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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

English Version

Railway applications - Testing and simulation for the
acceptance of running characteristics of railway vehicles
operated on the heavy rail network - Part 2: Safety against
derailment on twisted track

Applications ferroviaires - Essais en vue de l'évaluation
du comportement dynamique des véhicules
ferroviaires circulant sur un réseau du système
ferroviaire lourd - Partie 2: Aptitude au franchissement
des gauches de voie, sans déraillement

Bahnanwendungen - Prüfungen und Simulationen für
die Bewertung der fahrtechnischen Eigenschaften von
Schienenfahrzeugen, die auf dem Vollbahnnetz
betrieben werden - Teil 2: Sicherheit gegen Entgleisen
in Gleisverwindungen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 256.

If this draft becomes a European Standard, CEN 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.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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Contents

Page

European foreword	4
Introduction	5
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions	6
4 Safety against derailment on twisted tracks.....	7
4.1 General.....	7
4.2 Signal processing	8
4.3 Rail test conditions.....	8
4.4 Vehicle test conditions.....	9
4.4.1 General.....	9
4.4.2 Loading conditions.....	10
4.4.3 Conditions for vehicles with air springs.....	10
4.4.4 Conditions for bogie vehicles with more than two axles per bogie	10
4.4.5 Conditions for articulated vehicles	10
4.4.6 Conditions for vehicles with more than two suspension levels.....	10
4.4.7 Conditions for vehicles with steered or self-steering wheelsets.....	10
4.4.8 Possible simplification for certain carbody/bogie interface	11
4.5 Test methods	12
4.5.1 Test method 1: Test on twisted test track.....	12
4.5.2 Test method 2: Test on twist test rig and flat test track	18
4.5.3 Test method 3: Test on twist test rig and yaw test rig.....	23
5 Evaluation of the torsional coefficient of a vehicle body.....	27
Annex A (informative) Information on safety against derailment.....	28
A.1 Factors influencing the safety against derailment of vehicles running on twisted track.....	28
A.1.1 General.....	28
A.1.2 Wheel unloading influences.....	28
A.1.3 Guiding force influences.....	28
A.2 Evaluation and limit value for safety against derailment	29
A.3 Friction conditions during testing on special track	31
A.4 Special conditions for vehicles with air springs	32
A.4.1 General.....	32
A.4.2 4-point levelling systems	33
A.4.3 3-point levelling system with longitudinal connection	33
A.4.4 2-point levelling systems	33
A.5 Test twist conditions for articulated vehicles	34
A.6 Test twist conditions for vehicles with more than two suspension levels.....	41
A.7 Calculation of the shim sizes (test method 1).....	42
A.8 Performing and evaluating a twist test for a two-axle vehicle (test method 2)	43
A.8.1 General.....	43

A.8.2	Required test rig	43
A.8.3	Performing the twist test	44
A.8.4	Evaluation of twist diagrams	44
A.9	Performing and evaluation of a twist test for a vehicle with two bogies with two axles (test method 2)	46
A.9.1	General	46
A.9.2	Required test rig	46
A.9.3	Performing and evaluating a combined body and bogie twist test (test method 2, variant 1)	47
A.9.4	Performing separate twist tests on bogie centre distance and bogie wheel base (test method 2, variant 2)	50
Annex B (informative)	Tests for determination of the torsional coefficient of a vehicle body	55
B.1	Force-deflection measurement directly at the vehicle body	55
B.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	56
Annex ZA (informative)	Relationship between this European Standard and the Essential Requirements of EU Directive (EU) 2016/797 aimed to be covered	57
Bibliography		59

European foreword

This document (prEN 14363-2:2025) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document together with prEN 14363-1:2025, prEN 14363-3:2025, prEN 14363-4:2025 and prEN 14363 5:2025, will supersede EN 14363:2016+A2:2022.

The EN 14363 Series “*Railway applications — Testing and Simulation for the assessment of running characteristics of rail vehicles operated on the heavy rail network*” consists of the following parts:

- prEN 14363-1:2025, *General*;
- prEN 14363-2:2025, *Safety against derailment on twisted track*;
- prEN 14363-3:2025, *Stationary tests that are not obligatory on European level*;
- prEN 14363-4:2025, *On-track testing*;
- prEN 14363-5:2025, *Simulations/calculations*;
- prCEN/TR 14363-6:2025, *Technical Report providing background information to the EN 14363 series of standards* (under development).

This document has been prepared under a standardization request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

For the relationship with EU Legislation, see informative Annex ZA, which is an integral part of this document.

Introduction

General information for the application of this document is given in prEN 14363-1:2025.

1 Scope

This document applies to all railway vehicles including OTM's and Road-rail machines, which are operated on the heavy rail network with standard track gauge 1 435 mm and nominal static vertical wheelset forces up to 350 kN.

