
Železniške naprave - Preskušanje in simuliranje vozniških 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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**Railway applications - Testing and Simulation for the
acceptance of running characteristics of railway vehicles -
Running Behaviour and stationary tests**

Applications ferroviaires - Essais et simulations en vue
de l'homologation des caractéristiques dynamiques des
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Bahnanwendungen - Versuche und Simulationen für
die Zulassung der fahrtechnischen Eigenschaften von
Eisenbahnfahrzeugen - Fahrverhalten und stationäre
Versuche

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Contents	Page
European foreword.....	8
Introduction	10
1 Scope	12
2 Normative references	14
3 Terms and definitions	15
4 Deviations from requirements.....	17
5 Test requirements	18
5.1 Measuring uncertainty.....	18
5.2 Test extent	18
5.2.1 General.....	18
5.2.2 Fault modes	18
5.3 Test vehicle.....	19
5.3.1 Selection and status of the vehicle	19
5.3.2 Loading conditions	19
5.3.3 Distribution of static wheel forces.....	20
5.4 Assessment of test result.....	20
5.5 Documentation of test	21
6 First stages assessment.....	22
6.1 Safety against derailment on twisted track.....	22
6.1.1 General.....	22
6.1.2 Signal processing.....	23
6.1.3 Rail test conditions.....	23
6.1.4 Vehicle test conditions	24
6.1.5 Test methods	26
6.2 Safety against derailment under longitudinal compressive forces in S-shaped curves.....	41
6.3 Evaluation of the torsional coefficient of a vehicle body	41
6.4 Determination of displacement characteristics	41
6.5 Loading of the diverging branch of a switch.....	41
6.6 Running safety in curved crossings for vehicles with small wheels.....	42
7 Second stage – dynamic performance assessment	42
7.1 General.....	42
7.2 Choice of measuring method.....	43
7.2.1 General.....	43
7.2.2 Base conditions for the use of the simplified measuring method and measurement of axle box forces.....	45
7.2.3 Simplifications for separate stability testing.....	45
7.3 Performing on-track tests	46
7.3.1 General.....	46
7.3.2 Test zones and track sections.....	52
7.3.3 Extent of tests	53
7.3.4 Test operation	54
7.4 Measured quantities and measuring points.....	54
7.5 Assessment quantities and limit values.....	56
7.5.1 General.....	56
7.5.2 Running safety.....	62

7.5.3	Track loading	63
7.5.4	Ride characteristics	63
7.6	Test evaluation	63
7.6.1	Overview	63
7.6.2	Recording the measuring signals.....	64
7.6.3	Statistical evaluation in test zones	65
7.6.4	Evaluation of test results in transition curves	73
7.6.5	Verification of stability	73
7.7	Documentation	73
7.7.1	General	73
7.7.2	Description of the vehicle design and status of the tested vehicle	73
7.7.3	Additional information for future extension of acceptance.....	74
7.7.4	Description of the test routes.....	74
7.7.5	Description of data capture	74
7.7.6	Description of evaluation	74
7.7.7	Test results (including additional information for model validation)	74
7.7.8	Deficiencies in reaching the target test conditions	76
7.7.9	Infrastructure conditions more severe than the target test conditions.....	76
	Annex A (informative) Information on safety against derailment	77
A.1	Factors influencing the safety against derailment of vehicles running on twisted track.....	77
A.1.1	General	77
A.1.2	Wheel unloading influences	77
A.1.3	Guiding force influences.....	77
A.2	Evaluation and limit value for safety against derailment.....	78
A.3	Friction conditions during testing on special track	79
A.4	Special conditions for vehicles with air springs.....	81
A.4.1	General	81
A.4.2	4-point levelling systems	82
A.4.3	3-point levelling system with longitudinal connection	82
A.4.4	2-point levelling systems	82
A.5	Test twist conditions for articulated vehicles.....	83
A.6	Test twist conditions for vehicles with more than two suspension levels.....	90
A.7	Calculation of the shim sizes (test method 1).....	91
A.8	Performing and evaluating a twist test for a two-axle vehicle (test method 2)	92
A.8.1	General	92
A.8.2	Required test rig	92
A.8.3	Performing the twist test	93
A.8.4	Evaluation of twist diagrams	93
A.9	Performing and evaluation of a twist test for a vehicle with two bogies with two axles (test method 2)	95
A.9.1	General	95

EN 14363:2016+A1:2018+A2:2022 (E)

A.9.2	Required test rig.....	95
A.9.3	Performing and evaluating a combined body and bogie twist test (test method 2.1)	95
A.9.4	Performing separate twist tests on bogie centre distance and bogie wheel base (test method 2.2)	99
Annex B (informative)	Computer simulations designed to examine whether the vehicle has an acceptable resistance to flange climbing derailment at low speed	104
B.1	General requirement	104
B.2	Computer output	104
B.3	Track input	104
B.4	Body-bogie yaw torque	105
B.5	Performance requirement.....	105
Annex C (informative)	Tests for determination of the torsional coefficient of a vehicle body...	107
C.1	Force-deflection measurement directly at the vehicle body.....	107
Figure C.1	— Nomenclature of the supporting points.....	107
C.2	Force-deflection measurement at the contact points between wheel and rail after blocking of the suspension(s) between wheelset (bogie frame) and vehicle body	108
Annex D (informative)	Determination of displacement characteristics for application with EN 15273	109
D.1	Introduction	109
D.2	Determination of displacement characteristics	109
D.2.1	General.....	109
D.2.2	Assessment Requirements.....	109
D.2.3	Test conditions.....	109
D.2.4	Method 1: Stationary test	110
D.2.5	Method 2 – On-track test.....	113
Annex E (informative)	Assessment of the behaviour of vehicles with small wheels in curved crossings.....	115
E.1	Purpose.....	115
E.2	Area of application.....	115
E.3	Description of the crossing geometry.....	115
E.4	Test conditions.....	118
E.4.1	General.....	118
E.4.2	Method 1: Lateral forces and angle of attack	119
E.4.3	Method 2: Examination of the impact on the crossing nose	119
E.4.4	Limit values.....	119
E.4.5	Assessment.....	120
E.4.6	Dispensation	120
E.4.7	Simulation.....	120

