SLOVENSKI STANDARD
SIST EN 14363:2016+A1:2019

01-marec-2019

Železniške naprave - Preskušanje in simuliranje voznih karakteristik pri prevzemu železniških vozil - Preskušanje obnašanja med vožnjo in mirovanjem

Railway applications - Testing and Simulation for the acceptance of running characteristics of railway vehicles - Running Behaviour and stationary tests

Bahnanwendungen - Versuche und Simulationen für die Zulassung der fahrtechnischen Eigenschaften von Eisenbahnfahrzeugen - Fahrverhalten und stationäre Versuche

Applications ferroviaires - Essais et simulations en vue de l'homologation des caractéristiques dynamiques des véhicules ferroviaires - Comportement dynamique et essais stationnaires

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ICS:

45.060.01	Železniška vozila na splošno	Railway rolling stock in general

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EUROPEAN STANDARD

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Railway applications - Testing and Simulation for the acceptance of running characteristics of railway vehicles - Running Behaviour and stationary tests

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This European Standard was approved by CEN on 19 September 2015 and includes Amendment 1 approved by CEN on 15 July 2018.

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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 CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 14363:2016+A1:2018) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2019, and conflicting national standards shall be withdrawn at the latest by June 2019.

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

This document includes Amendment 1 approved by CEN on 2018-07-15.

This document supersedes A1 EN 14363:2016 A1.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

It is not necessary to require further assessment of vehicles which have been already assessed under the conditions of previous standards in this field. Test results achieved under the conditions of the previous standards remain valid and can be used for the extension of acceptance of a vehicle or vehicle design according to this standard.

Prior to the first issue of this standard, national procedures were applied for vehicle acceptance, for example in Germany or UK. The underlying principles that were applied in these earlier standards are also incorporated in this standard. The fundamentals have not been changed but the formulation of the requirements has been made consistent. Therefore it is considered that also vehicles that were previously approved utilizing these earlier requirements have an equal status compared to vehicles that are approved according to this standard. This applies to the infrastructure and operating conditions that were considered in the earlier approval. This includes also a use as reference vehicle for extension of acceptance.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Acceptable running characteristics of a railway vehicle (hereafter called vehicle) are essential for a safe and economic operation of a railway system. They are related to:

— the vehicle,

— the operating conditions,

— the characteristics of the infrastructure (track layout design and track quality) and

— the contact conditions of the wheel/rail interface.

The objective is to quantify the vehicle's performance under known representative conditions of operation and infrastructure.

This standard describes methods to assess the vehicle performance in the following areas:

— safety against derailment on twisted track (see 6.1);

— running safety under longitudinal compressive forces in s-shaped curves (see 6.2);

— evaluation of the torsional coefficient (see 6.3);

— determination of displacement characteristics (see 6.4);

— loading of the diverging branch of a switch (see 6.5);

— running safety in curved crossings (see 6.6);

— running safety, track loading and ride characteristics (see Clause 7).

The vehicle performance is assessed in two stages. Usually in the first stage the basic characteristics and low speed behaviour are investigated before first runs on the line under controlled operating conditions. In the second stage the running behaviour is assessed. The assessment of a vehicle according to the elements listed above can be performed either by physical testing, numerical simulation, calculation or comparison with a known solution (dispensation). Details about the requirements relating to the choice of the appropriate assessment method are given in this document.

The operational envelope (speed and cant deficiency) that the vehicle has been assessed for needs to be documented.

The establishment of this document was based on existing rules, practices and procedures. The following principles were applied:

— the railway system requires comprehensive technical rules in order to ensure an acceptable interaction of vehicle and track;

— the performance of new railway vehicles has to be evaluated and assessed before putting them into service;

— it is of particular importance that the existing level of safety and reliability is not compromised even when changes in design or operating conditions are demanded, e.g. by the introduction of higher speeds, higher vertical wheel forces, modification of the suspension, etc.

— it is possible to demonstrate compliance with the requirements of this standard by comparison of relevant parameters or by simulation if changes are made to the design or to the operating conditions;

— as the combination of all the target test conditions described is not always achievable, the compliance against the missing target test conditions can be demonstrated by other means.

Requirements on running safety under longitudinal compressive forces in S-shaped curves of certain vehicles are given in EN 15839, while EN 16235 specifies a method to get dispensation from on-track

testing for ▌Ⓐ1⟩ vehicles equipped with established or standardised running gear ⟨Ⓐ1▐, if certain conditions are fulfilled.

The informative Annexes A, B, C, D, E, F; Q, S, T and U contain requirements that have to be fulfilled when the annex is applied.

1 Scope

This European Standard defines the process for assessment of the running characteristics of railway vehicles for the European network of standard gauge tracks (nominally 1 435 mm).