This document may also be applicable (partly or in full) to:

- rail systems with different track layout, e. g. urban rail systems and/or;
- rail systems with other than 1 435 mm nominal track gauge and/or;
- non-public rail networks and vehicles, e. g. mine rail systems.

NOTE For rail systems other than 1 435 mm track gauge or urban rail systems, the related post analysis, limit values and test conditions could be different. They are specified nationally taking into account track design and operating conditions.

This document applies to the assessment of safety against derailment on twisted tracks of railway vehicles which:

- are newly developed;
- have had relevant design modifications; or
- have changes in their operating conditions.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

prEN 14363-1:2025¹, *Railway applications — Testing and Simulation for the assessment of running characteristics of rail vehicles operated on the heavy rail network — Part 1: General*

prEN 14363-4:2025, *Railway applications — Testing and Simulation for the assessment of running characteristics of rail vehicles operated on the heavy rail network — Part 4: On-track testing*

EN 17343:2023, *Railway Applications — General terms and definitions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 17343:2023 and prEN 14363-1:2025 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp/>
- IEC Electropedia: available at <https://www.electropedia.org/>

No terms and definitions are listed in this document.

¹ At draft stage.

4 Safety against derailment on twisted tracks

4.1 General

The test methods described in this clause are intended to ensure that vehicles can run safely on twisted tracks. The existence of twist in railway tracks is fundamental. This is a result of transition layout between levelled track and canted track as well as cross level deviations (maintenance limits). When running through twisted tracks there is an increased risk of derailment because of the risk of initiating flange climbing as a result of reduced vertical wheel force and high lateral forces. The vertical wheel forces are influenced by the following effects:

- twist on bogie wheel base;
- twist on bogie centre distance or axle distance for non-bogie vehicles;
- torsional hysteresis;
- eccentricity of centre of gravity;
- twist of the bogie and vehicle body as a result of tolerances or vehicle design;
- eccentricity of the centre of gravity due to cant excess – this influence is eliminated in the test;
- roll torque of the lateral axle box forces.

NOTE 1 It is assumed that the reduction in the guiding forces in larger curve radii has a stronger influence on the safety against derailment than the higher unloading of the guiding wheel due to the higher allowed cant excess in these radii.

The test methods for proving safety against derailment create an artificial and extreme situation for the vehicles.

This sub clause specifies three test methods to investigate the derailment performance of vehicles while negotiating twisted track. All three test methods are derived from work by ORE (later ERRI) and subsequently reported in documents prepared by the B55 groups of ORE. The objective of the test methods is common but the methods that are described below are independent and shall not be directly compared. In addition, the values and conditions referred to in each method shall only apply to that method; it is not possible to directly compare test conditions and numerical results between the test methods.

The test conditions specified in the three test methods detailed below for the assessment of safety against derailment on twisted track do not represent the worst conditions which could occur. Nevertheless, experience over many years has demonstrated that vehicles that comply with the assessment criteria specified in this sub clause operate safely on European Railways. It is recommended that this assessment by test or replaced by calculation as described in prEN 14363-5:2024 is carried out before executing a possible on-track testing. In case of testing, one of the methods described below shall be used.

Test method 1 represents a vehicle negotiating track with a 150 m radius curve with defined twist in the track. The assessment criterion is the wheel lift Δz .

Test method 2 determines the guiding forces between wheel and rail as a vehicle negotiates a 150 m radius curve without twist. It measures separately the change in vertical wheel force when the vehicle is subjected to twisted track. The assessment criterion is the ratio of guiding force and vertical wheel force on the outer wheel $(Y/Q)_a$. This method includes the possibility of approval by calculation based on previous test results of a reference vehicle.

NOTE 2 ORE B55, Rp.8 [5] gives a lot of models and parameters for freight- and special vehicles that can be used to describe a reference vehicle.

Test method 3 determines the bogie yaw resistance (X -factor) when negotiating the minimum radius curve specified for the vehicle. It measures separately the relative wheel unloading $\Delta Q/Q$ when the vehicle is subjected to twisted track. The assessment criterion is the X -factor together with the relative wheel unloading $\Delta Q/Q$. Where it is not possible to demonstrate the simultaneous acceptable performance of both criteria using Method 3 (phase 1), validated computer simulations according to informative Annex A of prEN 14363-5:2025, may be used.

The three test methods result in safe operation of the vehicles when the track twist including design twist and cross level is maintained in accordance with the rules given in EN 13848 5:2017, 7.6.

NOTE 3 The requirements for assessment of safety against derailment on twisted track of special vehicles operated in degraded working track are given in EN 14033-2:2017.

For the extension of field of application, the assessment by calculation or testing is only necessary if the modification of the parameters might increase the risk of derailment.

NOTE 4 The most important factors influencing the safety against derailment are given in Clause A.1.

