
Železniške naprave – Vozna sredstva – Odjemniki toka: karakteristike in preskusi – 1. del: Odjemniki toka za železniška vozila na magistralnih progah

Railway applications - Rolling stock - Pantographs: Characteristics and tests - Part 1: Pantographs for main line vehicles (IEC 60494:1974 (Related))

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EUROPEAN STANDARD

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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

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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 9XB, Electromechanical material on board of rolling stock, of Technical Committee CENELEC TC 9X, Electrical and electronic applications in railways.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50206-1 on 1998-01-01.

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 (doa) 1998-12-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1998-12-01

In this standard:

- Annexes A, B, C, D are normative
- Annex E is informative
- Annex F is informative and contains a list of clauses where agreement between supplier and customer is mentioned.

Clauses and subclauses subject to future change are indicated in the text by a note.

Those affected are:

- 4.5 : Measurement of forces
- 4.7.4 : Contact strips
- 6.4.3 : Resistance to vibrations
- 6.11 : Total contact forces
- 6.12 : Current collection tests

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Introduction

The electrical power supply of a tractive unit is achieved by the collection of current from one or more contact wires by means of one or more pantograph(s), installed on the traction unit or on the trainset's vehicle.

The contact strips of the pantograph which slide along the contact wire facilitate the transmission of power.

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

1 Scope

This document defines the general assembly characteristics which are to be applied to pantographs, to enable current collection from the overhead line system. It also defines the tests the pantographs have to perform, excluding insulators.

This standard does not apply to pantograph dielectric tests, which are to be performed on the pantograph installed on the vehicle roof.

This standard does not apply to pantographs used on isolated metros and light rail systems : these pantographs are considered in EN 50206-2.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 29001	Quality systems - Model for quality assurance in design/development, production, installation and servicing
EN 29002	Quality systems - Model for quality assurance in production and installation
ENV 50121	Railway applications - Electromagnetic compatibility
EN 50125-1 *)	Environmental conditions for rolling stock
EN 50126*)	Railway applications - The specification and demonstration of dependability - Reliability, Availability, Maintainability and Safety (RAMS)
EN 50163	Supply voltage of traction system
EN 50206-2 *)	Railway applications - Rolling stock - Part 2: Pantographs for metros and light rail systems Characteristics and tests
EN 50215 *)	Railway applications - Rolling stock - Tests after completion of construction and before entry into service
IEC 60494 (1974)	Rules for pantographs of electric rolling stock

*) In preparation

- IEC 61373 *) Shocks and vibrations requirements for rolling stock
- IEC 61376 *) General service conditions and general rules for electric equipment for rolling stock

3 Definitions

For the purpose of this standard, the following definitions apply.

3.1 General

3.1.1 **supplier**: the manufacturer of the pantograph.

3.1.2 **customer** : either the operating authority or the vehicle manufacturer.

3.1.3 **pantograph** (see annex A) : an apparatus that collects current on one or more contact-lines. It consists of a base frame, an operating system, a frame and a collector 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 line to the vehicle electrical system.

3.2 Design

The following definitions are related to the sketch in annex A, except items 9, 15, 16, 17, 18.

3.2.1 **frame** (Item 1) :

An 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** (item 2) :

Fixed part of the pantograph which supports the frame and is mounted on insulators fixed to the vehicle roof.

3.2.3 **collector head** (item 3) :

Part of the pantograph supported by the frame which includes contact strips, horns and may include a suspension.

3.2.4 **contact strip** (item 4) :

Replaceable wearing part of the collector head which interfaces with the overhead line.

3.2.5 **horns** (item 5) :

Ends of the collector head which ensure smooth engagement with the contact wire.

3.2.6 **collector head length** (item 6) :

Dimension of collector head measured horizontally transversely in relation to the vehicle.

3.2.7 **collector head width** (item 7) :

Dimension of collector head measured longitudinally in relation to the vehicle.

3.2.8 **collector head height** (item 8) :

The vertical distance between the lowest point of the horns and the upper most point of the contact strips.

3.2.9 **collector head pivot** (item 9) :

The pitching axis of the collector head.

3.2.10 **length of contact strips** (item 10) :

The total length measured transversely in relation to the vehicle.

*) In preparation

3.2.11 height at "lower operating position" (item 11) :

Vertical distance between the pantograph mounting plane on the top of insulators and the upper surface of contact strips, the pantograph being raised to the lowest level at which it is designed to collect current.

