SLOVENSKI STANDARD

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Železniške naprave – Sistemi za odjem toka – Tehnični kriteriji za interaktivnost med odjemnikom toka in kontaktnim vodnikom (za doseganje prostega dostopa)

Railway applications - Current collection systems - Technical criteria for the interaction between pantograph and overhead line (to achieve free access)

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English version

Railway applications - Current collection systems - Technical criteria for the interaction between pantograph and overhead line (to achieve free access)

Applications ferroviaires -
Systèmes de captage de courant -
Critères techniques d'interaction
entre le pantographe et la ligne aérienne
de contact (réalisation du libre accès)

Bahnanwendungen -
Zusammenwirken der Systeme -
Technische Kriterien
für das Zusammenwirken zwischen
Stromabnehmer und Oberleitung
für einen freien Zugang

This European Standard was approved by CENELEC on 2005-10-01. 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.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists 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 Central Secretariat has the same status as the official versions.

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

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Foreword

This European Standard was prepared by SC 9XC, Electric supply and earthing systems for public transport equipment and ancillary apparatus (fixed installations), of Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50367 on 2005-10-01.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2006-11-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2008-10-01

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and covers essential requirements of EC Directive 96/48/EC. See Annex ZZ.

Contents

1 Scope

Combination of different overhead contact lines and pantographs will provide various interaction performances.

This standard defines parameters for interoperability in the field of interaction between pantograph and overhead contact line. The document specifies the interface requirements of rolling stock and infrastructure to achieve free access to the European railway network.

This standard describes parameters and values for all planned lines and future lines.

Annex B gives some essential parameters for existing lines.

The line categories given in Table 1 are applicable:

Table 1 – Line categories

Line speed v [km/h]	$v \leq 160$	$160 < v \leq 220$	$220 < v < 250$	$v \geq 250$
Category for a.c. system	AC 1	AC 2	AC 3	AC 4
Line speed v [km/h]	$v \leq 160$	$160 < v \leq 220$	$220 < v \leq 250$	-
Category for d.c. system	DC 1	DC 2	DC 3	-

AC 1 conventional and connecting lines – a.c.

AC 2 and AC 3 upgraded lines around 200 km/h - a.c.

AC 4 high-speed lines - a.c.

DC 1 conventional and connecting lines – d.c.

DC 2 upgraded lines around 200 km/h – d.c.

DC 3 high-speed lines – d.c.

The energy supply system is not covered by this standard.

2 Normative references

The following referenced documents are indispensable for the application 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.

96/48/EC *EU council directive on the interoperability of the trans-European high speed rail system TSI sub-system Energy, Official Journal L 235 , 17/09/1996 p. 0006 – 0024*

2001/16/EC *Directive of the European Parliament and of the Council on the interoperability of the trans-European conventional rail system, Official Journal L 110, 20/04/2001 p. 0001 – 0027*

EN 50119:2001 *Railway applications – Fixed installations – Electric traction overhead contact lines*

EN 50149:2001 *Railway applications – Fixed installations – Electric traction – Copper and copper alloy grooved contact wires*

EN 50163:2004	*Railway applications – Supply voltages of traction systems*
EN 50206-1:1998	*Railway applications – Rolling stock – Pantographs: Characteristics and tests – Part 1: Pantographs for main line vehicles*
EN 50317:2002 + A1:2004	*Railway applications – Current collection systems – Requirements for and validation of measurements of the dynamic interaction between pantograph and overhead contact line*
EN 50318:2002	*Railway applications – Current collection systems – Validation of simulation of the dynamic interaction between pantograph and overhead contact line*
EN 50388:2005	*Railway applications – Power supply and rolling stock – Technical criteria for the coordination between power supply (substation) and rolling stock to achieve interoperability*
EN 50405 [1)]	*Railway applications – Current collection systems – Pantographs, testing methods for carbon contact strips*
IEC 60050-811	*International Electrotechnical Vocabulary – Chapter 811: Electrical traction*
EN ISO 3166-1:1997	*Codes for the representation of names of countries and their subdivisions – Part 1: Country codes (ISO 3166-1:1997)*
UIC leaflet 505:1997	*Railway transport stock – Rolling stock construction gauge*
UIC leaflet 506	*Rules governing application of the enlarged GA, GB and GC gauges*
UIC leaflet 608	*Conditions to be complied with for the pantographs of tractive units used in international services*

3 Definitions

For the purposes of this document, the following terms and definitions apply:

3.1
maximum collected current
highest value of current that is collected by a pantograph from an overhead contact line

3.2
contact force
vertical force applied by the pantograph to the overhead contact line. The contact force is the sum of forces for all contact points of one pantograph

3.3
static contact force
mean vertical force exerted upwards by the pantograph head on the overhead contact line, and caused by the pantograph-raising device, whilst the pantograph is raised and the vehicle is at standstill

3.4
mean contact force
statistical mean value of the contact force

3.5
maximum contact force
maximum value of the contact force

[1)] To be published.

