



SLOVENSKI STANDARD

SIST EN 50405:2016

01-marec-2016

Nadomešča:
SIST EN 50405:2007

Železniške naprave - Sistemi za odjem toka - Odjemniki toka, preskusne metode za kontaktne drsnike

Railway applications - Current collection systems - Pantographs, testing methods for contact strips

Bahnanwendungen - Stromabnahmesysteme - Stromabnehmer für Oberleitungsfahrzeuge, Prüfverfahren für Schleifstücke
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Applications ferroviaires - Systèmes de captage de courant - Méthodes d'essais des bandes de frottement des pantographes
<https://standards.sist/1e378955-d313-437d-b180-46df65a35bd7/sist-en-50405-2016>

Ta slovenski standard je istoveten z: EN 50405:2015

ICS:

29.280	Električna vlečna oprema	Electric traction equipment
45.020	Železniška tehnika na splošno	Railway engineering in general

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EUROPEAN STANDARD

EN 50405

NORME EUROPÉENNE

EUROPÄISCHE NORM

December 2015

ICS 29.280

Supersedes EN 50405:2006

English Version

Railway applications - Current collection systems - Pantographs, testing methods for contact strips

Applications ferroviaires - Systèmes de captage de courant
- Méthodes d'essais des bandes de frottement des
pantographes

Bahnanwendungen - Stromabnahmesysteme -
Stromabnehmer für Oberleitungsfahrzeuge, Prüfverfahren
für Schleifstücke

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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European foreword

This document (EN 50405:2015) has been prepared by CLC/SC 9XB "Electromechanical material on board of rolling stock".

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) 2016-11-16
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2018-11-16

This document supersedes EN 50405:2006.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

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.

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Introduction

This European Standard defines testing methods for pantograph contact strips, but excludes wear tests, and tests using a particular pantograph.

In this issue of the standard, additional clauses have been included to address the European Rail Agency (ERA) request for standard (IU-RFS-024 of 3rd July 2009) which requested that this standard specifies the assessment methods for contact strips of different materials as specified in the High Speed and Conventional Rail Locomotives and Passenger rolling-stock technical specifications for interoperability (LOC and PAS TSIs). A method for determining the metal content for metal impregnated (metalized) contact strips (7.8) has been added in this issue of the standard. Tests for the coefficient of friction (7.9) and impact resistance of the carbon material (7.10) have also been included in this revision.

The Locomotives and Passenger rolling-stock technical specification for interoperability (COMMISSION REGULATION (EU) No 1302/2014 of 18 November 2014) (LOC and PAS TSI) chapter 4.2.8.2.9.4.2 states:

4.2.8.2.9.4.2 Contact strip material

- (1) Material used for the contact strips shall be mechanically and electrically compatible with the contact wire material (as specified in Clause 4.2.14 of the ENE TSI, in order to ensure proper current collection and to avoid excessive abrasion of the surface of the contact wires, thereby minimising wear of both contact wires and contact strips.
- (2) Plain carbon or impregnated carbon with additive material shall be permitted.

Where a metallic additive material is used, the metallic content of the carbon contact strips shall be copper or copper alloy and shall not exceed a content of 35 % by weight where used on AC lines and of 40 % where used on DC lines.

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Pantographs assessed against this TSI shall be fitted with contact strips of a material mentioned above.

- (3) Additionally, contact strips of other material or higher percentage of metallic contents or impregnated carbon with clad copper are allowed (if permitted in the infrastructure register) provided that:
 - they are referenced in recognised standards, with mention of restrictions if any, or
 - they have been subject to a test of suitability for use (see 6.1.3.8).

Evidence from the UIC project “COSTRIM” testing of a sample of carbon contact strips has shown the difficulty of defining a cross-industry wear test. This could be the subject of a new requirement following further analysis of the COSTRIM results for a future revision of this standard. (These values were determined as a result of the tests undertaken under the COSTRIM project, and are the limit of the tests carried out, rather than an absolute limit.)

Although not currently applicable to contact strips for railway applications, it should be noted that certain materials listed in the EU Directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment 2011/65/EU are prohibited from use in certain applications

1 Scope

This European Standard specifies testing methods to establish the basic characteristics of newly manufactured pantograph contact strips. Not all tests may be relevant to some designs of contact strips. This standard does not define tests for pure metallic contact strips.

This European Standard excludes wear tests, and tests using a particular pantograph. Additional supplementary tests, out of the scope of this standard, may be necessary to determine suitability for a particular application and are by prior agreement between customer and manufacturer.

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 ISO 148-1:2010, *Metallic materials — Charpy pendulum impact test — Part 1: Test method (ISO 148-1:2009)*

EN ISO 179-1:2010, *Plastics — Determination of Charpy impact properties — Part 1: Non-instrumented impact test (ISO 179-1:2010)*

EN ISO 180:2000, *Plastics — Determination of Izod impact strength (ISO 180:2000)*

IEC 60413:1972, *Test procedures (for determining physical properties) of brush materials for electrical machines*

IEC 60773:1983, *Test methods and apparatus for measurement of the operational characteristics of brushes*

3 Terms and definitions

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

3.1 General

3.1.1

air flow continuity

uninterrupted flow of air

3.1.2

air flow rate

flow rate, in standard litres per minute, based upon mass flow to be calculated at the standard temperature and pressure (STP)

Note 1 to entry: Referenced at a temperature of 15 °C (288,15 K, 59 °F) and an absolute pressure of 101,325 kPa (1,013 25 bar, 1 standard atmosphere (atm)).

