SLOVENSKI STANDARD
SIST EN 50546:2020

01-december-2020

Nadomešča:
SIST-TS CLC/TS 50546:2013

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 - 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: **EN 50546:2020**

ICS:

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

SIST EN 50546:2020 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 50546

October 2020

ICS 29.120.30; 45.060.01

Supersedes CLC/TS 50546:2013 and all of its amendments and corrigenda (if any)

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

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

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European foreword

This document (EN 50546:2020) 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) 2021-08-17
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2023-08-17

This document supersedes CLC/TS 50546:2013.

EN 50546:2020 includes the following significant technical changes with respect to CLC/TS 50546:2013:

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) 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.

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 mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

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

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:

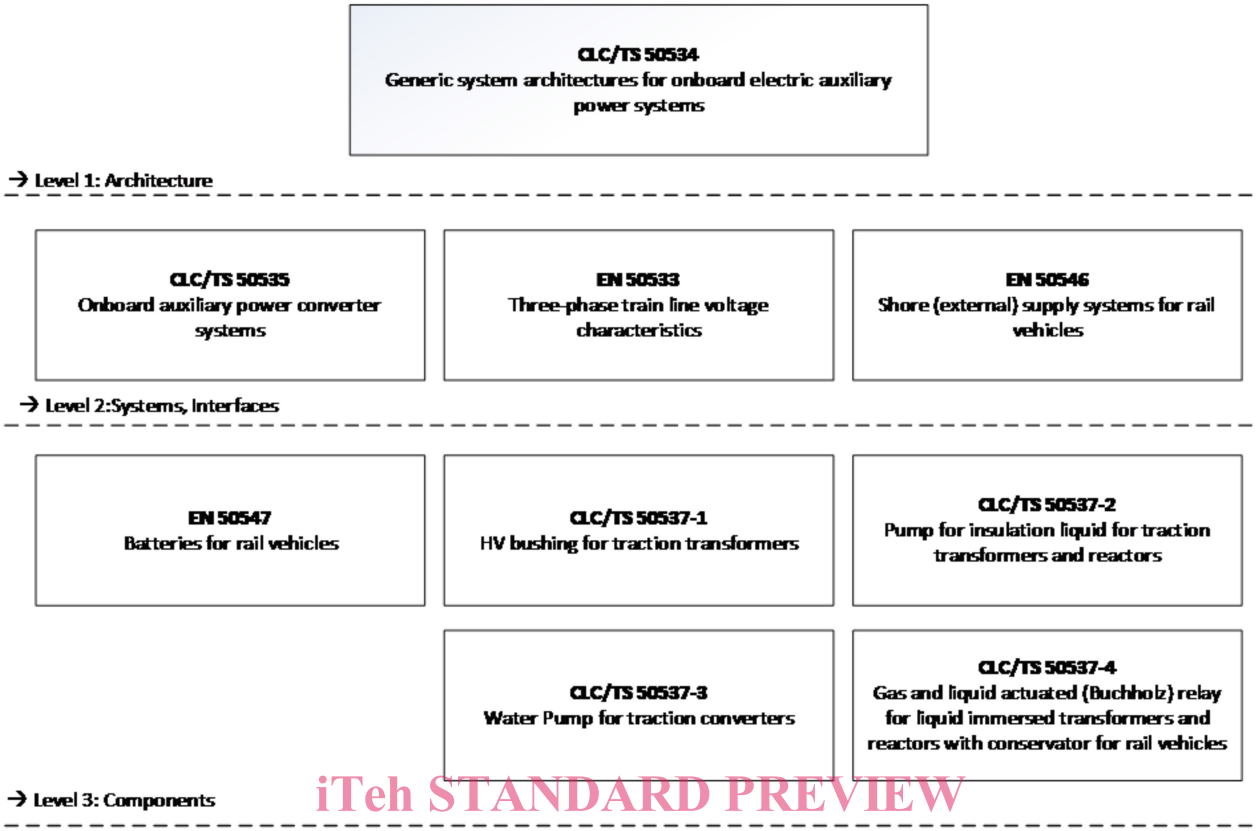

Figure 1 — Overview on the technical framework CLC/TS 50534 defines the basis for other dependent standards

Introduction

The shore supply system is used within depots and sidings location 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 that is to run across borders and has been equipped with batteries which are 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 50264-3-1:2008.

