SLOVENSKI STANDARD
oSIST prEN 50388-1:2026

01-junij-2026

Fiksni postroji in tirna vozila za železniške naprave - Tehnični kriteriji za uskladitev med napajalnimi viri in tirnimi vozili za doseganje interoperabilnosti - 1. del: Splošno

Fixed installations and rolling stock for railway applications - Technical criteria for the coordination between electric traction power supply systems and rolling stock to achieve interoperability - Part 1: General

Ortsfeste Anlagen und Fahrzeuge für Bahnanwendungen - Technische Kriterien für die Koordination zwischen elektrische Bahnenergieversorgungssysteme und Fahrzeugen zum Erreichen der Interoperabilität - Teil 1: Allgemeines

Installations fixes et matériel roulant pour applications ferroviaires - Critères techniques pour la coordination entre les installations fixes de traction électrique et le matériel roulant pour réaliser l'interopérabilité - Partie 1 : Généralités

Ta slovenski standard je istoveten z: **prEN 50388-1:2026**

ICS:

29.280	Električna vlečna oprema	Electric traction equipment
45.060.01	Železniška vozila na splošno	Railway rolling stock in general

oSIST prEN 50388-1:2026 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

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ICS 29.280; 45.060.01

Will supersede EN 50388-1:2022

English Version

Fixed installations and rolling stock for railway applications - Technical criteria for the coordination between electric traction power supply systems and rolling stock to achieve interoperability - Part 1: General

Installations fixes et matériel roulant pour Applications ferroviaires - Critères techniques pour la coordination entre les installations fixes de traction électrique et le matériel roulant pour réaliser l'interopérabilité - Partie 1: Généralités

Ortsfeste Anlagen und Fahrzeuge für Bahnanwendungen - Technische Kriterien für die Koordination zwischen elektrische Bahnenergieversorgungssysteme und Fahrzeugen zum Erreichen der Interoperabilität - Teil 1: Allgemeines

This draft European Standard is submitted to CENELEC members for enquiry.
Deadline for CENELEC: 2026-06-26.

It has been drawn up by CLC/TC 9X.

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
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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European foreword

This document (prEN 50388-1:2026) has been prepared by CLC/SC 9XC, “Electric supply and earthing systems for public transport equipment and ancillary apparatus (Fixed installations)”, of Technical Committee CLC/TC 9X, “Electrical and electronic applications for railways”. It also concerns the expertise of CLC/SC 9XB, “Electromechanical material on board of rolling stock”.

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)	dav + 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)	dav + 12 months
— latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	dav + 36 months (to be confirmed or modified when voting)

This document will supersede EN 50388-1:2022 and all of its amendments and corrigenda (if any).

prEN 50388-1:2026 includes the following significant technical changes with respect to EN 50388-1:2022:

— Clause 1: clarification concerning traction units with onboard electric traction energy storage;

— Clause 2: reference to part 2 of this standard;

— Clause 3: clarification on reference to IEV (IEC 60050-811:2017);

— Clause 5: better description of the interface between infrastructure and electric trainsets with energy storage, and simplified requirements for passing through system separation sections;

— Clause 6: improved precision on the value of displacement power factor and associated conditions;

— Clause 7: minor improvements;

— Clause 8: minor editorial changes, and information concerning electric trainsets with energy storage;

— Clause 10: editorial change due to publication of part 2 of this standard;

— Clause 11: new Table 7 giving value of I^2t which is used for the interface with rolling stock (thermal design of return path of vehicle when short circuit current), minor modification of the sequence of tripping of circuit breakers taking into account the presence of line testing. Improved precision of on-board maximum AC inrush current;

— Clause 15: improved precision of tests for maximum inrush current, and traction unit tests;

— Annex B: Change of verbs to the correct form;

— Annex C: Improvement of Figure C1;

— Annex F: Correction of errors;

— Annex H: Corrections of values concerning 2x15 kV 16,7 Hz, specifically the length of route and resonance frequency in 15 kV and 2x15 kV 16,7 Hz (Table H1);

— Annex J: Modification of UK SNC.

This version includes technical changes, clarifications without technical changes and best practices coming from the use of the last version of the document.

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.

An additional part 2 is published. In relation to assessment of harmonics and dynamic effects, this document (Part 1) sets out the generic process in Clause 10, and the part 2 of this standard gives details and acceptance criteria related to known stability, harmonic phenomena and technologies.