A dispensation from tests and calculations of the safety against derailment is allowed for freight wagons, if the parameters and running gear types match with those that have shown results compliant with the limit value in published tests or calculations and the nominal wheel flange angle is 70° .

NOTE 5 Parameters and running gear types that meet the required criteria are included in the tabulated results given in Appendix A, Appendix B and Appendix C of UIC 530-2:2008 [6] available on the UIC-website.

4.2 Signal processing

The assessed signal for wheel lift Δz shall be low-pass filtered with a cut-off frequency between 5 Hz and 1 Hz depending on the speed in order to eliminate the detection of very short duration of wheel climbing occurrences.

If the Y and Q -forces are measured continuously with instrumented wheelsets, the signals shall be filtered as described in prEN 14363-4:2024, Table 7 for on-track testing.

4.3 Rail test conditions

Tests according to test method 1 and test method 2 shall be done under nominally dry conditions in order to consider high friction forces between wheel and rail.

Information used in the determination of the rail conditions shall be gathered by measuring:

- Y_i and Q_i on the inner leading wheel;
- angle of attack α ; and
- average vertical wheel force Q_{F0} of the leading wheelset;

and evaluated as described below.

During tests, the coefficient τ shall be at least 80 % of the value expected for dry rails. Therefore, the condition:

$$(Y/Q)_i \geq 0,8 \cdot \tau_{\text{dry}} + \gamma$$

as a function of the angle of attack shall be respected. In the above formula the contact angle of the tread γ at the contact point on the inner rail shall be inserted.

The coefficient τ_{dry} represents the ratio of the lateral friction force and the vertical force. For pure lateral creepage the coefficient τ_{dry} for dry rail conditions is defined as follows (see Clause A.3):

$$\left(\frac{1}{\tau_{\text{dry}}}\right)^n = \left(\frac{1}{a}\right)^n + \left(\frac{1}{b \cdot \alpha}\right)^n$$

where

$$a = \frac{Q_{F0}^2 - 242,5 Q_{F0} + 57\,150}{100\,000}$$

$$b = \frac{Q_{F0}^2 - 242,5 Q_{F0} + 21\,950}{100}$$

$$n = 0,005 Q_{F0} + 2,2$$

angle of attack α in rad and static vertical wheel force Q_{F0} in kN.

If the actual mean vertical wheel force on the inner rail during the test differs from Q_{F0} it is permitted to use this value in the above formulae.

The maximum values of τ_{dry} are obtained for the maximum values of α .

NOTE These formulae were determined with a wheel diameter of 1 m and static vertical wheel forces between 40 kN and 112,5 kN. For the application in this document, they are deemed to be valid also outside these conditions.

If the angle of attack is replaced with the total creepage (lateral and longitudinal creepage), this formula describes the friction /creepage diagram for dry track.

If during the tests a coefficient higher than 100 % of τ_{dry} occurred, the tests may be repeated.

To determine friction during tests, the measurement of the angle of attack is necessary.

The method to determine the friction during tests is not appropriate if the angle of attack is very small (e. g. below 0,0015 rad). In the case of bogies with a low angle of attack determination of the friction conditions is to be done by measuring on a leading wheelset of a vehicle which generates a higher angle of attack.

4.4 Vehicle test conditions

4.4.1 General

For test method 1 and test method 2 the effects of the running direction and the direction of curvature shall be analysed taking the vehicle design and the distribution of vertical wheelset forces in the vehicle into consideration. The test conditions and the wheelsets to be tested shall be determined for the worst case as a result of this analysis.

EXAMPLE For single vehicles with two wheelsets or bogies, the two outer wheelsets should be analysed in the leading position, unless the vehicle is symmetrical; then testing of one wheelset could be sufficient.

For all test methods all the relevant connections between body and bogie of the vehicle which influence the assessment quantities shall be correctly attached. If it is necessary to remove dampers for a correct shimming in test method 1, the effect on the vertical wheel forces shall be studied taking into account the low test speed. The result of this study shall be respected in the final assessment of the test results.

Single vehicles which are a part of a trainset may be tested separately. It shall be demonstrated that the test condition represents the forces and moments that exist when the vehicle is installed in the train set.

As long as the coupling forces and moments are lower or equal to the forces and moments between vehicles equipped with standard buffers and draw gear at their ends, vehicles may be tested separately.

4.4.2 Loading conditions

Vehicles shall be tested in the empty condition (see prEN 14363-1:2025, 5.3.2).

If the suspension is nonlinear, safety against derailment shall be tested in the worst combination of load and stiffness (e.g. this will occur for a two-rate spring at the smallest loading point above the application point of the second stiffness where, at full vehicle test twist, the relieved second stiffness just remains in contact/operation).

