SLOVENSKI STANDARD
oSIST prEN 50388-1:2021

01-januar-2021

Železniške naprave - Stabilne naprave električne vleke in voznih sredstev - Tehnična merila za uskladitev med elektronapajalnimi postajami in voznimi sredstvi za doseganje medobratovalnosti - 1. del: Splošno

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

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

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

ICS:

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

oSIST prEN 50388-1:2021 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 50388-1

November 2020

ICS

Will supersede EN 50388:2012 and all of its amendments and corrigenda (if any)

English Version

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

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

To be completed

This draft European Standard is submitted to CENELEC members for enquiry.
Deadline for CENELEC: 2021-02-19.

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

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

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

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European foreword

This document (prEN 50388-1:2020) 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”.

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 50388:2012.

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.

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

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

- EN 50388-1:General
- Future EN 50388-2:Stability and harmonics

EN 50388−1:2020 includes the following significant technical changes with respect to EN 50388:2012:

- Clause 1: clarification of scope,
- Clause 2: set dated normative references, simplification,
- Clause 3: clarification of definition, renumbering, coherence among terms, addition of abbreviations, withdrawal of terms not used anymore,
- Clause 4: clarification of applicability,
- Clause 5: new structure,
- Clause 6: new drafting taking into account the latest development of traction unit drives,
- Clause 7: new structure taking into account the latest development of traction unit and needs from infrastructure traction power supply system. Addition of power limitation due to frequency variation,

- Clause 8: Complete change, giving new parameters to evaluate the capability of the traction power supply system to supply the trains, definition of new indexes,
- Previous text in new Annex B,
- Clause 9: distinction between the table on traction power supply systems end their characterization,
- Clause 10: clarification with the new part 2, new clause on Roles and responsibility,
- Clause 11: clarification on the use of this chapter, new information on the sequence of tripping among the circuit breakers, new figure on reclosing sequences, new chapter on maximum inrush current of AC traction unit,
- Clause 12: Clarification and improvement, ex Table 8 in new Annex G, New condition for DC systems
- Clause 15: adaptation of the subclauses due to changes in Clauses 5 to 12
- Clause 15.4.1: new text, former Table 10 in Annex B,
- Annex A: improvement on values,
- Annex B normative, includes part of the previous Clause 8,
- Former Annex C will be located in part 2 of the EN 50388,
- New Annex C on sign convention, includes ex Annex E,
- Former Annex D remains as Annex H as long as part 2 of the EN 50388 is not issued,
- New Annex D including ex Annex F, on maximum allowable train set current,
- New Annex E on power limitation as a function of line frequency,
- New Annex F on maximum traction and power of a train set against voltage, includes parts of ex Clause 7,
- New Annex G: includes ex Table 8 on the use of generative Braking,
- New Annex H: ex Annex G on Special National Conditions

Changes include mainly clarifications without technical changes and also the best practises coming from the use of the last version of the standard.

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, especially fault discrimination for short-circuits;
- co-ordination of installed power on the line and the power demand of trains;
- co-ordination of traction unit regenerative braking and power supply receptivity;
- compatibility assessment relating to harmonics and dynamic effects.

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

NOTE 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 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 standard.

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 50122-2:2010, *Railway applications - Fixed installations - Electrical safety, earthing and the return circuit - Part 2: Provisions against the effects of stray currents caused by d.c. traction systems*

EN 50122-3:2010, *Railway applications - Fixed installations - Electrical safety, earthing and the return circuit - Part 3: Mutual Interaction of a.c. and d.c. traction systems*

EN 50163:2004,[1] *Railway applications - Supply voltages of traction systems (with Corrigenda in May 2010 and January 2013)*

EN 50367:2020, *Railway applications - Fixed installations and rolling stock - Criteria to achieve technical compatibility between pantographs and overhead contact line*

IEC 60050-811:2017, *International Electrotechnical Vocabulary (IEV) - Part 811: Electric traction*

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

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-811:2017 and the following apply.

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

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

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 may 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 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 introduction of an existing element on another infrastructure system: “new to this infrastructure”.

Note 4 to entry: This concept will be addressed further in the future part 2 of this document.

3.1.5
normal operating conditions
traffic 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 - 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
register stating the values of the network parameters of each subsystem or part 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, phase or frequency being connected together by the passage of current collectors

[SOURCE: IEC 60050-811:2017, 811-36-16, modified - the term "neutral" has been replaced is replaced by "separation".]

3.1.10
(traction) substation
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.

[SOURCE: IEC 60050-811:2017, 811-02-04, modified – The Note 1 to entry has been added.]

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

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 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]

3.1.15
vehicle
any 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

[SOURCE: EN 50123-1:2003, 3.2.12]

3.1.17
cut-off current (Icut-off)
maximum instantaneous value of current attained during the breaking operation of a switching device