3.2.12 height at "upper operating position" (item 12) :

Vertical distance between the pantograph mounting plane on the top of insulators and the upper surface of the contact strips, the pantograph being raised to the highest level at which it is designed to collect current.

3.2.13 working range (item 13) :

Difference between the "upper operating position" height and the "lower operating position" height.

3.2.14 housed height (item 14) :

Vertical distance between the pantograph mounting plane on the 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 "electrical thickness" (item 15) :

Vertical distance between the highest live part and the lowest live part of the pantograph at housed position.

3.2.16 operating system (item 16) :

Device which provides a force to raise or to lower the pantograph.

3.2.17 maximum extension (item 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 (item 18) :

Reduced extension allowed by intermediate mechanical stops.

3.3 General characteristics

All general characteristics are defined in the customer specifications. Unless otherwise specified, environmental conditions are defined in EN 50125-1.

3.3.1 rated voltage, vehicle at standstill

The 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 minutes 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

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Current collected via the pantograph from standstill to maximum speed of the vehicle.

3.3.5 static force

The mean vertical force exerted upward by the collector head on the catenary, and caused by the pantograph raising device, whilst the pantograph is raised and the vehicle is at standstill.

3.3.6 nominal static force

An average of the actual values of static forces evaluated as follows : the static forces are measured continually within the working range during raising (Fr) and lowering (Fl) operation. By convention, the nominal static force at any point is equal to $\frac{Fr + Fl}{2}$.

2

3.3.7 total mean uplift force

The vertical force measured at the collector head, the latter not touching the contact line. It is equal to the sum of static force and the aerodynamic force caused by the air at the considered speed for a given collector height, the results being referred to zero ambient wind conditions.

3.3.8 total contact force

Total force between collector head and contact-line while running.

3.3.9 housing force

The force applied vertically to the collector head to maintain the whole pantograph in housed position.

4 Technical requirements

4.1 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 UIC 505-1 and UIC 505-5 (see annex E).

4.2 Extension of the pantograph

The customer specifications shall give the values in relationship with 3.2.10 to 3.2.13. In the absence of specifications in the tender documents, when the pantograph is raising or lowering, the collector head trajectory over the working range shall be within a range of ± 50 mm in the longitudinal direction, and ± 10 mm in the lateral direction in relation to the vertical line.

4.3 Electrical values

The supply voltages of traction systems are specified in EN 50163.

The customer specifications shall also state the duration and values of the exceptional voltages for operating pantographs and housed pantographs.

Values defined in 3.3.2 to 3.3.4 shall be given in the customer specifications.

4.4 Static force tolerances

Static forces measured during raising and lowering shall lie within the boundaries defined in annexes B or C.

4.5 Measurement of forces

Operating requirements for static force, total mean uplift force and total contact force shall be specified in the customer specifications.

NOTE: This subclause is under revision taking into account work in progress in sub-commission UIC 57 H2

4.6 Transverse rigidity

When a transverse force is exerted on the part of the frame which supports the collector head at the upper operating position, the deflection shall not exceed the value defined in 6.6 and no permanent deformation shall occur.

4.7 Collector head

4.7.1 Length

If not specified in the customer specification, lengths defined in UIC 608 (see enclosed annex E) shall be used.

4.7.2 Width

The collector head width shall be defined according to the type of suspension, the number of wear strips and the catenary system characteristics.

4.7.3 Head profiles

If not specified in the customer specification, the collector head outline profiles and maximum allowable tilt defined in UIC 608 (see enclosed annex E) shall be used.

4.7.4 Contact strips

Wear strip material, maximum current density and compatibility of different wear strip materials shall be specified in the customer specifications.

NOTE: This subclause is under revision taking into account work in progress in sub-commission UIC 57 H2

4.8 Operating system

The installation and the definition of the operating system shall be provided by the supplier.

The operating system shall be designed to ensure, at standstill and up to the maximum speed of the traction unit, a break from the contact wire, within 3 seconds, over the minimum insulation distance.

The housing force shall prevent the pantograph from raising from the housed position at all speeds up to maximum speed of the vehicle.

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.

4.9 Automatic dropping device (A.D.D)

The pantograph shall be fitted with an automatic dropping device only if requested in the customer specifications.

The automatic dropping device shall initiate the immediate lowering of the pantograph in the event of collector head failure.

If precise requirements are not specified in the customer specifications, damage occurring to contact strips and insulated horns liable to cause subsequent damage to overhead line shall be detected by A.D.D.

When designing, the following characteristics should be taken into account:

- A.D.D reaction time
- A.D.D failure to safe condition
- A.D.D self test in workshop