Note 2 to entry: Based upon the Standard Temperature and Pressure defined by EN ISO 13443:2005.

3.1.3

auto-drop detection sensor

function incorporated in the contact strip which initiates the pantograph automatic dropping device

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Note 1 to entry: The tests specified in this standard relate only to pantograph automatic dropping devices operated by air pressure.

3.1.4

pantograph automatic dropping device

device intended to lower the pantograph automatically if it should be damaged

[SOURCE: IEC 60050-811:1991, 811-32-22]

3.1.5

rated current

current value that the contact strip is designed to sustain indefinitely without degradation under the specified operating and environmental conditions

3.1.6

shear strength

force which can be withstood without failure of the adhesion between the carbon strip and the integral carrier

3.2 Contact strip material

3.2.1

metal contact strip

strip of metal or metal alloys without carbon as a functional element

3.2.2

metal impregnated (metalized) carbon

plain carbon strips where the cavities are filled with metal or metal alloys

Note 1 to entry: The degree of impregnation is defined in percentage of weight.

Note 2 to entry:

The material can contain additives and can be impregnated with oil, wax or resin.

3.2.3

plain carbon

hard carbon material, without added metal and consisting of a mixture of amorphous and graphite carbon elements

Note 1 to entry: The material can contain additives and can be impregnated with oil, wax or resin.

3.3 Contact strip construction

NOTE The designs described in 3.3 may or may not include any of the following:

- Auto-drop detection sensor
- Integrated End Horns
- Arc Protection; either with additional components or coatings or with the carbon enshrouding the supporting carrier

3.3.1

bonded carbon contact strip

contact strip formed by a carbon contact strip permanently attached to an integral carrier by an adhesive

3.3.2

carrier

structure which supports the contact strip, but is not permanently attached to it, and is used as an interface to the pantograph head

3.3.3**copper clad contact strip**

carbon contact strip housed in a formed copper sheath, with copper on the leading and trailing faces extending from the base to the contact surface of the carbon

Note 1 to entry: Often referred to as a “Kasperowski” contact strip.

3.3.4**fitted carbon contact strip**

contact strip formed by a carbon contact material permanently attached to an integral carrier without the application of adhesive or solder

Note 1 to entry: This includes, but is not exclusive to, designs with carbon crimped, rolled or pressed into a carrier.

3.3.5**integral carrier**

structure which supports the contact strip without the need for any additional support between the mounting points used to interface to the pantograph head and permanently attached to the contact strip

3.3.6**metal and carbon composite contact strip**

contact strip formed by vertical layers of metal mixed with layers of carbon permanently attached to a carrier

3.3.7**self-supported**

contact strip which does not need additional support between the mounting points used to interface the contact strip and the pantograph

3.3.8**soldered carbon contact strip**

contact strip formed by a carbon contact strip permanently attached to an integral carrier by solder

3.3.9**un-supported**

contact strip which requires mounting to an additional support structure (a carrier) before fitting to the pantograph

4 Symbols and abbreviations

A	designed area of adhesion (mm^2)
F_s	shear force (N)
R	resistance (Ω)
T_s	shear strength (N/mm^2)
μ	coefficient of friction
T_{cs}	maximum temperature of the contact strip at the interface between the carrier and the “wearing material” determined by test (see 7.1) ($^{\circ}\text{C}$). The temperature is measured in the “wearing material” immediately adjacent to the interface.
T_{max}	the limit temperature at which the shear strength of the bond maintains a minimum value determined by test (see 7.4.3) ($^{\circ}\text{C}$). (For bonded carbon contact strips). The temperature is measured in the carbon immediately adjacent to the interface.
W_b	weight of the part before impregnation

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W_a	weight of the part after impregnation
AD_b	apparent density of the specimen before impregnation
AD_a	apparent density of the specimen after impregnation
Δh	vertical deflection in the middle of the contact strip (Deflection upwards is positive)
Δl	change in length of the contact strip assembly (Increase in length is positive)
F	test contact force (test 7.1.2.)

5 Requirements for data sheets

5.1 Data sheet and design drawing

The essential characteristics of the contact strip material shall be provided in a data sheet and design drawing containing as a minimum the following information:

5.2 Contact strip material

1. manufacturer's grade designation;
2. hardness according to IEC 60413;
3. density according to IEC 60413;
4. flexural strength according to IEC 60413;
5. electric resistivity according to IEC 60413;
6. percentage of metal impregnation according to 7.8, with tolerance;
7. coefficient of friction according to 7.9;
8. material type e.g. plain carbon.

NOTE For metal contact strips information is provided according to alternative relevant standards.

5.3 Contact strip characteristics

1. contact strip construction as defined in 3.3 and Table 1;
2. data sheet and drawing reference numbers;
3. record of standard compliance and certification;
4. dimensions, tolerances and design drawings including specific requirements;
5. weight (new and fully worn) with tolerances;

NOTE 1 The worn weight, if provided, is an estimate based upon the service conditions.

6. designed rated current in operation;
7. wear limit;
8. value of T_{cs} determined by test 7.1;
9. value of T_{max} determined by test 7.4.3;
10. maximum and minimum operating pressure for use with a pantograph automatic dropping device;
11. air flow rate (in standard litres per minute) at minimum pressure for use with a pantograph automatic dropping device;