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INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

Applications ferroviaires – Systèmes de captage du courant – Méthodes d'essais des bandes de frottement en carbone des pantographes

IEC 62499:2008

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

RAILWAY APPLICATIONS – CURRENT COLLECTION SYSTEMS – PANTOGRAPHS, TESTING METHODS FOR CARBON CONTACT STRIPS

FOREWORD

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The text of this standard is based on the following documents:

FDIS	Report on voting
9/1190/FDIS	9/1218/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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- withdrawn,
- replaced by a revised edition, or
- amended.

RAILWAY APPLICATIONS – CURRENT COLLECTION SYSTEMS – PANTOGRAPHS, TESTING METHODS FOR CARBON CONTACT STRIPS

1 Scope

This International Standard gives rules for testing methods for carbon contact strips. The purpose of this standard is to demonstrate that the carbon contact strip construction, by attachment to integral supporting structure (carrier) but excluding bolted assembly, is fit for purpose. Not all tests may be relevant to some designs.

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.

None.

3 Terms and definitions

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

3.1
carbon contact strip
strip of carbon material, permanently attached to an integral supporting structure (carrier) but excluding bolted assemblies

3.2
shear strength
stress at failure of the adhesion between carbon and the support structure

3.3
autodrop detection sensor
mechanism incorporated in the carbon contact strip to provide the indication for the pantograph automatic dropping device (ADD)

3.4
flow continuity
uninterrupted flow of air or other fluid

3.5
rated current loading
current value defined by the manufacturer that the carbon strip is designed to sustain without degradation under the specified operating conditions

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)

5 Tests

5.1 General

There are two categories of tests:

– type tests,

– routine tests.

The above tests are described in 5.1.1 to 5.1.2.

Supplementary tests may be required if they have been specified in the customer specification and after agreement with the supplier.

Annex A summarises the tests which shall be performed.

5.1.1 Type tests

Type tests shall be performed on a single piece of product of a given design.

Equipment in current manufacture shall be considered to have satisfied the type tests; if the manufacturer can provide certified reports of type tests already conducted on identical components, the type tests shall be considered to be complied with.

5.1.2 Routine tests

Routine tests shall be carried out to verify that the properties of a product correspond to those measured during the type test. Routine tests shall be performed by the supplier on each equipment.

5.2 Test procedures

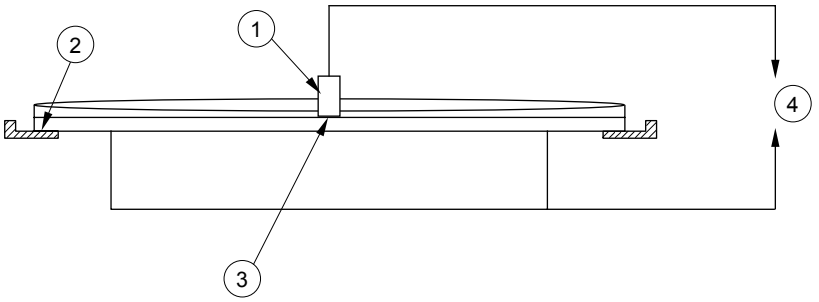
5.2.1 Tests for the temperature characteristic of the carbon contact strip under rated current loading

5.2.1.1 General

The test aims to determine the temperature characteristic to stability of the carbon contact strip at the maximum designed current loading.

5.2.1.2 Test method

The carbon contact strip shall be fixed at one end and freely supported at the other end (see Figure 1). The current supply connection shall be made by clamping suitable interfaces to the vertical faces of the carbon, but not in contact with the carrier material (see Figure 2). The current take off shall be made at the normal design interface(s) between the carrier and the pantograph.



Key

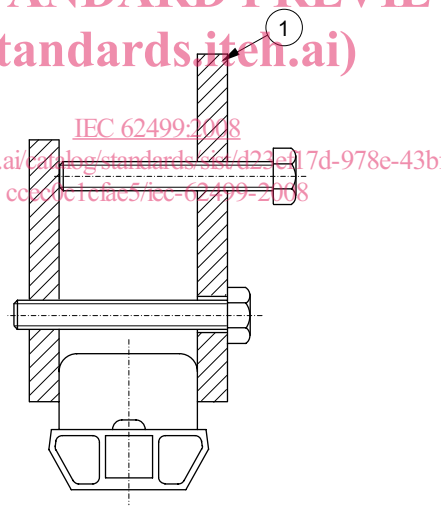
1 parallel clamp (steel)

2 carbon contact strip fixed end

3 temperature sensor 2 mm above carbon carrier interface

4 power supply

Figure 1 – Arrangement of test device for testing temperature characteristic



Key

1 current supply connection (steel, copper)

Figure 2 – Example of current supply connection

The temperature shall be monitored adjacent to the current supply connection at a point 2 mm above the carbon / carrier interface. The maximum rated current loading shall be applied to the carbon contact strip until the monitored temperature remains constant and then for a further 30 min. The temperature shall be continuously recorded during the test as a temperature – time characteristic.