4.4.3 Conditions for vehicles with air springs

Safety against derailment shall be tested with inflated and deflated air springs.

For deflated cases, the most critical situation shall be tested (usually all bogies deflated).

With inflated air spring the vertical wheel force distribution may be changed by the response time of the levelling system. The type of the levelling system has an important influence (e.g. 4-point levelling, 3-point levelling and 2-point levelling), informative Annex A gives some additional information.

The effect of the levelling system's response time shall be investigated. During the test the effects of the levelling system shall be measured by including breaks in the test procedure to enable the system to stabilize.

4.4.4 Conditions for bogie vehicles with more than two axles per bogie

For test method 1 and test method 2 vehicle test twist for a bogie is related to the outer wheel base of the bogie. Twist displacements of intermediate wheelsets shall be interpolated.

4.4.5 Conditions for articulated vehicles

In the case of articulated vehicles where adjacent vehicle-bodies are suspended on a common running gear or articulation, the influence of inter-vehicle constraints shall be analysed in order to determine their significance. The test conditions and the wheelsets to be tested shall be determined as a result of this analysis. Intermediate running gear or bogies shall also be tested. It could be necessary to test more than one vehicle body at the same time.

Clause A.5 gives some additional information and examples.

4.4.6 Conditions for vehicles with more than two suspension levels

The word suspension is used to indicate freedom between adjacent bodies which may or may not include springs or dampers. Clause A.6 shows an example of such an arrangement, many other different types exist.

The relevant vehicle test twists for the individual suspension levels shall be defined by analogy to the rules given for bogie vehicles for each test method. Clause A.6 gives an example for the vehicle illustrated.

4.4.7 Conditions for vehicles with steered or self-steering wheelsets

For vehicles including mechanisms which steer the wheelsets (actively and/or passively), the track conditions (e.g. S-curves) may lead to angles of attack which are larger than those obtained on the test track. This shall be considered in the tests for test method 1 and test method 2. The worst conditions occurring in operation with regard to the angle of attack shall be determined. Normally, in full curves the angles of attack and therefore the guiding forces are low. However, in transitions or reverse curves

the steering mechanism may generate adverse angles of attack. In order to get the highest guiding forces during the test, these additional angles of attack shall be simulated by suitable methods (e. g. by removing the steering mechanism and fixing the wheelsets to this angle of attack).

For vehicles with self-steering wheelsets which show a major influence of wheel/rail contact geometry on the steering effect and the resulting angle of attack, appropriate investigations shall be carried out.

4.4.8 Possible simplification for certain carbody/bogie interface

For vehicles with $P_{r0} > 250$ kN in the case when test method 3 is used and in the case when the interface between carbody and bogie consists only of a so-called centre casting, possibly in combination with constant contact side bearers, the bogie rotational test to derive the X -factor, see 4.5.3.3, may be omitted and be replaced with the following procedure:

By calculations it shall be ensured that the X -factor will not exceed the limit value given in 4.5.3.4. In the calculation a margin of at least 10 % to the limit value shall be demonstrated.

If non-constant contact side bearers are used, these do not need to be included in the calculations, if it can be shown that they would not be in contact if the test is actually performed.

The following shall be considered:

- verified friction coefficient over the range of load in question, used from drawings and component type tests;
- the vertical contact force between side bearers and carbody as well as between centre pan and bogie, if applicable;
- deflection of bogie structure or of carbody structure do not need to be considered if it can be expected that the influence of these only have negligible influence. The rationale for the compliance with this requirement shall be provided in the report;
- a static calculation of the resisting yaw moment is sufficient.

NOTE The reason for this is that this test is performed at very low speed.

Vehicles not fit for using test method 3, 4.5.3 can only be used where all of the following conditions are fulfilled:

- the vehicle in question is a vehicle where sub-systems important to the running dynamics properties can be said to be designed according to state-of-the art principles;
- vehicles with two two-axle bogies per carbody or articulated vehicle with two axle bogies.

In the case of articulated vehicles particular requirements are put on the test site for the wheel unloading test.

The nominal flange angles of the wheels are between 68° and 70°.

In the case a vehicle does not qualify for using test method 3, as an alternative to use test method 1 or test method 2 as in 4.1, calculations based on test results of a reference vehicle, may be used to show compliance with the requirements. In this case calculation of test method 2 shall be used.

4.5 Test methods

4.5.1 Test method 1: Test on twisted test track

4.5.1.1 General

The safety against derailment shall be determined by measuring the wheel lift of the outer wheel of the leading wheelset when running through a curved twisted test track. The $(Y/Q)_a$ values shall be measured, $(Y/Q)_{a,max}$ be calculated and the results shall be reported but $(Y/Q)_{a,max}$ is not an assessment quantity.

