SLOVENSKI STANDARD
SIST EN 50367:2012

01-julij-2012

Nadomešča:
SIST EN 50367:2006

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)

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

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

Ta slovenski standard je istoveten z: **EN 50367:2012**

ICS:

29.280 Električna vlečna oprema Electric traction equipment

SIST EN 50367:2012 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 50367

May 2012

ICS 29.280

Supersedes EN 50367:2006

English version

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CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 50367:2012 E

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Foreword

This document (EN 50367:2012) has been prepared by CLC/SC 9XC "Electric supply and earthing systems for public transport equipment and ancillary apparatus (fixed installations)".

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)	2013-03-19
•latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2015-03-19

This document supersedes EN 50367:2006.

EN 50367:2012 includes the following significant technical changes with respect to EN 50367:2006: general technical updating since last version; inclusion of requirements for pantographs with contact strips with independent suspensions; reference to EN 15273 for lateral deviation.

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

1 Scope

This European Standard specifies requirements for the interaction between pantographs and overhead contact lines, to achieve interoperability.

NOTE These requirements are defined for a limited number of pantograph types, referred to as 'interoperable pantograph', together with the geometry and characteristics of compatible overhead contact lines.

This European Standard describes parameters and values for all planned lines and future lines.

Annex B gives some parameters for existing lines (informative).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50119:2009, *Railway applications – Fixed installations – Electric traction overhead contact lines*

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

EN 50206-1:2010, *Railway applications – Rolling stock – Pantographs: Characteristics and tests – Part 1: Pantographs for main line vehicles*

EN 50317:2012, *Railway applications – Current collection systems – Requirements for and validation of measurements of the dynamic interaction between pantograph and overhead contact line*

EN 50318, *Railway applications – Current collection systems – Validation of simulation of the dynamic interaction between pantograph and overhead contact line*

EN 50388:2012, *Railway applications – Power supply and rolling stock – Technical criteria for the coordination between power supply (substation) and rolling stock to achieve interoperability*

EN 50405, *Railway applications – Current collection systems – Pantographs, testing methods for carbon contact strips*

IEC 60050-811:1991, *International Electrotechnical Vocabulary – Chapter 811: Electrical traction*

EN 15273 (all parts), *Railway applications – Gauges*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-811:1991 and the following apply.

3.1
arcing
flow of current through an air gap between a contact strip and a contact wire usually indicated by the emission of intense light

[SOURCE: EN 50317:2012]

3.2
automatic dropping device
device that lowers the pantograph in the event of pantograph head failure or damage of the pantograph head

[SOURCE: EN 50206-1:2010]

3.3
contact force
vertical force applied by the pantograph to the overhead contact line.

Note 1 to entry: The contact force is the sum of forces of all contact points

[SOURCE: EN 50317:2012]

3.4
contact plane
plane parallel to base frame of pantograph at the contact point

3.5
contact point
point of the mechanical contact between a contact strip and a contact wire

[SOURCE: EN 50317:2012]

3.6
contact wire height
distance from the top of the rail to the lower face of the contact wire, measured perpendicular to the track

[SOURCE: EN 50119:2009]

3.7
continuous pantograph head profile
pantograph head with collector strips and horns suspended in one piece

3.8
encroachment of the pantograph head above the contact plane
perpendicular distance from the contact plane to the highest point of the pantograph head

Note 1 to entry: Additional information is given in EN 15273-1:2009, Figure 45.

3.9
maximum contact wire height
maximum possible contact wire height which the pantograph is required to reach, in all cases

[SOURCE: EN 50119:2009]

3.10
maximum design contact wire height
maximum theoretical contact wire height not including tolerances and uplift, which the pantograph is required to reach

3.11
maximum width of pantograph head
maximum distance measured along the axis of the track between the outer edges of the contact strips

3.12
mean contact force (F_m)
statistical mean value of the contact force.

Note 1 to entry: F_m is formed by the static and aerodynamic components of the pantograph contact force

[SOURCE: EN 50206-1:2010]

3.13
mechanical kinematic pantograph gauge
maximum gauge of the pantograph head under all operating conditions

Note 1 to entry: Additional information is given in EN 15273-1:2009, Clause 3.

3.14
minimum contact wire height
minimum value of the contact wire height in the span in order to avoid arcing between one or more contact wires and the vehicles in all conditions

[SOURCE: EN 50119:2009]

3.15
neutral section
a section of a contact line provided with a sectioning point at each end, to prevent successive electrical sections differing in voltage or phase being connected together by the passage of current collectors

[SOURCE: IEC 60050-811:1991, 36-16]

3.16
nominal contact wire height
a nominal value of the contact wire height at a support in normal conditions

[SOURCE: EN 50119:2009]

3.17
non-continuous pantograph head profile
pantograph head with collector strips separately (independently) suspended from the main horns

3.18
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

[SOURCE: IEC 60050-811:1991, 33-02]

3.19
percentage of arcing
proportion of driving time with arcing

3.20
static contact force
vertical force exerted upward by the pantograph head on the overhead contact line, caused by the pantograph-raising device, whilst the pantograph is raised and the vehicle is stationary

3.21
transition zone of pantograph head
range for the transition point between non independently suspended parts and independently suspended parts of the pantograph head (see Figures 1 to 3)

