SLOVENSKI STANDARD

SIST EN 50317:2003

maj 2003

Železniške naprave – Sistemi za odjem toka – Zahteve in veljavnost meritev medsebojnih dinamičnih vplivov med odjemnikom toka in kontaktnim vodnikom

Railway applications - Current collection systems - Requirements for and validation of measurements of the dynamic interaction between pantograph and overhead contact line

ICS 29.280

Referenčna številka
SIST EN 50317:2003(en)

EUROPEAN STANDARD **EN 50317**

NORME EUROPÉENNE

EUROPÄISCHE NORM July 2002

ICS 29.280

English version

Railway applications - Current collection systems - Requirements for and validation of measurements of the dynamic interaction between pantograph and overhead contact line

Applications ferroviaires - Systèmes de captage de courant - Prescriptions et validation des mesures de l'interaction dynamique entre le pantographe et la caténaire

Bahnanwendungen - Stromabnahmesysteme - Anforderungen und Validierung von Messungen des dynamischen Zusammenwirkens zwischen Stromabnehmer und Oberleitung

This European Standard was approved by CENELEC on 2002-04-01. 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.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists 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 Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Ref. No. EN 50317:2002 E

Foreword

This European Standard was prepared by SC 9XC, Electric supply and earthing systems for public transport equipment and ancillary apparatus (fixed installations), of Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50317 on 2002-04-01.

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 (dop) 2003-04-01

- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2005-04-01

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and supports the Interoperability Directive, 96/48/EC.

Contents

1 Scope

This European Standard specifies the functional requirements for output and accuracy of measurements of the dynamic interaction between pantograph and overhead contact line.

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 (including amendments).

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

3 Definitions

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

3.1
pantograph head
pantograph equipment comprising the contact strips and their mountings

3.2
contact point
point of mechanical contact between a contact strip and a contact wire

3.3
working area of pantograph head
lateral and vertical range of possible contact points on the contact strips during normal operation

3.4
contact force
vertical force applied by the pantograph to the overhead contact line. The contact force is the sum of the forces of all contact points

3.5
mean force
F_M
statistical mean of the contact force

3.6
static force
mean vertical force exerted upward by the collector head on the contact wire, and caused by the pantograph raising device, whilst the pantograph is raised and the vehicle is at standstill
[EN 50206-1]

3.7
aerodynamic force
additional vertical force applied to the pantograph as a result of air flow around the pantograph assembly

3.8
quasistatic force
sum of static force and aerodynamic force at the particular speed

3.9
tension length
distance from one termination point of the overhead contact line to the next

3.10
control section
representative part of the total measuring length, over which the measuring conditions are controlled

3.11
pantograph current
current that flows through the pantograph

3.12
arcs
arcing
flow of current through an air gap between a contact strip and a contact wire usually indicated by the emission of intense light

3.13
nominal current
current that flows through one pantograph for nominal power of train

3.14
percentage of arcing
NQ
is given by the following formula:

$$NQ = \frac{\Sigma t_{arc}}{t_{total}} \times 100 \qquad (1)$$

where

t_{arc} is the duration of an arc lasting longer than 1 ms

t_{total} is the measuring time with a current greater than 30 % of the nominal current

The result, given in %, is a characteristic for a given speed of the vehicle.

4 Abbreviations and symbols

d is the distance between arc sensor and light source (contact strip)

$F_{applied}$ is the force applied to pantograph head

$F_{measured}$ is the force measured

f_i is the actual frequency

f_n is the maximum frequency

f_1 is the minimum frequency

n is the number of frequency steps

x is the power density of the smallest arc that can be detected

y is the calibration distance between arc sensor and light source

5 General

The measurement of the interaction of the contact line and the pantograph is intended to prove the safety and the quality of the current collection system. Results of measurements of different current collection systems shall be comparable, to approve components for free access within Europe.

NOTE Measured values are also required for validation of simulation programs and other measurement systems.

To check the performance capability of the current collection system at least the following data shall be measured:

- the contact force or percentage of arcing;
- the contact wire uplift at the support as the pantograph passes.

In addition to the measured values, the operating conditions (train speed, location, ...) shall be recorded continuously and the environmental conditions (rain, ice, temperature, wind, tunnel, ...) and test configuration (parameters and arrangement of pantographs, type of overhead contact system, ...) during the measurement shall be recorded in the test report. This additional information shall ensure a repeatability of the measurement and a comparability of the results.

6 Measurement of contact force

6.1 General requirements

The measurement of contact force shall be carried out on the pantograph with force sensors. The force sensors shall be located as near as possible to the contact points.

The measurement system shall measure forces in the vertical direction, without interference from forces in other directions.

The measurement deviation of the force sensors caused by the temperature shall be less than 10 N (for the sum of the force of all sensors) under all measuring conditions.

For pantographs with independent contact strips each contact strip shall be measured separately.

The measurement system shall be immune to electromagnetic interference.

The maximum error of the measurement system shall be less than 10 %.

6.2 Influence of the measurement system

The measurement system shall not have any effects on the measured force which could change the result by more than 5 %.

NOTE The most important influence for distortion of the result by the measurement system are aerodynamic forces on the measurement equipment. This distortion can be checked by carrying out aerodynamic tests with and without the measurement system.

6.3 Inertia correction

The inertia forces due to the effect of the mass between the sensors and the contact point shall be corrected. This shall be stated in the measurement results.

NOTE This can be done by measurement of the acceleration to these components.

6.4 Aerodynamic correction

A correction shall be applied to allow for the influence of aerodynamic forces on the components between sensors and the contact points.

Aerodynamic tests shall be carried out to establish the aerodynamic corrections.

NOTE 1 The aerodynamic influence can be checked by a tethered test on line.

Aerodynamic tests shall be carried out with nominally the same configuration (contact wire height, train configuration, measurement equipment, environmental conditions, ...) as during the measurement of contact force.

NOTE 2 The aerodynamic test may be carried out during a line test.

6.5 Calibration of the measurement system

The measurement system shall be laboratory tested to check the accuracy of the measured force. This test shall be carried out for the complete pantograph fitted with the complete force measurement devices and any accelerometers, the data transfer system (telemetry, optical systems) and amplifiers.

The ratio between the applied and the measured forces (the transfer function of the pantograph and instrumentation) shall be determined by a dynamic excitation of the pantograph, at the pantograph head for a range of frequencies.

NOTE 1 If a sinusoidal force is used, an amplitude (peak to peak) of 30 % of the static force gives representative results.

The tests shall be carried out for the two cases:

- the force being applied centrally to the pantograph head;
- the force being applied 250 mm from the centre line of the pantograph head, if possible. Otherwise the point of force application shall be as close as possible to this value. If another value is used, it shall be noted in the test report.

The test shall be carried out with the pantograph head at the height of interest.

This test shall be carried out with the mean force equal to the static force. If the pantograph contact force increases with speed, the test shall also be carried out at the maximum quasistatic force.

Measurements of the applied force and the measured force shall be taken at frequencies up to 20 Hz in 0,5 Hz steps, with reduced intervals at resonant frequencies. The frequency steps near the resonant frequencies shall be specified.

NOTE 2 The transfer function is a continuous function with greater variations close to the resonant frequencies. The reduction of the frequency steps near the resonant frequencies is necessary.