SLOVENSKI STANDARD
oSIST prEN 50206-1:2026

01-julij-2026

Železniške naprave - Tirna vozila - Pantograf: karakteristike in preskusi - 1. del: Pantograf za železniška vozila na magistralnih progah

Railway applications - Rolling stock - Pantographs: Characteristics and tests - Part 1: Pantographs for main line vehicles

Bahnanwendungen - Schienenfahrzeuge - Merkmale und Prüfungen von Stromabnehmern - Teil 1: Stromabnehmer für Vollbahnfahrzeuge

Applications ferroviaires - Matériel roulant - Pantographes: Caractéristiques et essais - Partie 1: Pantographes pour véhicules grandes lignes

Ta slovenski standard je istoveten z: **prEN 50206-1:2026**

ICS:

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

oSIST prEN 50206-1:2026 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 50206-1

May 2026

ICS 29.280

Will supersede EN 50206-1:2010

English Version

Railway applications - Rolling stock - Pantographs: Characteristics and tests - Part 1: Pantographs for main line vehicles

Applications ferroviaires - Matériel roulant - Pantographes: Caractéristiques et essais - Partie 1: Pantographes pour véhicules grandes lignes

Bahnanwendungen - Schienenfahrzeuge - Merkmale und Prüfungen von Stromabnehmern - Teil 1: Stromabnehmer für Vollbahnfahrzeuge

This draft European Standard is submitted to CENELEC members for enquiry.
Deadline for CENELEC: 2026-08-21.

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

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.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

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.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.

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

Project: 79344

Ref. No. prEN 50206-1:2026 E

Contents

Page

Figures

Tables

European foreword

This document (prEN 50206-1:2026) was prepared by SC 9XB, Electromechanical material on board rolling stock, of Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways.

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 50206-1:2010 and all of its amendments and corrigenda (if any).

prEN 50206-1:2026 includes the following significant technical changes with respect to EN 50206-1:2010:

— update of normative references and definitions;

— definition of new tests for ADD, operating system and lateral stiffness;

— definition of new annexes for test of control units and insulators;

— adjustment of terms to EN 50317 and EN 50367;

— deletion of Clauses 7, 8 and 9;

— update of normative references.

The following changes are describing the relation to TSI ENE:

— working range: changes are not affecting the working range;

— current capacity: test acceptance criteria improved;

— lowering: time definition improved;

— verification: test conditions improved.

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.

Introduction

The electrical power supply of an electric traction unit is achieved by the collection of current from one or more contact wires by means of one or more roof-mounted pantograph(s), installed on the unit.

The contact strips of the pantograph which brush along the contact wire accommodate the transmission of power.

The pantograph and the overhead contact line system form two oscillating sub-systems which can be displaced. There exists a unilateral sliding contact between them, which shall ensure continuous contact. Their design shall allow for minimum wear of both sub-systems when used.

1 Scope

This document specifies the general assembly characteristics applied to pantographs and their control unit, to enable current collection from the overhead contact line system. It also specifies the tests the pantographs and their control unit need to perform.

This document is not applicable to pantograph dielectric tests performed on the pantograph installed on the vehicle roof. Insulation coordination is covered in EN 50124-1.

This document is not applicable to pantographs used on isolated metros and light rail systems. These pantographs are considered in EN 50206-2.

This document is not applicable to third and fourth rail current collectors used on isolated metros and light rail systems. These pantographs are considered in EN 50702.

