BRITISH STANDARD

BS EN 15687:2010

Railway applications — Testing for the acceptance of running characteristics of freight vehicles with static axle loads higher than 225 kN and up to 250 kN

ICS 45.060.01

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 15687:2010.

The UK participation in its preparation was entrusted to Technical Committee RAE/1/-/8, Railway Applications - Vehicle/Track Interaction.

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Railway applications - Testing for the acceptance of running characteristics of freight vehicles with static axle loads higher than 225 kN and up to 250 kN

Applications ferroviaires - Essais en vue de l'homologation du comportement dynamique des wagons pour charges statiques d'essieu de plus de 225 kN et jusqu'à 250kN

Bahnanwendungen- Fahrtechnische Prüfung für die fahrtechnische Zulassung von Güterfahrzeugen mit statischer Radsatzlast von 225 kN bis 250 kN

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Foreword

This document (EN 15687:2010) 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of an identical text or by endorsement, at the latest by November 2010, and conflicting national standards shall be withdrawn at the latest by November 2010.

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

This document has been prepared under a mandate given to CEN/CENELEC/ETSI by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2008/57.

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

It is intended that the requirements of this European Standard will be incorporated into EN 14363 when it is revised.

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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This European Standard covers the on-track testing for acceptance of the running characteristics of railway freight vehicles with static axle loads higher than 225 kN and up to 250 kN. It was established by Working Group 10 Vehicle/Track Interaction of CEN Technical Committee 256 Railway Applications as a supplement to EN 14363:2005, which is related to the acceptance of railway vehicles with static axle loads up to 225 kN. It is planned to implement the requirements of this European Standard in a revision of EN 14363:2005.

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

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

2) due to the numerous national and international regulations new railway vehicles have to be tested and homologated before putting them into service. In addition, existing acceptance has to be checked when operating conditions are extended;

3) in view of the increasing significance of international traffic, the standardisation of existing regulations is required. In some cases, additional rules are required as well. An update of existing regulations is also needed due to the considerable progress achieved in the field of railway-specific methods for measuring, evaluation and data processing;

4) it is of particular importance that the existing level of safety and reliability is not compromised even when changes in design and operating practices are demanded, e.g. by the introduction of higher speeds, higher wheel forces.

This European Standard takes account of the present state of the art which is generally applicable for test procedures and the evaluation of 'on-track' tests.

NOTE This European Standard is derived in essential parts from UIC 518-2 which has not yet been fully validated by experience.

The working group is aware that the combination of the test conditions is not always achievable. In some cases, the existing regulations may require exceptions for which justification will be provided to the acceptance body. In this event, the conditions which are not fulfilled will be identified.

The working group expects that existing shortcomings will be recognized in further investigations and during frequent application of the rules.

1 Scope

This European Standard specifies the testing for acceptance of the running characteristics of freight vehicles with static axle loads higher than 225 kN and up to 250 kN.

All requirements of EN 14363 are applicable with some adaptations concerning:

— the conditions of line tests;

— limit values for some assessment quantities.

Only differences for the special cases are listed.

The testing of the running characteristics applies principally to all freight vehicles, which operate without restriction on standard gauge tracks (1 435 mm).

NOTE 1 The testing of the running characteristics of:

— railways with different track layout,

— railways with non-standard gauge tracks

can be conducted by analogy with this European Standard.

The testing of running characteristics is part of the test for the acceptance of running characteristics of vehicles which:

— are newly developed,

— have had relevant design modifications, or

— have changes in their operating regimes.

The testing and acceptance of running characteristics refers to the complete vehicle including the running gear. If a running gear, which has already been tested and accepted, is used under a vehicle body of another design, this is considered a design modification. The procedure as described in EN 14363:2005, 5.2 is used.

NOTE 2 In addition to the testing of running characteristics for the acceptance of vehicles, the regulations can be generally applied in other technical tasks, e.g.:

— the checking for compliance against development contracts;

— the optimization of components, vehicles or running gear;

— the testing of influences, influencing parameters and relationships of dependence;

— the monitoring of track or vehicles in operational use.

The application of the full method and the stated limit values reflects unrestricted international operation.

Testing for acceptance of vehicles is based on some reference conditions of track. If these are not respected on certain lines, appropriate measures will be taken (speed modifications, additional tests etc.).

For national or multinational operations, variations may be authorized from to the defined conditions. Permissible deviations are indicated in this European Standard.

It is allowed to deviate from the rules laid down if evidence can be furnished that safety is at least the equivalent to that ensured by complying with these rules.

NOTE 3 For vehicles other than freight wagons with static axle loads higher than 225 kN and up to 250 kN it is possible to use the limit values stated in this European Standard together with the specified track conditions and operational conditions as a basis for proof of the same safety level.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 14363:2005, *Railway applications — Testing for the acceptance of running characteristics of railway vehicles — Testing of running behaviour and stationary tests*

EN 15528:2008, *Railway applications — Line categories for managing the interface between load limits of vehicles and infrastructure*

3 Terms and definitions

For the purposes of this European Standard, the symbols of quantities and characteristics given in Annex F of EN 14363:2005 and the following apply.

