOVENSKI STANDARD
oSIST prEN 50546:2019

01-junij-2019

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

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

Bahnanwendungen - Fahrzeuge - Dreiphasige Fremdeinspeisung für Eisenbahnfahrzeuge

Applications ferroviaires - Matériel roulant - Systèmes d'alimentation triphasée (externe) de quai pour les véhicules ferroviaires

Ta slovenski standard je istoveten z: prEN 50546:2019

ICS:

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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Will supersede CLC/TS 50546:2013

English Version

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

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This draft European Standard is submitted to CENELEC members for enquiry.
Deadline for CENELEC: 2019-06-28.

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.

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European Committee for Electrotechnical Standardization
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European foreword

This document [prEN 50546:2019] has been prepared by CLC/SC 9XB, “Electrical, electronic and electromechanical material on board rolling stock, including associated software”.

This document is currently submitted to the Enquiry.

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 CEN/TS 50546:2013.

prEN 50546:2019 includes the following significant technical changes with respect to CEN/TS 50546:2013:

a) Revision of Clause 1, Scope;

b) Revision of Clause 2, Normative references;

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

d) Revision of Clause 4, General requirements, to include reference to connectors and associated shore side requirements;

e) Introduction of new Clause 5, Classification;

f) Introduction of new Clause 6, Connector requirements;

g) Introduction of new Clause 7, Tests;

h) Introduction of the following mandatory Annexes:

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

   2) Annex B, Connector design 600 A;

i) Bibliography, revised and corrected.

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

For the relationship with Directive 2008/57/EC amended by Commission Directive 2011/18/EU, see informative Annex ZZ, which is an integral part of this document.

Introduction

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:

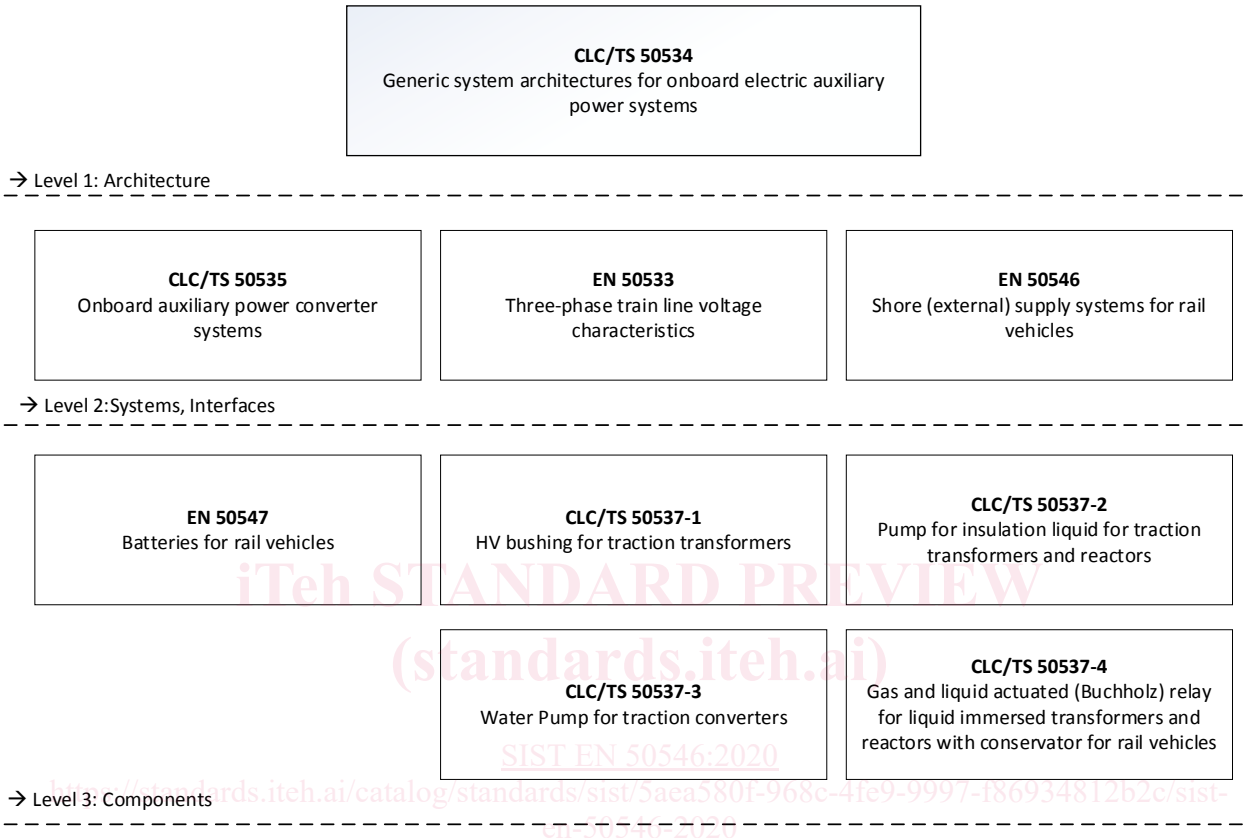

Figure 1 — Overview on the technical framework CLC/TS 50534 defines the basis for other dependent standards

The shore supply system is used within depots and sidings for providing power to the auxiliary electrical supply (which may include battery charging) when the primary power supply is not available, and the train is static (0 km/h). This document defines connectors that are intermateable to provide interoperability for rolling stock to run across borders and be charged in locations other than their normal depot or sidings location.

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

This document provides the requirements for compatibility of systems defined and good practice for three phase + Neutral AC 400 V/50 Hz shore (external) supply systems. It focuses on describing the defined interfaces regarding electrical power supply in stations, depots/workshops and stabling points into the rail vehicle.

This document provides recommended characteristics of power supply and the interface drawings for the shore supply connectors. The interface drawings are supplied to provide intermateability and interoperability of connectors. The fixed connector is provided with a protective cover to prevent any ingress when the connector is not in use.

Two connectors have been specified in this document. The first is suitable for either 63 A or 125 A shore supplies. The second is suitable for 600 A shore supplies. The 600 A connector is the existing UK standard three-phase shore supply connector which has a long service history.

The contacts in the connector have each been assigned a phase.

1 Scope

The scope of this document is to define requirements for the shore supply system for auxiliaries and pre-conditioning and the related intermateable connector pairs.

Shore supplies to move the rolling stock are outside the scope of this document.

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, *Railway applications – Fire protection on railway vehicles – Part 2: Requirements for fire behaviour of materials and components*

EN 50122 (all parts), *Railway applications - Fixed installations - Electrical safety, earthing and the return circuit*

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

EN 50125 (all parts), *Railway applications – Environmental conditions for equipment*

EN 50153, *Railway applications – Rolling stock – Protective provisions relating to electrical hazards*

EN 50160, *Voltage characteristics of electricity supplied by public electricity networks*

EN 50264-3-1, *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 50467:2011, *Railway applications – Rolling stock – Electrical connectors, requirements and test methods*

EN 50533:2011[1], *Railway applications – Three-phase train line voltage characteristics*

EN 60512-1-4, *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)*

EN 60512-1-100, *Connectors for electronic equipment – Tests and measurements – Part 1-100: General – Applicable publications (IEC 60512-1-100)*

EN 60529, *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, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps (ISO 4892-2)*

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

[1] Currently impacted by EN 50533:2011/A1:2016.

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
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 may affect the form of the conductor.

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

3.2
connector
electrical 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: In this document a connector is a connector without breaking capacity.

[SOURCE: IEC 60050-581:2008, 581-26-01, modified –Note 2 to entry was added.]