4.5.1.2 Test conditions

The vehicle test twist values shall be applied as follows:

— for bogie test twist:

$$g_{test}^+ = 7 \quad \text{if } 2a^+ \leq 4 \text{ m and}$$

$$g_{test}^+ = \frac{20}{2a^+} + 2,0 \quad \text{if } 2a^+ > 4 \text{ m}$$

with $2a^+$ as the bogie wheel base in m and g_{test}^+ in ‰.

— for vehicle body test twist:

$$g_{test}^* = 7 \quad \text{if } 2a \leq 4 \text{ m and}$$

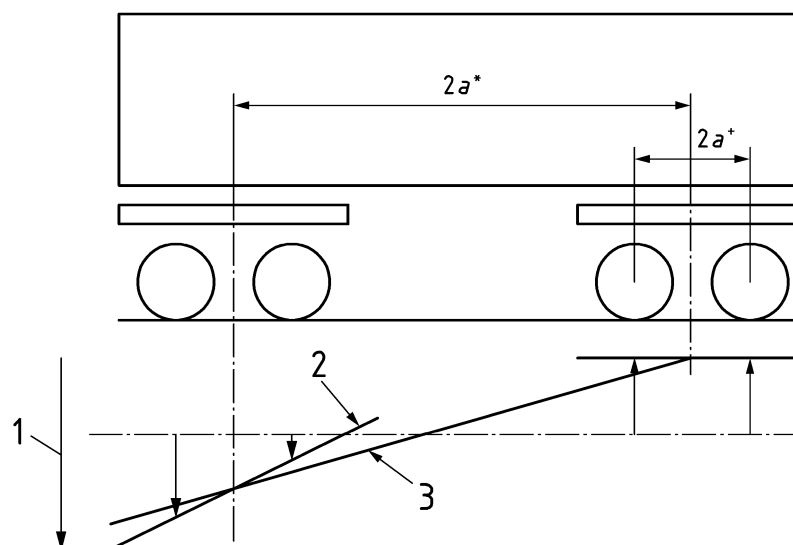
$$g_{test}^* = \frac{20}{2a} + 2,0 \quad \text{if } 4 \text{ m} < 2a \leq 20 \text{ m}$$

$$g_{test}^* = 3 \quad \text{if } 20 \text{ m} < 2a \leq 30 \text{ m}$$

$$g_{test}^* = \frac{90}{2a} \quad \text{if } 2a > 30 \text{ m}$$

with $2a$ as the longitudinal dimension of twist in m (for single vehicles the longitudinal dimension of twist equals $2a^*$, the distance between centre pivots for vehicles with bogies or the distance of the wheelsets for non-bogie vehicles) and g_{test}^* in ‰.

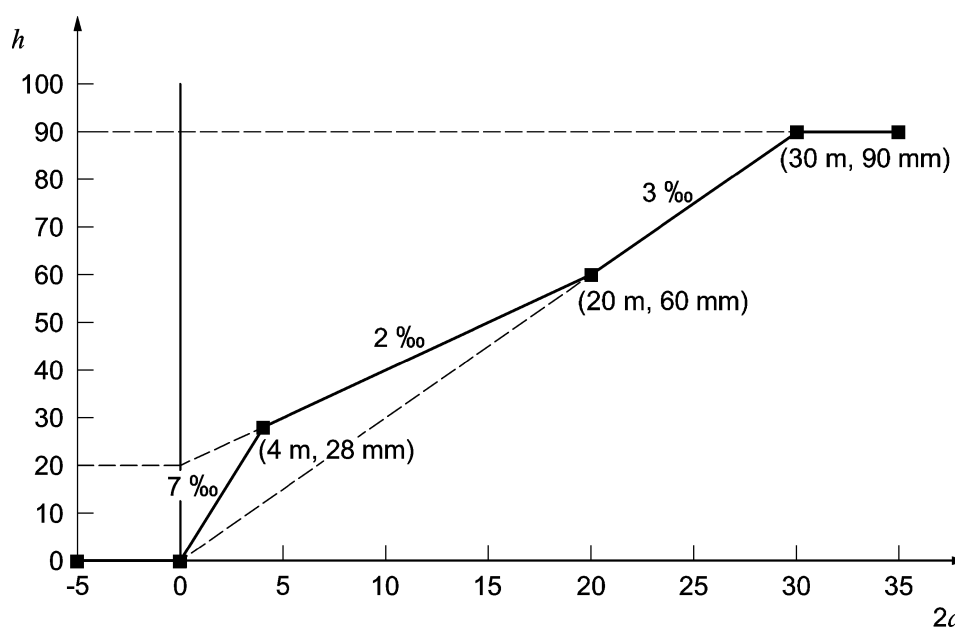
For bogie vehicles the twist due to the bogie wheel base $2a^+$ and the twist due to the bogie centre distance $2a^*$ shall be combined as shown in Figure 1.