EN 50388 “Fixed installations and rolling stock for railway applications- Technical criteria for the coordination between traction power supply and rolling stock to achieve interoperability” consists of the following parts:

— EN 50388-1, *General*

— EN 50388-2, *Stability and harmonics*

1 Scope

This document establishes requirements for the electrical aspects to achieve technical compatibility between rolling stock and electric traction systems, limited to:

— co-ordination of protection principles between power supply and traction units, i.e. separation sections, train set current or power limitation, short circuit current discrimination, circuit breaker coordination and use of regenerative braking;

— co-ordination of installed power on the line and the power demand of trains, i.e. traction unit power factor, train set current or power limitation, electric system performance, type and characterization;

— compatibility assessment relating to harmonics and dynamic effects.

Informative values are given for some parts of the existing European railway networks, in annexes.

NOTE For those railways within the scope of EU Interoperability Directive, definitive values are set out in the register of infrastructure published in accordance with Article 49 of Directive (EU) 2016/797, and the list of items included in the register is described in the commission decision (EU) 2019/777.

The following electric traction systems are within the scope of this document:

— railways;

— guided mass transport systems that are integrated with railways;

— material transport systems that are integrated with railways.

Information is given on electrification parameters to enable train operating companies to confirm, after consultation with the rolling stock manufacturers, that risks of non-compatibility are minimized and that there will be no consequential disturbance on the electrification system.

The interaction between pantograph and overhead contact line is dealt with in EN 50367:2020.

The interaction with the control-command and signalling subsystem is not dealt with in this document.

Basic considerations have been included concerning the use of traction units with onboard electric traction energy storage in the electric traction power system. Details of this are dealt with in CLC/TS 50729:2025.

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 50163:2004,[1] *Railway applications - Supply voltages of traction systems*

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 terminological 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/

[1] As impacted by EN 50163:2004/Corrigendum May 2010, EN 50163:2004/A1:2007, EN 50163:2004/AC:2013, EN 50163:2004/A2:2020 and EN 50163:2004/A3:2022.

3.1.1
contact line
conductor system for supplying electric energy to vehicles through current-collecting equipment

[SOURCE: IEC 60050-811:2017, 811-33-01, modified - The Note 1 to entry has been removed.]

3.1.2
overhead contact line
contact line placed above the upper limit of the vehicle gauge and supplying vehicles with electric energy through pantographs

[SOURCE: IEC 60050-811:2017, 811-33-02, modified - “Catenary” has been removed as synonym, “or beside” has been removed, “roof mounted current collection equipment” has been replaced by “pantographs“.]

3.1.3
infrastructure manager
any body or undertaking that is responsible in particular for establishing and maintaining railway infrastructure

Note 1 to entry: This can also include the management of infrastructure control and safety systems. The functions of the infrastructure manager on a network or part of a network may be allocated to different bodies or undertakings.

[SOURCE: Directive 2012/34/EU Article 3 (2) modified - only referring to part of the infrastructure.]

3.1.4
new element
new, rebuilt or modified traction-unit or power supply component (hardware or software) having a possible influence on the harmonic or dynamic behaviour of the power supply system

Note 1 to entry: This new element can be integrated in an existing power supply network with traction units e.g. for fixed installation:

— transformer;

— HV cable;

— filters;

— converter.

Note 2 to entry: Depot areas are a combination of equipment listed in the Note 1 to entry associated with a large number of traction units and therefore very prone to harmonic and dynamic effects.

Note 3 to entry: New means also the introduction of an existing element on another infrastructure system: i.e. “new to this infrastructure”.

Note 4 to entry: This concept is addressed further in part 2 of this document.

3.1.5
normal operating conditions
conditions pertaining when traffic is operating to the design timetable and train formation used for power supply fixed installation design

Note 1 to entry: Power supply equipment is operated in accordance with the system specification which is defined by the infrastructure manager’s policy.

[SOURCE: EN 50163:2004, 3.16, modified – “traffic operating” has been replaced by “Conditions pertaining when traffic is operating “, last sentence has been removed and the Note 1 to entry has been modified.]