3.3
connector without breaking capacity
COC (abbreviation)
connector which is not allowed to be engaged or disengaged in normal use when live or under load

[SOURCE: IEC 60050-581:2008, 581-27-73]

3.4
free connector
connector for attachment to a free end

[SOURCE: IEC 60050-581:2008, 581-26-10]

3.5
fixed connector
connector for attachment to a rigid surface

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

3.6
shore supply connector
connector dedicated to the shore supply system

3.7
contact
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]

3.8
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]

3.9
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 (151–12–20) nor that sockets have only socket contacts.

[SOURCE: IEC 60050-581:2008, 581-22-06]

3.10
interlock
<electrical> device, which prevents the contacts of a connector from becoming live before it is in proper engagement with its counterpart, and which either prevents the connector from being withdrawn while its contacts are live or makes the contact dead before separation

[SOURCE: IEC 60050-581:2008, 581-27-48, modified – specific usage was added and ‘either electrical or mechanical’ was deleted.]

3.11
locking device
feature incorporated in certain components to provide mechanical retention of their mating part

[SOURCE: IEC 60050-581:2008, 581-23-22]

3.12
cycle of (connector) operation
<mating cycles> one insertion and one withdrawal of the connector halves

[SOURCE: IEC 60050-581:2008, 581-21-06]

3.13
clearance
shortest distance in air between two conductive parts

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

3.14
creepage distance
shortest distance along the surface of a solid insulating material between two conductive parts

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

3.15
rated voltage (U)
<connector> value of voltage assigned to the connector and to which operation and performance characteristics are referred

[SOURCE: IEC 60050-442:2014, 442-09-10, modified – specific usage was added, and 'assigned by the manufacturer to a component, device or equipment' and notes were deleted.]

3.16
rated impulse voltage (U_{Ni})
<connector> impulse voltage value assigned to the connector, characterizing 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: EN 50124-1:2017, 3.4.7, modified – 'by the manufacturer to the equipment or a part of it' was replaced with 'to the connector'.]

3.17
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 60050-442:2014, 442-09-18]

3.18
rated (connector) current
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 – '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' and notes were deleted.]

3.19
shore supply connection system
complete system consists of the fixed connector, the free connector and the associated cables

3.20
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]

3.21
pilot contact
control contact specifically made for safety functions

3.22
coding contact
control contact for the system to know which current is available from the shore (external) supply

4 General requirements

4.1 Functional description

Shore (external) supply systems have the following main functions:

— feed the auxiliary electrical equipment on board railway vehicles from an external power source;

— ensure safety during operation of shore (external) supply systems;

— ensure that the connecting and disconnecting operations take place under conditions of zero current;

— ensure that movement of the rolling stock is not possible when the shore (external) power supply is physically connected.

4.2 System requirements

4.2.1 General

The rolling stock side of the system consists of the fixed connector and the associated controls and protection devices.

The functional requirements of the rolling stock are set out in EN 50533:2011, Clause 5.

The shore side of the system consists of the free connector, connector stowage location, cable and power supply with its associated control and protection devices.

The functional requirements of the shore (external) supply system are set out in EN 50160.

4.2.2 Supply voltages for the shore supply system

Supply voltage range is:

3 AC + Neutral 400 V/50 Hz voltage range ± 10 %

Full characteristics of the shore supply are set out in EN 50533:2011, Clause 5, and EN 50160.

The phases and neutral are assigned to contacts as set out in the connector drawings in Annex A.

For DC railways, the earthing arrangements as set out in the EN 50122 series shall be considered.

The installer of the shore side (infrastructure) system shall connect any earths provided on the free connector to the earth of the shore side (infrastructure) system.

4.2.3 Power limitation

4.2.3.1 Current ratings for the shore supply system

The maximum external supply power for one infeed point is limited to the values specified in Table 1.

NOTE The pilot and control contacts are not rated for these currents.

The breaking capacity of the pilot contacts shall be 110 V DC, 2 A minimum.