**Key**

- 1 vertical displacement
- 2 bogie test twist
- 3 vehicle body test twist

Figure 1 — Combination of bogie and vehicle body test twist

Figure 2 shows the test twist values depending on length dimensions $2a^+$ and $2a^*$. The maximum vertical height difference from twist shall be 90 mm which corresponds to a twist value of 3 ‰ at 30 m. For lengths greater than 30 m the vertical height difference from twist shall be 90 mm.

**Key**

- h twist height
- 2a twist length

Figure 2 — Test twist values and twist heights

For articulated vehicles the influence of bodies and bogies that are not being tested shall also be considered and actions shall be taken to identify these influences. Where appropriate, these influences shall be removed by physical means (for example by shims) or the influence mitigated by other means (for example by calculation to demonstrate the consequence on the performance) or minimized to a justifiable level.

The objective is to apply the correct test twist to the vehicle. The condition of the test track shall be determined; using the measured track condition (twist, length of twist, cant, length of constant cant) any necessary adjustments to the vehicle (for example by the use of shims) to achieve the required test twist conditions shall be determined and reported. The achieved test twists (g^+ , g^*) in the most critical position shall not deviate by more than 10 % from the intended values ($g^{+_{test}}$, $g^{*_{test}}$).

The influence of longitudinal forces in the train set shall be minimized. The vehicle shall not be braked. The speed shall be constant and not exceed 10 km/h.

Tests shall be carried out successfully a minimum of 3 times.

4.5.1.3 Track features

Figure 3 contains an example for installing a test track with characteristics described below.

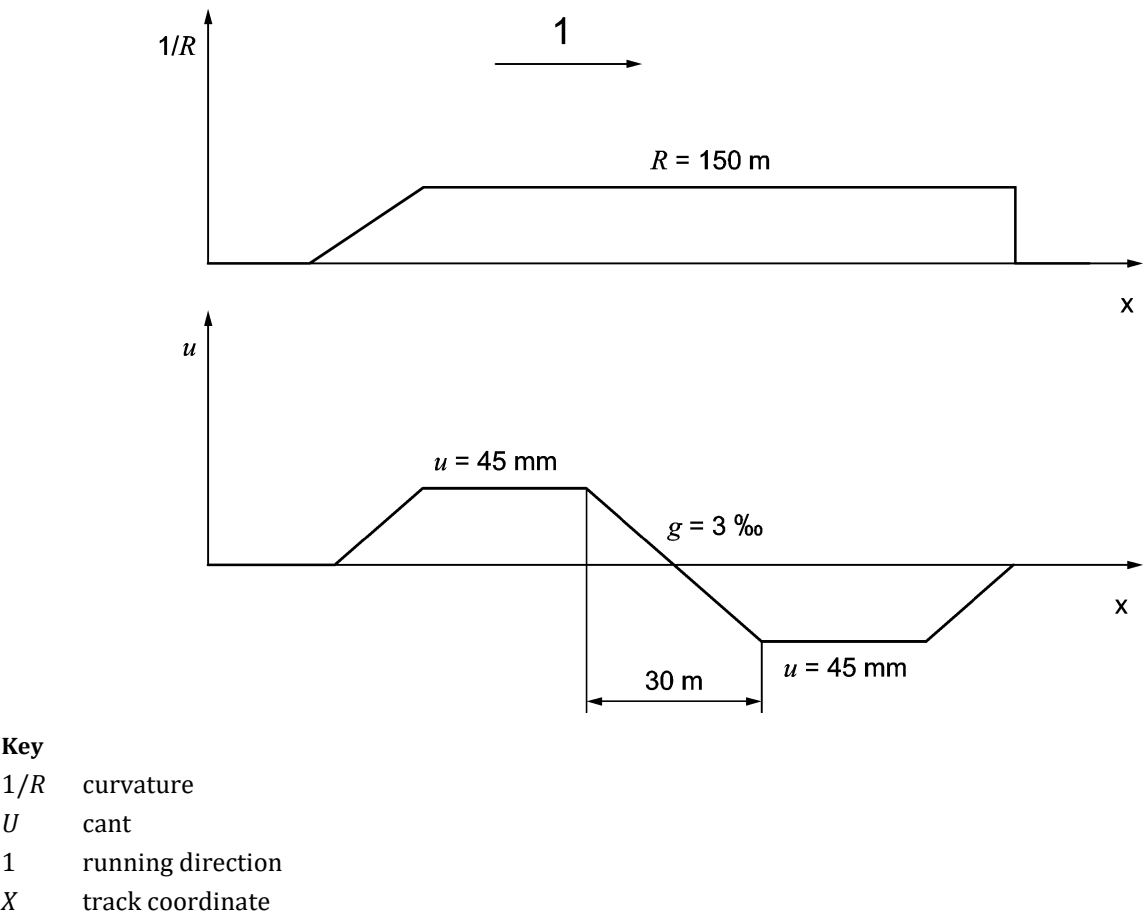


Figure 3 — Example for general layout of test track

Tests shall be done on a test track with the following characteristics:

- nominal curve radius $R = 150\text{ m}$;

- nominal gauge in the range between 1 440 mm and 1 465 mm along the test track, variations of ± 5 mm around the nominal value are accepted;
- test track shall not exceed a tolerance for mean to peak alignment of 10 mm; section of twisted track with constant curvature and a nominal twist of 3 ‰;
- the twist is realized by varying the height of the outer rail from a positive to a negative cant. It is also permitted to use a horizontal track centre line by lowering and lifting both rails; the actual cant shall be measured at each rail fastening position and documented;
- sudden changes of contact geometry, gauge and curvature within the tolerances shall be avoided inside the measuring area. If sudden changes of contact geometry, gauge or curvature are included together with friction values at the upper end of the acceptable range, the test can be too severe and the test may be repeated.

Test conditions as described in 4.3 (dry rail conditions) shall be fulfilled for the inner rail. For the outer rail the test shall be carried out with wheel flange and rail in a dry condition and no residual lubrication shall be present. This shall be documented.

4.5.1.4 Vehicle condition

The test shall be planned to ensure that the direction of running and track curvature are in such a way that the wheel with the lowest vertical wheel force of a tested wheelset is tested in the leading position running on the outer rail of the curve. This may include additional shims in the suspensions. The aim is to make sure that the lower vertical wheel force is located at the most unfavourable position. The achieved vertical wheel force distribution shall be verified.

It is not necessary to test at the maximum permitted vertical wheel force difference.

For vehicles with air suspension the vertical wheel force distribution in the inflated and the deflated condition is different. This may lead to different requirements for shimming. If it can be demonstrated by the measured Y and Q forces, that one suspension condition is less critical with a sufficient margin (10 % difference between the two results of $(Y/Q)_a$), then the shimming for the more critical condition with respect to wheel climbing is acceptable for both conditions.

If the installed twist of the test track is smaller than the test twist specified in 6.1.5.1.2, the missing twist shall be included within the vehicle, for example by including shims in the springs (and anti-roll bar seats) in an appropriate way. Justification of the used method of shimming shall be documented. This shall demonstrate that the effect of the shimming achieves the same effect as the application of the required twist at track level. Clause A.7 contains suggestions for calculating the thickness of the shims depending on their location.

The nominal flange angle of the design wheel profile of the vehicle used for the test shall be $\leq 70^\circ$. If the vehicle is normally equipped with a profile with a nominal flange angle $> 70^\circ$, a special profile with a flange angle of 70° shall be used for testing.

NOTE On new wheelsets or after machining the actual values of flange angles that are achieved can vary by the extent allowed by the tolerances defined in the specification for the wheel profile.

If the vehicle to be investigated was not only transferred to the test site but was already operated for a certain distance, it is required that the flange angle of the wheel profile or the contact angle during a theoretical wheel climbing is $\leq 71^\circ$. If the wheel flange angle is above this value, the test may be regarded as valid in the conditions stated in 4.5.1.6. The wheel profiles used for the test shall be measured at the beginning of these tests and documented.

It is not required to reprofile wheels during the test. Measurement of flange angle before starting the test is sufficient.

4.5.1.5 Measurement

The following values shall be measured:

- lateral forces on the inner and outer wheel of the tested wheelset Y_i , Y_a ;
- vertical wheel forces on the inner and outer wheel of the tested wheelset Q_i , Q_a ;
- angle of attack of a leading wheelset α (see 4.3);
- wheel lift $\Delta z = (z - z_0)$ of the guiding wheel of the tested wheelset.

The reference value z_0 is obtained with the wheelset on a straight track. Forces shall be measured either by:

- appropriate devices on the rail; or
- appropriate devices on the vehicle.

The wheel lift is defined as the vertical displacement between the wheel tread and the rail head. Minor deviations from this definition are allowed, see Figure 4.

NOTE 1 A mathematically exact definition of the wheel lift is not useful, as the limit was determined based on measurements where two displacement sensors measured the vertical distance between a rig mounted on the axle box and the rails in front and behind the wheel. The longitudinal distance from the wheel was the same in front and behind. The zero position was determined on straight track before entrance of the curve. Any application, whether it be for measurements or for simulation can take this practice into account.