This document provides the requirements for compatibility of systems defined and good practice 3-phase AC + N; 400 V, 50 Hz shore (external) supply systems. It focuses on describing the defined interfaces regarding electrical power supply in stations, depots/workshops and sidings location 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.

1 Scope

This document specifies requirements for the shore supply system for auxiliaries and pre-conditioning and the related intermateable connector pairs. This standard specifies the characteristics of the connectors in order to achieve interoperability at the rolling-stock/shore power supply interface.

This document does not apply to shore supplies to move the rolling stock.

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 45545-2:2013+A1:2015, *Railway applications – Fire protection on railway vehicles – Part 2: Requirements for fire behaviour of materials and components*

EN 50122-1:2011, 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 50160, *Voltage characteristics of electricity supplied by public electricity networks*

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 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 60512-1-4:1997, *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[2)], 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 1431-1:2012, *Rubber, vulcanized or thermoplastic – Resistance to ozone cracking – Part 1: Static and dynamic strain testing*

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

2) Currently impacted by EN 60529:1991/A1:2000, EN 60529:1991/A2:2013 and EN 60529:1991/AC:2016-12.

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 https://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 capability.

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

3.3
connector without breaking capacity
COC
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 of a cable

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

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, <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]

3.8
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

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

[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.]

3.9
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, modified – The preferred term “socket contact” and the admitted term “female contact” have been inverted.]

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 disconnected while its contacts are live or makes the contact dead before separation

[SOURCE: IEC 60050-581:2008, 581–27–48, modified –The specific use “<of a connector>” has been replaced with “<electrical>”. “either electrical or mechanical,” has been deleted. The word ‘withdrawn’has been replaced by ‘disconnected’]

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
mating cycle
cycle of operation of a connector
<mating cycle> one connection and one disconnection of the connector 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’]

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

3.16
rated impulse voltage
U_{Ni}
<of 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: IEC 60050-581:2008, 581-21-18, modified – specific use and Note 1 to entry were added and “by the manufacturer” was deleted]

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 – 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]

3.19
shore supply connection system
complete system consisting 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
auxiliary electric contact for use in a control or monitoring or interlock function

[SOURCE: EN 60309-4]

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

3.23
order, <of a symmetric polyphase system>
number k, in the expression $\vartheta_0 - 2\pi\frac{(i-1)k}{m}$ for the initial phase of quantity i of the set of m quantities forming a symmetric polyphase system, where u_0 is the initial phase of one of the quantities which is arbitrarily chosen out of the set of m quantities, i is one of the integers 1, 2, …, m, and k is a characteristic of the system, equal to one of the integers 0,1, 2, …, m-1

[SOURCE: IEC 60050-141:2004, 141-01-06]

3.24
last make, first break
contacts that are 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

3.25
load shed mode
when some of the loads on the rolling stock are shut down to reduce the current drawn by the rolling stock from the shore (external) supply system

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 and rolling stock;

— 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. This requirement is not applicable for hauled trains.

The phase order shall be 1, 2, 3 using the contacts as set out in 6.1.3.

4.2 System requirements

4.2.1 General

4.2.1.1 Rolling stock side of the system

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.

4.2.1.2 Shore side (Infrastructure) of the system

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 voltage 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-phase AC + N; 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.

NOTE EN 50533:2011, Clause 5 states that the supply is 3 phase AC floating. This means that the Neutral is floating and so not connected to the earth.

The phases assigned to the contacts in the connectors shall be as set out in Annex A for the 63 A/125 A connectors and Annex B for the 600 A connectors.

For DC railways, the earthing arrangements as set out in the EN 50122-1:2011 shall be considered.

For AC traction: 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.

For DC traction: Depending on the earth principle of the DC traction installation and the train signalling the installer of the shore side (infrastructure) system shall decide how to 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 shall be 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-phase AC; 400 V, 50 Hz	600 A per phase	400 kW High power system
3-phase AC + N; 400 V, 50 Hz	125 A per phase	86 kW Medium power system
3-phase AC + N; 400 V, 50H z	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 rated operating 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.

For the 600 A connector current restriction is done by the overload protection on the shore side (infrastructure) by disconnection. No disconnection due to overload has to be ensured by operational routines.