Test acceptance criteria: The carbon contact strip shall remain fit for purpose. The contact strip shall remain in accordance with drawing at room temperature.

5.2.2 Test for deflection and extension of the carbon contact strip under extremes of temperature

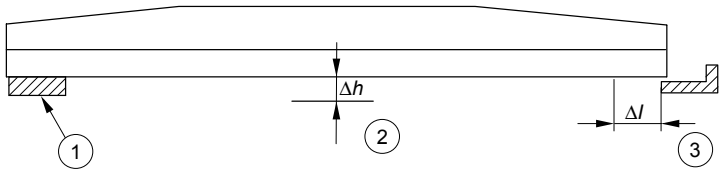
5.2.2.1 General

The test aims to determine the vertical displacement and change in length of the carbon contact strip under extremes of temperature.

5.2.2.2 Test method

5.2.2.2.1 High temperature test

This test may be carried out concurrently with the test described in 5.2.1. Under the steady state heated conditions of 5.2.1.2, the change of length of the carrier (Δl) and vertical displacement of the strip (Δh) from the room temperature condition shall be recorded by means of an automatic data recorder (see Figure 3).



IEC 2193/08

Key

1 carbon contact strip fixed

2 vertical displacement

3 change of length

Figure 3 – High temperature test

5.2.2.2.2 Low temperature test

The contact strip shall be cooled by a suitable method until the temperature of the strip is –40 °C. The contraction and vertical displacement from the room temperature condition shall be recorded by means of an automatic data recorder.

Test acceptance criteria: The carbon contact strip shall remain fit for purpose. The contact strip shall remain in accordance with drawing at room temperature.

5.2.3 Test for flexural characteristic of the carbon contact strip

5.2.3.1 General

The test aims to determine the flexural characteristic of the carbon contact strip at room temperature.

5.2.3.2 Test method

The flexural characteristic is determined by three point bending of the complete contact strip when supported at each end of the strip along the longitudinal centreline of the contact strip and loaded vertically at the centre. The force shall be gradually applied until permanent deformation is recorded on a force-deflection chart. The effective stiffness shall be determined from the results of the test and the applied force at which permanent deformation is recorded.

5.2.4 Test for shear strength of the contact strip

5.2.4.1 General

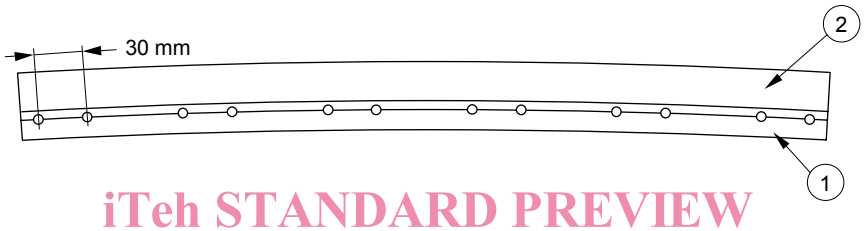
Definition of shear strength: $T_s = F_s / A$ (N/mm^2)

This test shall demonstrate that the adhesion between carbon and supporting structure meets the minimum shear strength criteria at room temperature, at specified temperatures (criteria specified by the manufacturer) and thermal fatigue. The shear strength at failure of the specimen at room temperature shall exceed a minimum acceptable value or result in failure of the parent carbon material alone.

5.2.4.2 Test method

5.2.4.2.1 Test at room temperature

Samples of the contact strip material shall be prepared in accordance with Figure 4:



Key

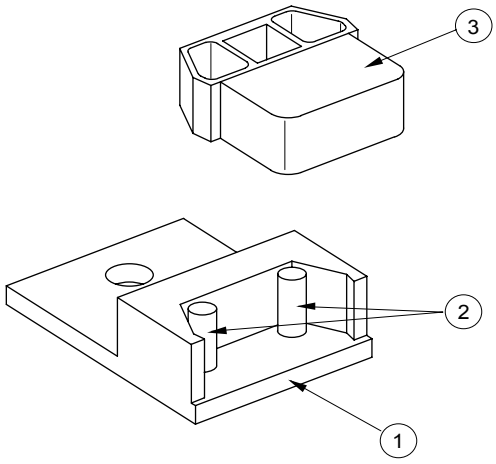
1 carrier

2 carbon

Figure 4 – Preparation of samples

A minimum of 3 samples shall be prepared from a production contact strip and shall include each end of the contact strip and the centre. Each sample shall be prepared to a preferable length of 30 mm. Each sample shall be installed in a suitable fixture (see Figure 5) in order that the applied shear force F_s is guided directly into the interface defined as area of adhesion A between carrier and carbon (see Figure 6).The force of failure of the sample shall be recorded. The shear strength shall be determined by calculation of T_s.