Annex F (informative) Test specification for assessment of vehicle behaviour in switches and crossings.....	121
F.1 Introduction.....	121
F.2 Definitions.....	121
F.3 Test conditions	121
F.4 Assessment of the test results.....	122
F.5 Documentation	122
Annex G (normative) Coordinate system for measured quantities.....	126
Annex H (informative) Operational parameters.....	127
Annex I (informative) Position of the different wheelsets during test.....	129
Annex J (informative) Additional track loading assessment quantities.....	130
J.1 General	130
J.2 Maximum lateral force.....	130
J.3 Combination of lateral and vertical forces	130
Annex K (informative) Evaluation and background of the rail surface damage quantity.....	132
Annex L (informative) Typical maximum estimated values of ride characteristics	134
Annex M (normative) Track geometric quality – Selection of test tracks	135
M.1 Basis of evaluation	135
M.2 Assessment quantities for track geometric quality	135
M.3 Different measuring systems	136
M.4 Target test conditions.....	137
M.5 Reporting.....	139
Annex N (informative) Background of track quality description.....	140
Annex O (normative) Rail profile measurement.....	141
O.1 General	141
O.2 Manual measurements	141
O.2.1 Measurements for equivalent conicity	141
O.2.2 Measurements for radial steering index.....	141
O.3 Automatic measurements	141
Annex P (normative) Requirements for evaluation of equivalent conicity.....	142
Annex Q (informative) Radial steering index.....	143
Q.1 Introduction.....	143
Q.2 Calculation of radial steering index.....	144
Annex R (normative) Statistical evaluation	147
R.1 Objectives and principles of statistical analysis.....	147
R.1.1 General	147
R.1.2 One-dimensional method	147

EN 14363:2016+A1:2018+A2:2022 (E)

R.1.3	Two-dimensional method or simple regression.....	147
R.1.4	Multiple regression	147
R.2	Determination of the percentiles for each track section.....	148
R.3	Preparation of the random samples.....	149
R.4	One-dimensional analysis for estimated maximum values.....	149
R.5	Two-dimensional analysis for estimated values	149
R.6	Multiple regression analysis for estimated values	150
R.7	Statistical evaluation for the overturning criterion	152
R.8	Regression assumptions.....	153
R.8.1	Regression assumptions and associated problems.....	153
R.8.2	Identification and correction techniques.....	154
	Annex S (informative) Running behaviour of special vehicles.....	156
S.1	General.....	156
S.2	Vehicle design and classification.....	156
S.3	Use of the simplified measuring method.....	157
S.4	Test conditions.....	157
S.5	Specific limit value.....	157
	Annex T (informative) Simulation of on-track tests.....	158
T.1	Introduction	158
T.2	Fields of application.....	158
T.2.1	General.....	158
T.2.2	Extension of the range of test conditions	158
T.2.3	Assessment of vehicles following modification	159
T.2.4	Assessment of new vehicles by comparison with an already approved reference vehicle	159
T.2.5	Investigation of dynamic behaviour in case of fault modes.....	160
T.3	Validation.....	160
T.3.1	General principles.....	160
T.3.2	Vehicle model	161
T.3.3	Validation of the vehicle model.....	161
T.4	Input.....	175
T.4.1	Introduction	175
T.4.2	Vehicle model	175
T.4.3	Vehicle configuration.....	175
T.4.4	Track data	176
T.4.5	Track model parameters.....	177
T.4.6	Wheel/rail contact geometry.....	177

T.4.7	Rail surface condition	177
T.4.8	Direction of travel	178
T.4.9	Speed	178
T.4.10	Position of the vehicle in the trainset.....	178
T.4.11	Frequency content of simulations	178
T.5	Output.....	179
T.6	Documentation	179
T.7	Examples for model validation according to Method 1	180
Annex U (informative)	Extension of acceptance.....	187
U.1	General	187
U.2	Determination of the safety factor	195
U.3	Dispensation.....	195
U.3.1	General	195
U.3.2	Special cases	195
U.4	Use of the simplified method A_1	196
U.5	Requirements depending on the initial approval.....	196
Annex V (normative)	Symbols.....	198
Annex W (informative)	List with the main technical changes compared to EN 14363:2005, EN 15686:2010 and EN 15687:2010.....	202
Annex ZA (informative)	Relationship between this European Standard and the Essential Requirements of EU Directive (EU) 2016/797 aimed to be covered	205
Bibliography	207

EN 14363:2016+A1:2018+A2:2022 (E)**European foreword**

This document (EN 14363:2016+A1:2018+A2:2022) 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 February 2023, and conflicting national standards shall be withdrawn at the latest by February 2023.

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 includes Amendment 2 approved by CEN on 2022-07-18.

A2 This document supersedes EN 14363:2016+A1:2018.

In comparison with the previous edition, the following technical modifications have been made:

- Introducing ERA/OPI/2018-3, clauses 4.1.5, 4.1.6 and 4.1.7 in 7.3.1, Table 2;
- Deleting informative Annex X;
- Update of informative Annex ZA **A2**

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

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A2** **A2**.

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.

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

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.

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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 $\overline{A_1}$ vehicles equipped with established or standardised running gear $\overline{A_1}$, 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.

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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.