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 12663-1:2010+A2:2023, *Railway applications - Structural requirements of railway vehicle bodies - Part 1: Locomotives and passenger rolling stock (and alternative method for freight wagons)*

EN 15273 (all parts), *Railway applications*

EN 15273-1:2025, *Railway applications - Gauges - Part 1: General - Common rules for rolling stock and infrastructure*

EN 50119:2020, *Railway applications - Fixed installations - Electric traction overhead contact lines*

EN 50125-1:2014, *Railway applications - Environmental conditions for equipment - Part 1: Rolling stock and on-board equipment*

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

EN 50317:2025, *Railway applications - Current collection systems - Requirements for and validation of measurements of the dynamic interaction between pantograph and overhead contact line*

EN 50367:2020,[2] *Railway applications - Fixed installations and rolling stock - Criteria to achieve technical compatibility between pantographs and overhead contact line*

EN 50405:2015,[3] *Railway applications - Current collection systems - Pantographs, testing methods for carbon contact strips*

EN 60077-1:2017, *Railway applications - Electric equipment for rolling stock - Part 1: General service conditions and general rules (IEC 60077:2017)*

EN 61373:2010, *Railway applications - Rolling stock equipment - Shock and vibration tests (IEC 61373:2010)*

---

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

[2] As impacted by EN 50367:2020/A1:2022 and EN 50367:2020/A2:2025.

[3] As impacted by EN 50405:2015/A1:2016.

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 https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1 General

3.1.1
supplier
manufacturer of the pantograph

3.1.2
customer
either operating authority or vehicle manufacturer

3.1.3
Pantograph (see Figure 1)
apparatus for collecting current from one or more contact wires, formed of a hinged device designed to allow vertical movement of the pantograph head

Note 1 to entry: It consists of a base frame, an operating system, a kinematic structure and a pantograph head. It is of variable geometry. In the “operating” position, the apparatus is entirely or partly under voltage. It is electrically insulated only generally at its interfaces, on the vehicle roof. It enables current to be transmitted from the overhead contact line system to the vehicle electrical system

[SOURCE: IEC 60050-811:2017, 811-32-02, modified – Note 1 to entry added.]

3.1.4
control system
apparatus that transmits the necessary energy (pneumatic or electric) to the pantograph actuation to generate a defined contact force between pantograph contact strip and contact line

3.2 Design

The definitions in Table 1 are related to Figure 1, except items 9, 15, 16, 17, 18.

Table 1 — Design definitions

Def. No.	Term	Item No.	Definition
3.2.1	kinematic structure	1	articulated structure which enables the collector head to move in a vertical direction with respect to the base frame of the pantograph
3.2.2	base frame	2	fixed part of the pantograph which supports the kinematic structure and is fixed to the vehicle roof (e.g. using insulators)
3.2.3	pantograph head	3	part of the pantograph comprising the contact strips and their mountings, horns and possibly a suspension [SOURCE: IEC 60050-811:2017, 811–32–05]
3.2.4	contact strip	4	replaceable wearing part of the pantograph head which interfaces with the contact wire [SOURCE: IEC 60050-811:2017, 811–32–06]
3.2.5	horns	5	ends of the pantograph head which ensure smooth engagement with the contact wire
3.2.6	pantograph head length	6	dimension of pantograph head measured transversely in the horizontal plane in relation to the vehicle
3.2.7	pantograph head width	7	dimension of pantograph head measured longitudinally in relation to the vehicle
3.2.8	pantograph head height	8	vertical distance between the lowest point of the horns and the upper most point of the contact strips
3.2.9	pantograph head pivot	9	pitching axis of the pantograph head
3.2.10	length of contact strips	10	total length of wearable material intended for normal interaction measured transversely in relation to the vehicle
3.2.11	height at “lower operating position”	11	vertical minimum distance above housed height at which the pantograph is designed to collect current
3.2.12	height at “upper operating position”	12	vertical maximum distance above the housed height at which the pantograph is designed to collect current
3.2.13	working range	13	difference between the “upper operating position” height and the “lower operating position” height