3.22
working range in height
range of permissible contact wire heights for interaction

4 Symbols and abbreviations

AC	Alternative Current
b_w	half-length of the pantograph head
$b_{w,c}$	half-length of the pantograph head conducting length (with insulating horns) or working length (with conducting horns)
b'_h	length of mechanical kinematic pantograph gauge at contact wire height, h
D'	length of neutral section excluding overlapping parts taking into account the uplift by pantograph passage and insulation clearances
D	overall length of neutral section as distance between adjacent systems/phases including overlapping parts taking into account the uplift by pantograph passage and insulation clearances
$D`_0$	reference cant taken into account by the vehicle for the pantograph gauge
d	length of insulator inserted in contact wire
d_l	lateral deviation of contact wire
DC	Direct Current
F_m	mean contact force
F_{max}	maximum contact force
$F_{m,\,min}$	minimum mean contact force
$F_{m,\,max}$	maximum mean contact force
F_{min}	minimum contact force
F_{stat}	static contact force
h'_o	maximum verification height of the pantograph gauge in a collecting position
h'_u	minimum verification height of the pantograph gauge in a collecting position
$h`_{c0}$	reference roll centre height for the pantograph gauge
I'_0	reference cant deficiency taken into account by the vehicle for the pantograph gauging
L	inner distance between two adjacent pantographs
L'	outer distance between first and last operating pantographs
L''	inner distance between one and the second following operating pantographs
l	maximum width of pantograph
NQ	percentage of arcing
s'_0	flexibility coefficient taken into account by agreement between the railway undertaking and the infrastructure manager for pantograph gauging
σ_{max}	maximum standard deviation of contact force
α	angle of independent suspended part of the pantograph head at the transition point

β angle of the main horn on the fixed part of the pantograph head

5 Geometry

5.1 General

The geometric characteristics of the overhead contact line shall be designed and built in accordance with 5.2. The geometric characteristics of the pantograph(s) shall be designed and built in accordance with 5.3, according to the type of infrastructure on which it will operate.

5.2 Overhead contact line characteristics

5.2.1 General

The following geometric parameters of the overhead contact line are defined in order to achieve free access:

- gauge;
- contact wire height;
- contact wire gradient;
- lateral deviation of the contact wire from the track centre line under action of a crosswind;
- free and unrestricted contact wire uplift at the support;
- neutral section arrangements.

The overhead contact line shall conform to EN 50119.

5.2.2 Gauges

The design of the overhead contact line shall allow the operation of vehicles compliant to the appropriate vehicle gauge for the route. This gauge shall be calculated according to EN 15273.

5.2.3 Contact wire height

The range of nominal contact wire height shall be in accordance with Table 1.

The contact wire may be higher in certain cases such as level crossings, loading areas, etc. In these cases the maximum design contact wire height shall not be greater than 6,20 m.

The maximum contact wire height is 6,5 m.

The contact wire height may be lower in certain cases related to gauge such as bridges and tunnels. Minimum contact wire height shall be calculated in accordance with EN 50119:2009, 5.10.4.

Table 1 – Range of nominal contact wire height for AC and DC systems

Line speed v (km/h)	**$v \leq 200$**	**$200 < v < 250$**	**$v \geq 250$**
Range of nominal contact wire height [m]	5,0 up to 5,75	5,0 up to 5,5	5,08 up to 5,3

5.2.4 Contact wire gradient

The permissible contact wire gradient is defined in EN 50119:2009, 5.10.3.

The variation in contact wire height shall fulfil the requirements imposed by EN 50119:2009, 5.10.3.

The contact wire gradient specified in EN 50119:2009, 5.10.3 may be exceeded on an exceptional basis, where a series of restrictions on the contact wire height such as level crossings, bridges, tunnels, etc., prevents compliance. In this case the requirements of 7.3 are not applicable, and the contact force shall not exceed the maximum value defined in EN 50119:2009, 5.2.5.2.

5.2.5 Lateral deviation

The maximum lateral deviation of the contact wire shall be calculated by taking into consideration the total movement of the pantograph with respect to the nominal track position and the conducting range (or working length, for pantographs with horns made from a conducting material) as follows:

$$d_{l} = b_{w,c} + b_{w} - b'_{h}$$

The values shall be adjusted taking into account the pantograph movement, track gauge and track tolerances according to EN 15273 and the following reference parameters:

s'_0 = 0,225

$h`_{c0}$ = 0,5 m

I'_0 = 0,066 m and $D`_0$ = 0,066 m

h'_o = 6,500 m and h'_u = 5,000 m

$b_{w,c}$ = 600 mm for pantographs in accordance with Figure A.6

b_{w} = 800 mm for pantographs in accordance with Figure A.6

$b_{w,c}$ = 775 mm for pantographs in accordance with Figure A.7

b_{w} = 975 mm for pantographs in accordance with Figure A.7

For interoperable pantographs defined in A.2 the limit for the maximum permissible lateral deviation of the contact wire normal to the design track centre line under the action of cross wind is given in Table 2.

Table 2 – Maximum lateral deviation

Dimensions in millimetres

Pantograph length	Maximum lateral deviation
1 600	400
1 950	550

In the case of a multi-rail track, the requirement shall be fulfilled for each pair of rails (designed to be operated as separated track) that is intended to be interoperability.