In addition to the assessment of the running characteristics of vehicles for acceptance processes, this standard also defines quantities and dependencies that are not directly used for acceptance purposes. This information is for example intended for the validation of simulation models. It can also be used to define operating conditions outside the reference conditions to be used for the approval.

The assessment of running characteristics applies to vehicles which:

— are newly developed;

— have had relevant design modifications; or

— have changes in their operating conditions.

The assessment process is based on specified target test conditions (see 3.1) given in this document.

Experience over many years has demonstrated that vehicles complying with this standard can be operated safely on infrastructure with conditions more severe than the target test conditions, if the current general operating rules are applied. As an example it is generally current practice to restrict cant deficiency in curves below a certain radius. It may be necessary to adapt these operating rules, if a deterioration of the infrastructure conditions is observed. These operating rules are defined on a national basis. The procedure to evaluate these operating rules is out of the scope of this standard.

NOTE 1 There are margins included in the specified limit values and the statistical evaluation. They cannot be quantified, but they explain why vehicles can also be operated at full speed and cant deficiency in many cases outside of the target test conditions.

This standard also enables the demonstration of compliance against the target test conditions for the case that their combination is not achievable during tests. It is also possible to carry out the assessment of a vehicle for limited test conditions such as test zones 1 and 2 or reduced speed or reduced cant deficiency. In this case the approval of the vehicle shall be restricted accordingly.

NOTE 2 National regulations sometimes allow the increase or decrease of the values for speed, curve radius and cant deficiency for local operation based on safety considerations taking into account the local characteristics of the infrastructure (track layout, track structure, track geometrical quality and contact conditions). These local characteristics can be different from those included in the assessment for the vehicle acceptance.

NOTE 3 The methods of this standard can also be applied to gather information about the compatibility between the vehicle and infrastructure with conditions more severe than the target test conditions. The results of such investigations can be used to determine safe operating rules for such infrastructure conditions.

Where testing the vehicle demonstrates that the performance of a vehicle complies with the requirements of this standard when operating at maximum speed and maximum cant deficiency under infrastructure conditions that are more severe than the target test conditions, the obtained results are accepted and there is no need to carry out additional tests to fulfil the requirements defined in this standard.

This standard addresses four aspects:

1) Vehicles

The assessment of the running characteristics applies principally to all railway vehicles. The document contains acceptance criteria for all types of vehicles with nominal static vertical wheelset forces up to 225 kN (of the highest loaded wheelset of the vehicle in the assessed load configuration specified in 5.3.2). In addition for freight vehicles with nominal static vertical wheelset forces up to 250 kN the acceptance criteria are defined. The acceptance criteria given in this document apply to vehicles designed to operate on standard gauge tracks.

2) Infrastructure

In the acceptance process the range of curve radii is defined, for which the vehicle is assessed. A vehicle accepted according to the requirements of this standard is able to be operated on all standard gauge tracks complying with EN 13803-1 and EN 13803-2.

EN 14363 also gives guidance about the handling of geometric track quality associated with the assessment.

3) Conditions of the wheel rail interface

This standard contains requirements relating to the necessary range of equivalent conicity to be included in the assessment as target test conditions.

In some national systems, either parts or all, equivalent conicities are significantly higher than the target test conditions of this standard. These cases are outside the scope of this standard. Nevertheless the methodology defined in this standard for the proof of running stability can also be used for higher equivalent conicities.

NOTE 4 In these cases running safety is demonstrated by application of existing national requirements for high equivalent conicities during stability testing. Experience shows, that it is not necessary to include the maximum occurring values of equivalent conicity in such national requirements.

4) Operating conditions

The document requires the specification of the combination of admissible speed and admissible cant deficiency as well as the loading conditions for each type of vehicle.

NOTE 5 Recommended values of cant deficiencies for broad international approval are given in informative Annex H.

This standard is not directly applicable to:

— railways with different track layout, e.g. tramways, metros and underground railways;

— railways with non-standard gauge tracks;

but assessment can be conducted by analogy with this document, e.g. the test procedures described in this standard can be applied also to vehicles operated in networks with other track gauges (e.g. 1 524 mm and 1 668 mm). The related limit values and test conditions could be different. They are specified nationally taking into account track design and operating conditions.

The strength of the vehicle and mounted parts, passengers and train crew vibration exposure, comfort, load security and effects of cross wind are out of the scope of this standard.

This document includes the assessment of track loading quantities, the quantification of track deterioration or track fatigue is out of the scope of this standard.