Def. No.	Term	Item No.	Definition
3.2.14	housed height above insulators	14	vertical distance between top of insulators and the upper surface of the contact strips or any other part of the pantograph structure if higher (pantograph being in the housed position)
3.2.15	pantograph insulation distance when raised	15	minimum distance between the bottom of the insulator and the closest conductive component of the pantograph in every height when raised
3.2.16	operating system	16	device which provides a force to raise or to lower the pantograph
3.2.17	maximum extension	17	maximum extended height to mechanical stops (without any device which will limit the pantograph extension within the working range)
3.2.18	limited maximum extension	18	reduced extension allowed by intermediate mechanical stops
3.2.19	housed height with insulators	19	vertical distance between the pantograph mounting plane on the roof of the vehicle (under insulator) and the upper surface of the contact strips or any other part of the pantograph structure if higher (pantograph being in the housed position)
3.2.20	longitudinal movement	20	Maximum longitudinal movement between “lower operating position” and “upper operating position”
3.2.21	lateral movement free of force	21	Maximum right and left movement of pantograph until “upper operating position” compared to central axis, due to internal tolerances and kinematic
3.2.22	lateral pantograph semi-width	22	Maximum right and left width of pantograph at “upper operating position” compared to central axis, due to internal tolerances and kinematic
3.2.23	pantograph insulation distance when lowered	15’	minimum distance between the bottom of the insulator and the closest conductive component of the pantograph in every height when lowered (useful if a pantograph can live because connected to another pantograph in contact with overhead line)

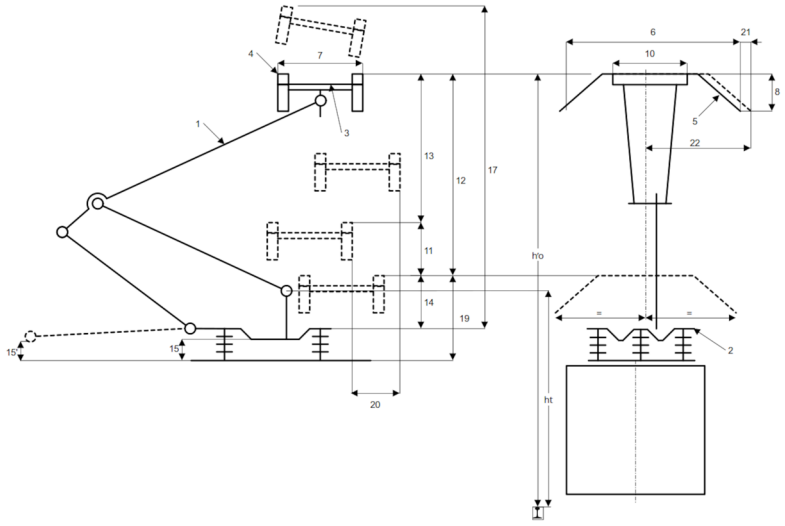

Figure 1 — Pantograph terminology (to be updated)

The sketch in Figure 1 is an example only and does not exclude other types of pantographs (diamond type, for example).

NOTE Value ht and h´0 are used by gauging calculation according to EN 15273 series.

3.3 General characteristics

3.3.1
rated voltage
the nominal voltage at which the pantograph is designed to function

3.3.2
rated current, vehicle at standstill
average value of that current withstood for 30 min by the pantograph at standstill

3.3.3
maximum current, vehicle at standstill
value of that current withstood by the pantograph at standstill for a given time

3.3.4
rated current, vehicle running
continuous current transfer capacity of the pantograph

3.3.5
static contact force
vertical force exerted upward by the pantograph head on the overhead contact line at standstill

[SOURCE: EN 50367:2020, 3.21]

3.3.6
nominal static contact force
specified set point for the static contact force

3.3.7
mean static contact force
average of the actual values of static contact forces evaluated as follows: the static contact forces are measured continually within the working range during raising (F_r) and lowering (F_l) operation. By convention, the mean static contact force at any point is equal to

$$\frac{F_r + F_l}{2}$$

3.3.8
mean cord force
statistical mean value of cord force measured at the pantograph head, the latter not touching the contact line, being equal to the sum of static contact force and the aerodynamic force caused by the air at the considered speed for a given height of contact points

3.3.9
contact force
<for a pantograph> vertical force applied by the pantograph to the contact wire(s)

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

Note 2 to entry: The contact force is measured perpendicular to the contact plane.