3.1.6
displacement power factor cos φ
ratio of the active power of the fundamental component P_1 to the apparent power of the fundamental component S_1 under periodic conditions

$$cos\varphi = \frac{active\ power\ of\ the\ fundamental}{apparent\ power\ of\ the\ fundamental}$$

Note 1 to entry: In this document, only the fundamental component is considered

3.1.7
register of infrastructure
<for railways within the scope of EU Interoperability Directive> register stating the values of the network parameters of each subsystem or part of subsystem concerned, as set out in the relevant TSI

Note 1 to entry: The parameters are given for each section of line and those relevant to the electric traction system are set out in the Energy subsystem entry.

Note 2 to entry: The register of infrastructure is published in accordance with Article 49 of Directive (EU) 2016/797, and the list of items included in the register is described in the commission decision (EU) 2019/777.

[SOURCE: derived from Article 49 of Directive (EU) 2016/797]

3.1.8
rolling stock
all vehicles with or without motors

Note 1 to entry: Examples of vehicles include a locomotive, a coach and a wagon.

Note 2 to entry: Preferred German translation “Bahnfahrzeuge”, French translation “Matériel roulant”, other translations given in IEV.

[SOURCE: IEC 60050-811:2017, 811-02-01, modified – The Note 2 to entry has been added.]

3.1.9
separation section
section of a contact line provided with a sectioning point at each end to prevent successive electrical sections, differing in voltage amplitude, phase or frequency being connected together by the passage of current collectors

Note 1 to entry: In other standards, IEV, EN 50367, the term “neutral” replaces “separation”.

[SOURCE: IEC 60050-811:2017, 811-36-16, modified – The term ‘neutral’ has been replaced by ‘separation’, and in the definition ‘amplitude’ has been added and Note 1 to entry has been added.]

3.1.10
substation
<traction> installation, the main function of which is to supply a contact line system, at which the voltage of a primary supply system, and in certain cases the frequency, is converted to the voltage and frequency of the contact line

[SOURCE: IEC 60050-811:2017, 811-36-02, modified – The specific use “in electric traction” and the synonym “substation” have been removed. The definition has been modified and the Note 1 to entry has been removed.]

3.1.11
traction unit
TU
locomotive, motor coach or train-unit

Note 1 to entry: German translation “Triebfahrzeugeinheit”, French translation “Unité motrice”, other translations given in IEV.

Note 2 to entry: In this document, a traction unit specifically comprises all traction subsystems including auxiliary supplies, which can be collectively switched off by one current collector / pantograph.

[SOURCE: IEC 60050-811:2017, 811-02-04, modified – the Notes 1 and 2 to entry have been added.]

3.1.12
train set
combination of vehicles coupled together, including banking locomotives

[SOURCE: IEC 60050-811:2017, 811-01-08, modified – In the term ‘set’ has been added after ‘train’, in the definition ‘rolling stock’ has been replaced by ‘vehicles and banking locomotives’. The existing Note 1 to Entry has been replaced with a new Note 1 to Entry]

Note 1 to entry: German translation “Zugverband”, French translation “Train (composition)”.

3.1.13
maximum power at wheel
highest power derived from tractive effort vs speed diagram calculated for any type of train set

3.1.14
electric traction power supply system
railway electric distribution network used to provide energy for rolling stock

Note 1 to entry: The system includes:

— contact line systems;

— return circuit of electric traction systems;

— running rails of non-electric traction systems, which are in the vicinity of, and conductively connected to, the running rails of an electric traction system;

— electric installations, which are supplied from contact lines either directly or via a transformer;

— electric installations in power plants and substations, which are utilized solely for generation and distribution of power directly to the contact line;

— electric installations of switching stations.

[SOURCE: IEC 60050-811:2017, 811-36-21], modified – “power supply” has been added in the term

3.1.15
vehicle
single item of rolling stock, e.g. a locomotive, a coach or a wagon

Note 1 to entry: German translation “Fahrzeug”, French translation “Véhicule”.

3.1.16
short-circuit current
I_{ss}
prospective sustained current resulting from a short circuit due to a fault or an incorrect connection in an electric circuit

Note 1 to entry: The term I_{ss} relates to the short circuit performance characteristics for DC switchgear.