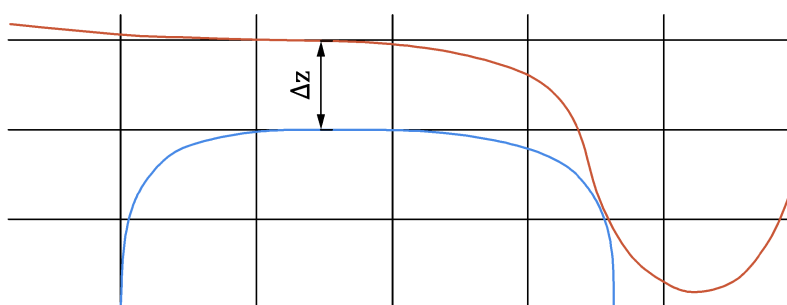


Figure 4 — Definition of wheel lift

In the case of rail measurements, the measuring positions have to fulfil the following conditions as shown in Figure 5:

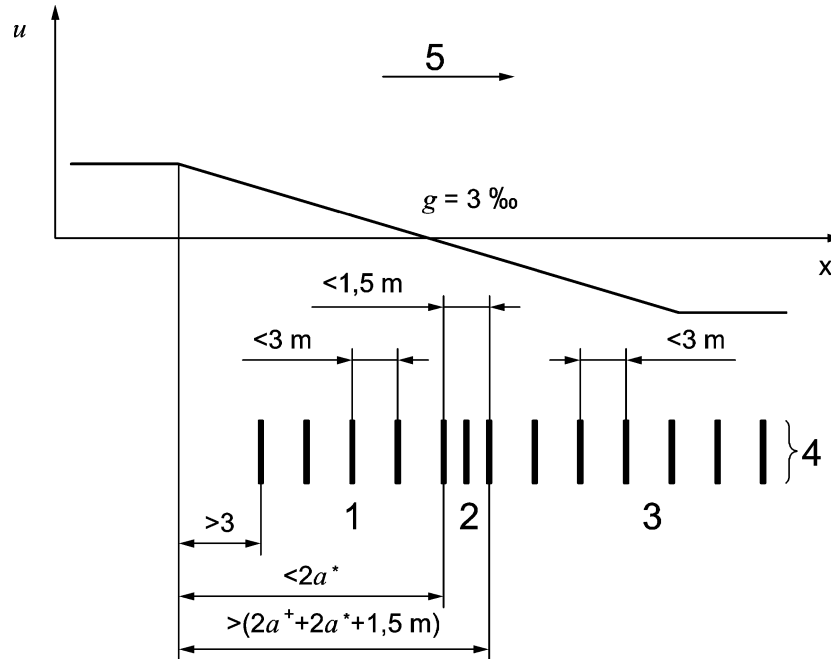
- measuring positions shall be within the twisted part of the track;
- in zone 2 where the track twist first influences the whole vehicle the distance between two measuring sections shall not be greater than 1,5 m;
- in zone 1 and zone 3 of the twisted track the distance between two measuring sections shall not be greater than 3 m.

NOTE 2 For testing articulated trains, it is useful to extend zone 2 towards the end of the twisted section in order to cover also the area where the maximum wheel unloading occurs.

For each measuring section the value of $(Y/Q)_a$ of the leading wheelset shall be recorded. Wheel lift of the outer wheel of the leading wheelset Δz shall be recorded continuously.

To determine the friction conditions $(Y/Q)_i$ and α have to be evaluated as mean values of all measuring sections or of a continuous recorded signal.

If vehicle based measurement is used, the processing of measuring signals shall be done by analogy to the above conditions.



Key

1 zone 1	3 zone 3	5 running direction	x track coordinate
2 zone 2	4 measuring points	u cant	

Figure 5 — Track based measuring positions to be used in test method 1 in the twisted curve

4.5.1.6 Assessment

Assessment is made for the maximum value $\Delta z_{\max}$ of wheel lift of the outer wheel of the tested wheelset. The limit value is $\Delta z_{\max} \leq \Delta z_{\lim} = 5 \text{ mm}$, this shall be achieved on the three separate tests.

This limit value is defined for typical combinations of wheel and rail profiles such as S1002 according to EN 13715:2020 and 49E1, 54E1 or 50E6 according to EN 13674-1:2011+A1:2017. For other profiles, this limit can be adapted, if the contact point reaches the part of the flange with the angle of 70° at wheel lifts only above 5 mm.

The three successful tests are not necessarily consecutive test runs. However, if two consecutive tests fail, despite valid test conditions, the vehicle shall be rejected.

When the flange angle is above the value specified in 4.5.1.4, the test run shall be considered as successful if both following conditions are achieved:

- $\Delta z_{\max} \leq \Delta z_{\lim} = 5 \text{ mm}$;
- $(Y/Q)_{a,\max} \leq (Y/Q)_{a,\lim} = 1,2$.

If wheel lift is higher than the limit, additionally $(Y/Q)_a$ on the outer rail shall be checked. If $(Y/Q)_a$ is below the value 1,12 (value corresponding a friction value of 0,4 and flange angle of 70°) the test shall be repeated.