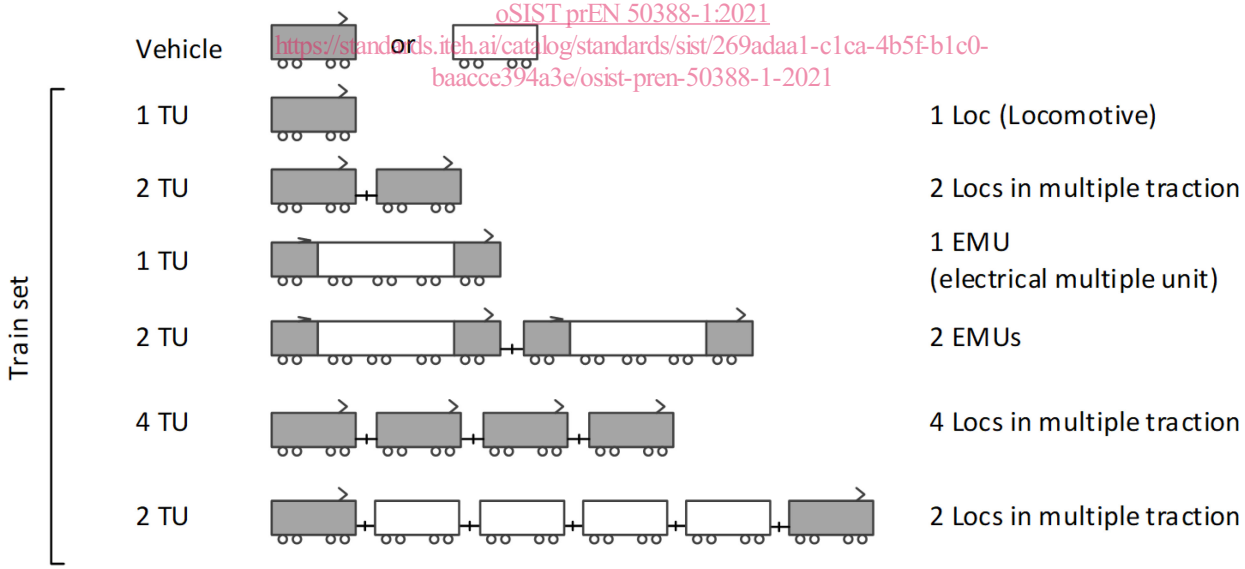
[SOURCE: EN 50123-1:2003, 3.2.14]

3.2 Term clarification, coherence and translation

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

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



Key

Motor vehicles shown in solid grey

Unpowered vehicles are shown in outline

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

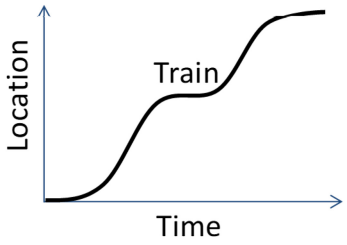


Figure 2 — Term clarification for Train (train path)

NOTE A unit is a piece of rolling stock which is subject to the application of a TSI, and subject to 'EC' verification. It may be composed of several vehicles, as defined in Directive (EU) 2016/797, Article 2(3); considering the scope of a TSI, the use of the term "vehicle" in a TSI is limited to the rolling stock subsystem. The word "unit" itself is not used in this document.

3.3 Abbreviations and symbols

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

EC	European Commission
EU	European Union
ERTMS	European Rail Traffic Management System
HV	High Voltage
LRAS	Load Reference-Arrow System
r.m.s.	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 System separation sections

5.1.1 General

A system separation section is an arrangement that allows train sets to travel from one traction power supply system to an adjacent one that uses a different traction power supply. The traction power supply systems are likely to have a different voltage, or use either ac or dc supplies.

The objectives of separation sections are to enable train sets to move from one traction power supply system to an adjacent one that uses a different traction power supply without bridging the two contact line systems. The necessary actions (opening of the main circuit breaker(s), lowering of the pantographs, etc.) depend on the type of both supply systems as well as on the arrangement of pantographs on train sets and the running speed.

There are two options for train sets to run through system separation sections:

1) with pantograph raised and touching the contact wire(s) as described in 5.1.2;

2) with pantograph lowered and not touching the contact wire(s) as described in 5.1.3.

The choice between either 1) or 2) shall be made by the entity responsible for the contact line system design choices e.g. infrastructure manger, contracting entity etc. The method of operation of the system separation sections is set out in the register of infrastructure.

The requirements for the design of the traction power supply system and rolling stock are set out in 5.1.2 and 5.1.3.

NOTE EN 50367:2020 describes the mechanical design of the system separation sections as well as other functional requirements of the overhead contact line and pantographs.

5.1.2 Pantograph raised

Where the system separation sections are traversed by a train set with multi-system pantographs raised to the contact wire(s), the following requirements apply:

- Provisions shall be made in the traction power supply system to avoid bridging the contact lines of both adjacent power supply systems, e.g. if the opening of the on-board circuit breaker(s) fails.

- For lines with speed v ≥ 250 [km/h], an on-board system shall automatically open the circuit breaker(s) before reaching the separation section and shall recognize automatically the voltage of the new power supply system at the pantograph in order to switch the corresponding on-board circuits.

- For lines with speed v < 250 [km/h], either the requirements for lines with speed v ≥ 250 [km/h] may be applied; or manual on-board operation of the circuit breaker(s) and selection of the power supply system shall be employed.

5.1.3 Pantograph lowered

Where the system separation sections are traversed by a train set with pantographs lowered the following requirements apply:

- The design of the separation section between differing traction power supply systems shall ensure that, in case of one or more pantographs unintentionally applied to the contact line, bridging the contact lines of two power supply systems is avoided and switching off both supply systems is triggered immediately, e.g. by detection of short circuits or unintended voltages.

- For lines with speed v ≥ 250 [km/h], at system separation sections which require a lowering of the pantograph, the pantograph shall be lowered, raised and the power supply system selected without the driver's intervention, triggered by control signals.