3.6
minimum contact force
minimum value of the contact force

3.7
overhead contact line
contact line placed above (or beside) the upper limit of the vehicle gauge and supplying vehicles with electric energy through roof - mounted current collection equipment

[IEC 60050-811-33-02]

3.8
neutral 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

[IEC 60050-811-36-16]

3.9
nominal voltage
voltage by which an installation or part of an installation is designated

[EN 50163]

3.10
contact wire height
distance from the top of the rail to the lower face of the contact wire, measured perpendicular to the track

[EN 50119]

3.11
minimum contact wire height
minimum value of the contact wire height which shall occur in any possible case during the lifetime of the overhead contact line

3.12
nominal contact wire height
a nominal value of the contact wire height at a support in the normal conditions

[EN 50119]

3.13
maximum contact wire height
maximum value of the contact wire height which shall occur in any possible case during the lifetime of the overhead contact line

3.14
automatic dropping device
device that lowers the pantograph in the event of pantograph head failure or damage of the pantograph head

[EN 50206-1]

3.15
arcing
flow of current through an air gap between a contact strip and a contact wire usually indicated by the emission of intense light

[EN 50317]

3.16
percentage of arcing
this is given by the following formula:

$$NQ = \frac{\sum t_{arc}}{t_{total}} \times 100$$

where

t_{arc} is the duration of an arc lasting longer 5 ms;

t_{total} is the measuring time with a current greater than 30 % of the nominal current.

The result, given in %, is a characteristic for a given speed of the vehicle

[EN 50317]

3.17
maximum width
maximum distance measured along the axis of the track between the outer edges of the contact strips

3.18
kinematics envelope
maximum envelope of the pantograph head under all operating conditions

3.19
skew of pantograph head
vertical distance between the highest point of the pantograph head and the contact point

NOTE Additional information is given in UIC leaflet 608.

4 Symbols and abbreviations

C	length of common part
D	overall length of neutral section
D'	length of neutral zone
D	length of insulator inserted in contact wire
F_m	mean contact force
F_{max}	maximum contact force
F_{min}	minimum contact force
GC	gauge C according UIC leaflet 506
L	distance between closest pantographs
L'	distance covered by farthest pantographs
L''	distance between 3 consecutive pantographs
L	maximum width
NQ	percentage of arcing
σ_{max}	maximum standard deviation of contact force

5 Geometry

The infrastructure manager shall ensure that the values for the geometric characteristics of the overhead contact line are as shown in Table 2 and Table 3.

The pantographs of the train shall fulfil the geometric characteristics as shown in Table 4, according to the type of infrastructure on which it will circulate under the rules of free access.

5.1 Overhead contact line characteristics

For free access the parametric requirements to achieve interaction that are dependent on the geometry of the overhead contact line (see EN 50119) are as follows:

- contact wire height;
- gauge;
- permissible contact wire gradient;
- permissible lateral deflection of the contact wire under action of cross wind;
- contact wire uplift at the support;
- neutral section.

According to the Directive 96/48/EC, newly built European high-speed lines shall allow the circulation of vehicles complying with *GC* as defined in UIC leaflet 506. For line speed AC 4 the contact wire height shall not exceed a certain limit for aerodynamic reasons, which excludes gauges higher than *GC* (as for piggyback services). The requirements for the contact wire uplift at the support are defined in EN 50119:2001, subclause 5.2.1.3. The permissible contact wire gradient is also defined in EN 50119:2001, subclause 5.2.8.2. The wind speed to be considered will be defined by the infrastructure manager.

The functional requirements of neutral sections are defined as follows:

- trains shall be able to move from one section to an adjacent one (which is fed from a different phase or system) without bridging the neutral section;
- the neutral section shall be designed in such a way that trains with several pantographs at an overall distance of maximum 400 m can cross with their pantographs up;
- power consumption of the train shall be brought to zero when entering the phase separation section. See also EN 50388;
- the infrastructure manager shall provide adequate means to allow a train that stops underneath the phase separation section to restart;
- in the case of trains with several pantographs, the pantographs shall be lowered for the entire length of the neutral section if some of the above requirements cannot be met. Technical or operational measures shall be taken to meet safety and availability requirements.

For compatibility between neutral sections and pantographs arrangement, see 5.2 and A.1.

Table 2 – Overhead contact line characteristics for a.c. systems

Category	AC 1	AC 2	AC 3	AC 4
Nominal contact wire height (m)	5,0 up to 5,75	5,0 up to 5,5		5,08 up to 5,3
Minimum contact wire height (m)	4,95	4,95		-
Maximum contact wire height (m)	6,2	6,0		-
Maximum lateral deviation of the contact wire from the track centre line under action of cross wind (m)	0,4 [a]			0,4

[a] This value is valid for contact wire heights up to 5,3 m and straight line. For contact wire heights greater than 5,3 m or curved track this value shall be adjusted in accordance with A.3.

Table 3 – Overhead contact line characteristics for d.c. systems

Category	DC 1	DC 2	DC 3
Nominal contact wire height (m)	5,0 up to 5,6	5,0 up to 5,5	5,0 up to 5,3
Minimum contact wire height (m)	4,9	4,9	4,9
Maximum contact wire height (m)	6,2	6,2	5,3
Maximum lateral deviation of the contact wire from the track centre line under action of cross wind (m)	0,4 [a]		0,4

[a] This value is valid for contact wire heights up to 5,3 m and straight line. For contact wire heights greater than 5,3 m and/or curved track this value shall be adjusted in accordance with A.3.

The overhead contact line shall conform to EN 50119.

5.2 Pantograph characteristics

The geometry of the pantograph is characterised by the following major interaction parameters:

- geometric profile of pantograph head;
- range of working height;
- length of contact strips;
- maximum width;
- skew of pantograph head.

For a current collection without interruption, functional requirements are described in this clause. These requirements are related to the geometric profile of the pantograph head and to the dynamic behaviour of the vehicle (i.e. kinematics envelope) and ensure that at least one contact wire is always inside the conducting range of pantograph head (including all tolerances).

The permissible value for the skew of pantograph head is 60 mm.

The maximum lateral deviation of the European pantograph head is specified in A.3.

Additional characteristics, related to the train, shall also be implemented as follows:

- automatic dropping device;