[SOURCE: EN 50123-1:2003, 3.2.12], modified – Note 1 to entry has been added

3.1.17
cut-off current
$I_{cut\text{-}off}$
maximum instantaneous value of current attained during the breaking operation of a switching device

[SOURCE: EN 50123-1:2003, 3.2.14], modified – “($I_{cut\text{-}off}$)” has been added in the term

3.1.18
inrush current
transient current associated with energising of transformers, cables, reactors, etc

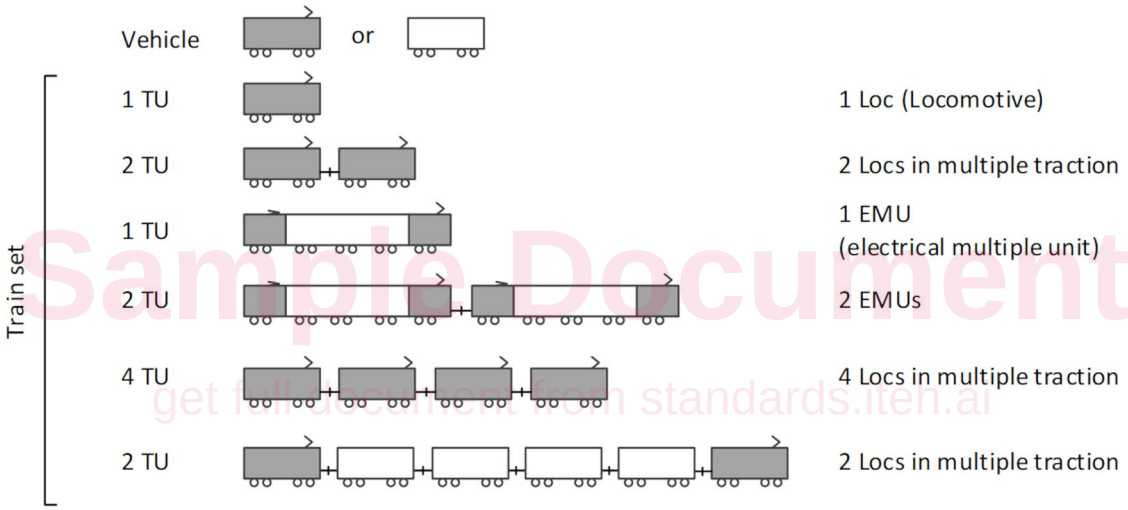
317 [SOURCE: IEC 60050-448:1995, 448-11-30]

318 3.2 Term clarification, coherence and translation

319 Due to inconsistency of definitions in the bibliography, the following statement in Table 1, Figure 1, Figure 2
320 and following text should be considered.

321 **Table 1 — Term coherence and translation**

Subclause	English term	German term	French term
3.1.15	Vehicle	Fahrzeug	Véhicule
3.1.8	Rolling stock	Bahnfahrzeuge	Matériel roulant
3.1.12	Train set	Zugverband	Train (composition)
3.1.11	Traction unit (TU)	Triebfahrzeugeinheit	Unité motrice
For information	Train (train path)	Zug (Zugfahrt)	Train (circulation)
For information	(motor) Train-unit	Triebzug	Automotrice



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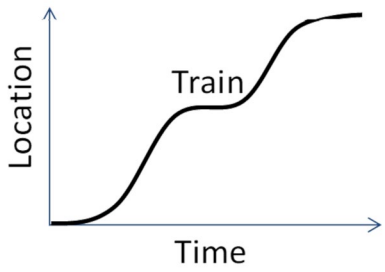
323 **Key**
324 solid grey motor vehicles
325 white unpowered vehicles
326 NOTE in the case of an EMU, motored axles are typically distributed throughout vehicles.

327 **Figure 1 — Term clarification for Traction unit (TU) and Train set**



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329 **Figure 2 — Term clarification for Train (train path)**

330 NOTE A unit is a piece of rolling stock which is subject to the application of a TSI, and subject to 'EC' verification. It
331 can be composed of several vehicles, as defined in Directive (EU) 2016/797, Article 2(3); considering the scope of a TSI,
332 the use of the term "vehicle" in a TSI is limited to the rolling stock subsystem.

3.3 Abbreviations and symbols

For the purposes of this document, the following abbreviations apply.