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 13803-1, *Railway applications — Track — Track alignment design parameters — Track gauges 1435 mm and wider — Part 1: Plain line*

EN 13803-2, *Railway applications — Track alignment design parameters — Track gauges 1 435 mm and wider — Part 2: Switches and crossings and comparable alignment design situations with abrupt changes of curvature*

EN 13848-1, *Railway applications — Track — Track geometry quality — Part 1: Characterisation of track geometry*

EN 13848-2, *Railway applications — Track — Track geometry quality — Part 2: Measuring systems — Track recording vehicles*

EN 13848-5:2008+A1:2010, *Railway applications — Track — Track geometry quality — Part 5: Geometric quality levels — Plain line*

EN 14033-1, *Railway applications — Track — Railbound construction and maintenance machines — Part 1: Technical requirements for running*

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

EN 15273-2, *Railway applications — Gauges — Part 2: Rolling stock gauge*

EN 15302:2008+A1:2010, *Railway applications — Method for determining the equivalent conicity*

EN 15663:2009, *Railway applications — Definition of vehicle reference masses*

EN 15746-1, *Railway applications — Track — Road-rail machines and associated equipment — Part 1: Technical requirements for running and working*

EN 15839, *Railway applications — Testing for the acceptance of running characteristics of railway vehicles — Freight wagons — Testing of running safety under longitudinal compressive forces*

EN 15954-1, *Railway applications — Track — Trailers and associated equipment — Part 1: Technical requirements for running and working*

EN 15955-1, *Railway applications — Track — Demountable machines and associated equipment — Part 1: Technical requirements for running and working*

EN 16235, *Railway application — Testing for the acceptance of running characteristics of railway vehicles — Freight wagons — Conditions for dispensation of freight wagons with defined characteristics from on-track tests according to EN 14363*

3 Terms and definitions

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

3.1
target test conditions
conditions specified in this standard for the performance of on-track tests

3.2
bogie yaw resistance
torque around the vertical axis between bogie and vehicle body required to rotate a bogie while supporting a vehicle body

3.3
unsprung mass
mass of a wheelset including all components that are attached to it and which are not suspended by the primary suspension or the wheelset guidance, e.g. brake discs, gear wheels, bearings, axle boxes plus half of the primary suspension mass, half the mass of suspension links and if applicable the unsuspended part of the traction equipment

Note 1 to entry: Sometimes it will be necessary to regard different wheelsets of a running gear separately.

Note 2 to entry: Sometimes it will be necessary to include or exclude parts which are separately suspended with regard to the problem in question, e.g. magnetic brakes.

3.4
primary suspended mass
mass between primary and secondary suspension of a running gear with two vertical suspension stages, i. e. the bogie frame together with all components attached to it, e.g. braking equipment, antennas, pipes and cables plus half of the primary and secondary suspension mass, half the mass of suspension links and traction rods and if applicable the primary suspended part of the traction equipment

Note 1 to entry: Sometimes it will be necessary to include or exclude parts which are separately suspended with regard to the problem in question, e.g. magnetic brakes.

3.5
secondary suspended mass
mass supported by the secondary suspension of a running gear, i. e. the mass of the relevant part of a vehicle body with all components attached to it, e.g. upper bolster or adapter beam plus half of the secondary suspension mass, half the mass of suspension links and traction rods and if applicable the secondary suspended part of the traction equipment

3.6
bogie mass
mass of the bogie which rotates against the vehicle body around the vertical axis during the entrance into curves

Note 1 to entry: In most cases this mass is similar to the sum of the unsprung masses and the primary suspended mass of a running gear with two or more wheelsets.

3.7
yaw moment of inertia of whole running gear
moment of inertia of the mass of the running gear which rotates against the vehicle body around the vertical axis during the entrance into curves

3.8
displacement characteristics
combination of lateral and roll displacements of a vehicle when subjected to cant excess or deficiency

3.9
running behaviour
behaviour of a vehicle or running gear with regard to the interaction between vehicle and track covering the specific terms running safety, track loading and ride characteristics

3.10
running characteristics
characteristics of a vehicle or running gear with regard to running behaviour, safety against derailment in twisted track and under longitudinal compressive forces in S-shaped curves, torsional coefficient of a vehicle body, displacement characteristics, loading of the diverging branch of a switch and running safety in curved crossings

3.11
equivalent conicity
tan γ_e
〚A1〛 tangent of the cone angle of a wheelset with coned wheels whose lateral movement has the same kinematic wavelength as the given wheelset 〚A1〛

Note 1 to entry: See also EN 15302.

3.12
radial steering index
q_E
〚A1〛 ratio between curve radius R_E negotiable without longitudinal creepage and the actual curve radius R of the track section and it describes the radial steering capability of a free wheelset in a track section 〚A1〛

3.13
operation envelope
〚A1〛 the combinations of speed and cant deficiency for which the vehicle is intended to be operated 〚A1〛

Note 1 to entry: See informative Annex H.

3.14
conventional technology vehicle
vehicles which are operated under normal operating conditions and correspond completely or in those construction parts which are relevant to the running behaviour to the proven state of the art