[SOURCE: EN 50317:2025, 3.1.4]

3.3.10
housing force
force applied vertically to the pantograph head to maintain the whole pantograph in housed position

3.4 Symbols and abbreviations

For the purpose of this document, the following symbols and abbreviations apply.

Fo	natural transverse frequency of the pantograph
AC	Alternating Current
ADD	Automatic Dropping Device
CAD	Computer Aided Design
DC	Direct Current
EPCU	Electro-Pneumatic Control Unit
PCU	Pneumatic Control Unit

4 Technical requirements

4.1 General

All general characteristics are given in the customer specifications. Unless otherwise specified, environmental conditions are defined in EN 50125-1. The category of environment has to be specified by the customer.

4.2 Gauge

The pantograph, at housed position and operating position, shall comply with the gauge specified in the customer specifications or shall be in accordance with EN 50367:2020 and the EN 15273 series.

The encroachment of the contact strips above reference profile according EN 15273-1 shall not exceed the value defined in EN 15273-1:2025, B.4 under all operating conditions.

4.3 Extension of the pantograph

The customer specifications shall state the values in relationship with items 10 to 13 in Table 1. In the absence of specifications in the tender documents, when the pantograph is raising or lowering, the

pantograph head trajectory over the working range shall be within tolerance of 100 mm in the longitudinal direction, and ± 10 mm in the lateral direction in relation to the vertical line.

4.4 Electrical values

The typical supply voltages of traction systems are specified in EN 50163. The typical values for insulation coordination are specified in EN 50124-1.

Values defined in 3.3.2 to 3.3.4 include all relevant voltage systems, the overvoltage category and pollution degree, and therefore the minimum value for clearance distance and creepage values for the insulation for operating shall be given in the customer specifications.

For insulated end horns which stick into the clearance distance of the pantograph, the following formula may apply:

$$\frac{l_{clearance\_is}}{l_{clearance\_nominal}} + \frac{l_{creepage\_is}}{l_{creepage\_nominal}} > 1$$

where

$l_{\text{clearance is}}$ is the clearance realized;

$l_{\text{clearance nominal}}$ is the clearance required (without additional creepage);

$l_{\text{creepage is}}$ is the creepage realized;

$l_{\text{creepage nominal}}$ is the creepage required (without additional creepage).

NOTE It is an approximation of Paschen's law where breakdown voltage is supposed linear in the air and for normal altitudes.

4.5 Force requirements

4.5.1 General

Static contact forces measured during raising and lowering shall lie within the boundaries defined in Annex A.

Operating requirements for static contact force, mean cord force and mean contact force shall follow the requirements in EN 50367:2020 if not specified in the customer specifications.

4.5.2 Housing force

The housing force shall prevent the pantograph from leaving the housed position at all speeds up to maximum speed of the vehicle. The housing force is the force required to maintain the pantograph head at the distance defined in the chapter 6.9 from the housed position.

The housing force may be agreed between the customer and the supplier. Alternatively, provision may be made for the fitting of a holding down device.

4.6 Transverse rigidity

The rigidity of the raised pantograph against lateral forces such as lateral acceleration forces, lateral wind forces, friction forces of the contact wire(s) etc. shall be tested to ensure the fulfilment of the gauge requirements.

The pantograph is raised at the upper operating position or at the operating position defined by the customer with static load and without any compression of the suspension. A transverse force of 300N is exerted at the extremity of the upper arm on the pantograph head pivot at the upper operating position or at the operating position defined by the customer and after removing the transversal gap of the pantograph head (2nd cycle), the lateral movement of the pantogaph head localized on the extremity of the horn shall not exceed the value defined in 6.6 and no permanent deformation shall occur.