EC	European Commission
EU	European Union
ETCS	European train control system
HV	high voltage
LRAS	load reference-arrow system
RMS	root mean square
RINF	register of infrastructure
TSI	technical specification for interoperability
U_{max2}	highest non-permanent voltage defined in EN 50163:2004, 3.5
U_{max1}	highest permanent voltage defined in EN 50163:2004, 3.4
U_n	nominal voltage defined in EN 50163:2004, 3.3
U_{min1}	lowest permanent voltage defined in EN 50163:2004, 3.7
U_{min2}	lowest non-permanent voltage defined in EN 50163:2004, 3.8
v	velocity

Other terms in the document are defined at the point of use within this document.

4 Periods over which parameters should be averaged or integrated - reference time

Where train operators or infrastructure managers use various parameters for their dimensioning computations, protection measures and planning, these are effective only if they are averaged over precisely defined time spans. Guidance and recommendations on these time spans are given in Annex A (informative).

5 Separation sections

5.1 General

Separation sections shall allow train sets to move from one overhead contact line section to another without them being bridged by the pantograph(s). Train sets shall be designed to accommodate this.

NOTE 1 EN 50367:2020 describes the mechanical design of separation sections with allowed section lengths and pantograph distances and connections.

Train sets shall pass a separation section by use of one of the following operational principles of train set action:

1) No action required, i.e. pantograph(s) may remain raised and on-board circuit breaker may remain closed.

NOTE 2 No train set action can be used for sectioning points.

2) With pantograph(s) raised and touching the contact wire(s), but with traction power exchange to the contact line brought to zero before entering the separation section.

NOTE 3 This solution to bring traction power exchange to zero is faster than opening the on-board circuit breaker and is in many cases sufficient as auxiliary and no-load current from components can be negligible to create an arc. The on-board circuit breaker can however be opened depending on train set design e.g. in order not to exceed permissible voltage limits.

3) With pantograph(s) raised and touching the contact wire(s) and on-board circuit breaker opened before entering the separation section.

4) With pantograph(s) lowered before entering the separation section and not touching the contact wire(s). Power exchange to the contact line shall be brought to zero before lowering the pantograph(s).

For lines with speed:

— v ≥ 250 [km/h] train set action shall be done automatically;

— v < 250 [km/h] train set action should be done automatically, otherwise it shall be done manually by intervention of the driver.

The choice of principle of train set action for each separation section shall be made by the infrastructure manager(s) and shall be set out in the register of infrastructure. The train set's driver shall be informed about the minimum necessary manual action by adequate means (e.g. visual signs along the track or on-board) sufficiently before entering the separation section.

NOTE 4 There might be other types of overhead contact line sections requiring train set actions, e.g. de-energised sections due to insufficient insulation distance or sections where overhead contact line is not installed for use of train sets with on-board energy storage. Such solutions are dealt with in CLC/TS 50729, and the requirements for separation sections are applied as far as reasonable to facilitate interoperability.

5.2 System separation sections

System separation sections separate different types of electric traction power supply systems.

Train set action (automatic or manual, for train sets designed for several power supply systems) additionally include choosing correct pantograph and electric circuits for the actual type of electric traction power supply system.

System separation sections shall have provisions to avoid damage caused by the bridging of the adjacent systems if the train set action fails.

5.3 Phase separation sections

Phase separation sections separate feeding sections with different voltage amplitude or phase within the same type of electric traction power supply system.

If train set action is required, the principle of passing with raised pantograph(s) is preferred. This depends mainly on the distribution of pantographs on the train set. The principle of lowering the pantograph(s) may be used under particular circumstances.

Other designs of phase separation sections that allow train sets to pass a sectioning point whilst taking power from the contact line (e.g. automatically switched sections or "change over sections"), are subject to future development. In this case, reliability and compatibility parameters shall be agreed between the parties involved.

5.4 Acceptance criteria

Traction units shall be designed in accordance with the requirements as given in 5.1.

The power supply system shall achieve the requirements as given in 5.1, 5.2 and 5.3.

6 Power factor of a traction unit

6.1 General requirements

The total power factor of a traction unit influences the power supply system performance, i.e. voltage profile, power feeding (active and reactive) and transfer capacity, energy losses, system stability and reliability of protection relays.

Where a train set comprises multiple traction units, if the requirements of each single traction unit in respect of total power factor are fulfilled, then they are considered to be fulfilled for the train set.

The displacement factor is measured at the pantograph.

The total power factor is composed of the following two elements:

— The displacement power factor; and