Table 1 — Shore supply power ratings

Type of socket	Rated operating current (continuous load at an ambient temperature of 20 °C)	Remarks
3 AC 400 V/50 Hz	600 A per phase	400 kW High power system
3 AC + Neutral 400 V/50 Hz	125 A per phase	86 kW Medium power system
3 AC + Neutral 400 V/50 Hz	63 A per phase	44 kW Low power system

4.2.3.2 Current restriction on the rolling stock system

For the 63 A/125 A connector, the rolling stock shall be able to read the shore supply current through the coding contacts, as set out in 6.8.2.2, and control the onboard systems such that only 63 A is drawn, without damage to the onboard equipment, when only 63 A is available from the shore side (infrastructure) system.

NOTE This could be done by including a load shed mode for the shore (external) supply system.

4.2.4 Emergency cut-off switch

All shore (external) supply systems shall be equipped with a clearly visible and readily identifiable emergency cut-off switch to disconnect the power supply. This emergency cut-off switch shall be coloured red.

The emergency cut-off switch shall be part of the shore side (infrastructure) system.

4.2.5 Earth fault system

An earth fault system shall be provided to ensure that:

— when an earth fault is detected on the rolling stock, the system prevents energization of the shore supply via the pilot contacts;

— if energized the shore supply system shall operate the protection on detection of an earth fault on the rolling stock.

NOTE An earth fault can be detected in some cases due to leakage currents caused by EMC filters. Therefore, an adaptive residual current circuit breaker or a short-time suppression of the earth fault detection can be used to avoid this operational condition.

4.2.6 Energization of system

The fixed connector mounted on the vehicle shall not be energized from the onboard auxiliary electrical supply.

4.2.7 Shore side (infrastructure) system

4.2.7.1 Energization conditions

Electrical parts of the free (infrastructure) connector shall be de-energized when the shore (external) supply system is not in use.

The shore side system shall include a visible indication when the system is live.

NOTE The indication does not have to be on the connector.

4.2.7.2 Stowage of connector

The shore side (infrastructure) system shall include a stowage location for the free connector when not in use. The stowage system shall provide an indicator that shows when the shore supply is connected and supplying power to the rolling stock, when it is not stowed and when it is safely stowed.

The indicator to show that the shore supply is connected and supplying power to the rolling stock may be the same as the one to show that the shore supply system is live.

The stowage device should be located such that the indicator is visible from the rolling stock connector location and the length of cable is minimized.

It is recommended that the stowage location is mounted at an angle to match the connection to the fixed connector and reduce the risk of water ingress.

4.2.8 Disconnection under load

The system shall be designed so that pilot contacts (contacts c and d) are last make and first break. The system shall only be energized when the pilot contacts are fully mated. The pilot contacts are defined in 6.8.2.1.

The shore supply connectors shall have a locking device using the locking pins as set out in Annex A.

4.2.9 Overload protection

Overload protection shall be provided on the shore (external) power supply that considers the inrush current and starting characteristics of the railway vehicle auxiliary loads, particularly on high power auxiliary systems.

4.2.10 Traction and brake interlock

A system shall be provided to ensure that movement of the rolling stock is not possible when the shore (external) power supply is connected.

4.2.11 Cables

The cables used shall meet the requirements set out in EN 50264-3-1 for both the rolling stock and shore side (infrastructure) system (connection between supply unit and rolling stock).

This provides performance compatibility and interoperability for the connectors.

NOTE The connectors are dimensioned based on the sizes of the standard railway cables.

4.3 Installation — Mounting of fixed connector

Where the fixed connector is mounted in location 4, the connector shall be mounted at an angle to prevent water ingress.

It is recommended that the shore supply connector is accessible from track level to allow for interoperability with the common shore side (infrastructure) system locations.

5 Classification

5.1 General

The shore supply connector shall comply with EN 50467 unless otherwise specified in this document.

5.2 Intended use of rolling stock

The shore supply connectors may be used on different rolling stock types for example mass transit underground, mass transit and high-speed passenger trains, locomotives, or non-passenger freight trains.