Test acceptance criterion: The minimum calculated shear strength shall be 5 N/mm^2.

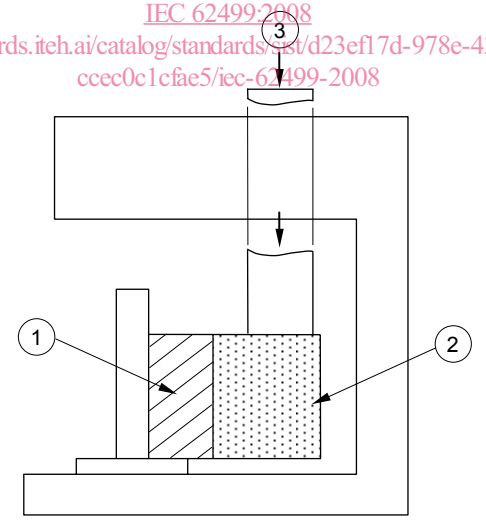


IEC 2195/08

Key

1 sledge
2 metal pins
3 test specimen

Figure 5 – Example of suitable fixture for testing shear strength of carbon contact strip



IEC 2196/08

Key

1 carrier
2 carbon
3 force

Figure 6 – Example of testing configuration of shear strength test

5.2.4.2.2 Test at specified temperature

Test specimens shall be prepared in accordance with 5.2.4.2.1. Specimens shall be cooled / heated to –40 °C, 100 °C, 200 °C, 250 °C and the steady state temperature recorded in test 5.2.1 whether it is greater or lower than 250 °C. The temperature shall be measured at the retention interface of the carbon and supporting structure. It shall be verified that the temperature of the monitoring point is representative of temperature at the interface and maintained during the test. The force of failure of each sample shall be recorded. The characteristics of T_s with temperature shall be provided.

5.2.4.2.3 Thermal fatigue test

The contact strip used in 5.2.1 shall be thermally cycled from room temperature to the maximum temperature achieved in 5.2.1.2 for 100 cycles. The electrical resistance shall be measured before and after the test (see 5.2.7). The shear strength of the contact strip shall be measured at the conclusion of the test by taking samples from the heated region.

Test acceptance criteria: It shall be demonstrated that the electrical resistance and method of attachment of carbon to the carrier have not deteriorated during the test.

5.2.5 Test of autodrop detection sensor integral with contact strips

5.2.5.1 General

The following tests shall demonstrate the sealing integrity of the contact strips, the flow continuity of the detection sensor and the operation of the detection sensor.

NOTE The tests are applicable only to contact strips that are equipped with a channel at the base of the carbon as a sensing device.

5.2.5.2 Test method

5.2.5.2.1 Sealing integrity

The carbon contact strip autodrop detection sensor shall be inflated for a minimum of 10 s at maximum operating pressure of the automatic dropping device (ADD). The maximum operating pressure shall be specified by the manufacturer and be agreed by the customer; a pressure of 10 bar is suggested. The air leakage rate shall be measured and demonstrated at room temperature. Maximum operating pressure shall be applied to the contact strip and the leakage rate shall be measured using a flow meter. Alternative methods of measurement are acceptable where it can be demonstrated that they equate to the above leakage rate at maximum operating pressure.

Test acceptance criterion: The leakage rate shall not exceed 0,1 l/min.

5.2.5.2.2 Temperature test

The carbon contact strip, tested under 5.2.2, where fitted with an autodrop detection sensor, shall be inflated during the test described in 5.2.2 to the maximum operating pressure of the automatic dropping device as specified by the manufacturer and be agreed by the customer (a pressure of 10 bar is suggested) and the sealing integrity during this test shall be continuously monitored.

Test acceptance criterion: The leakage rate shall not exceed 0,1 l/min.

5.2.5.2.3 Flow continuity

A flow meter shall be connected between the air supply and the contact strip. The supply shall be inflated to a minimum operating pressure of the autodrop system as specified by the manufacturer and be agreed by the customer (a pressure of 5 bar is suggested) and the blanking plug sealing the autodrop sensing system shall be removed.