3.1
factor for track loading parameters
lowest ratio between limit value and estimated value of maximum and quasi-static wheel force is expressed as follows:

$$\lambda' = min(Q_{qst,lim}/Q_{qst};\ Q_{lim}/Q_{max})$$

4 Stationary tests

For stationary tests the requirements of EN 14363 shall apply.

5 On-track tests

5.1 General

For the acceptance of a freight vehicle with static wheel force higher than 225 kN and up to 250 kN the following modifications of the procedure defined in EN 14363 shall be respected:

— for extension of acceptance the choice of the on-track test type and the measuring method is dependent on parameter χ of the loaded vehicle. It respects the wheel forcing of the outer rail in curves due to the height of the centre of gravity and the permissible cant deficiency (see Table 1 to Table 3 of EN 14363:2005).

— extension of acceptance requires compliance to factor λ';

— the simplified measuring methods are only applicable for extensions of acceptance with the exception of extension of cant deficiency;

NOTE Operational conditions of freight wagons with static axle loads less than or equal to 225 kN with higher cant deficiency and/or speed also require tests according to EN 14363 with the full test procedure and the normal measuring method.

— the admissible cant deficiency and speed are lower than for the static wheel forces defined in EN 14363;

— for the track loading parameters Q_{qst} and Q new limit values $Q_{qst,limit}$ and $Q_{max,limit}$ are given under the conditions of track design defined in EN 15528.

5.2 Type of on-track test and measuring method

5.2.1 General

For the acceptance of a new freight vehicle with 225 kN < $2Q_0 \leq$ 250 kN and operational parameters according to Annex B the complete on-track test combined with the normal measuring method defined in EN 14363:2005 is required; the simplified method is not applicable.

For the extension of an acceptance due to changes of design parameters or operation conditions a dispensation from on-track tests or a partial on-track test with the normal or a simplified measuring method can be applied depending on the test results of the accepted vehicle and on the range of modifications of relevant parameters.

NOTE 1 The latter case is possible only if the reference vehicle has already been accepted according to the normal measuring method. Otherwise a new acceptance is necessary.

The extension procedure referred to here is applicable only if the intended admissible cant deficiency (cd_{adm}) is less than or equal to the admissible cant deficiency ($cd_{adm,acceptance}$) for which the vehicle is accepted. Otherwise the full procedure and the normal measuring method shall be applied.

NOTE 2 Tests on vehicles intended for static axle loads higher than 225 kN do not cover load cases with static axle loads less than or equal to 225 kN due to the different operational parameters speed V and cant deficiency cd according to Annex B and EN 14363:2005, Annex G.

5.2.2 Choice of on-track test type

In principle the same procedure as defined in EN 14363:2005, 5.2.1 shall be applied.

For the extension of an acceptance state, Annex A gives the conditions for dispensation or application of partial on-track tests. They depend on the test methods of the initial and the new acceptance as well as on the results achieved during the initial acceptance and the modifications of relevant parameters.

NOTE The conditions for the choice of on-track test type for an extension of an acceptance state are slightly different from EN 14363. They are based on the process described in UIC 518:2009. WG 10 intends to modify EN 14363 accordingly during its revision.

5.2.3 Choice of measuring method

For the extension of an acceptance state, Annex A gives the conditions for the use of the simplified measuring methods including the indication of required axle box force measurement. They depend on the test methods of the initial and the new acceptance as well as on the results achieved during the initial acceptance and the modifications of relevant parameters.

NOTE The conditions for the choice of measuring method for an extension of an acceptance state are slightly different from EN14363. They are based on the process described in UIC 518:2009. WG 10 intends to modify EN 14363 accordingly during its revision.

5.3 Assessment, limit and measuring values

All the requirements of EN 14363:2005, 5.3 are applicable except the following track loading limit values (see EN 14363:2005, 5.3.2.3 b) and 5.3.2.3 c):

a) Quasi-static wheel force Q_{qst}:

$Q_{qst,lim}$ =155 kN Scope: Test zones 2, 3 and 4 excluding transition sections

Applicable only for axle loads 225 kN < $2Q_0 \leq$ 250 kN and

V_{adm} and cd_{adm} according to Annex B

b) Maximum wheel force Q_{max}:

$Q_{max,lim}$ = 210 kN

Applicable only for axle loads 225 kN < $2Q_0 \leq$ 250 kN and

V_{adm} and cd_{adm} according to Annex B

NOTE The track loading limit values take account of track work according to class E4 and E5 of EN 15528:2008.

5.4 Performing 'on-track' tests

The test procedure for on-track tests is the same as in EN 14363 taking into account that for freight wagons with axle loads higher than 225 kN and up to 250 kN the speed and cant deficiency are limited to the values given in Annex B (supplement to EN 14363:2005, Annex G).

If during the extension of an acceptance according to 5.2.2 a partial on-track test may be used, the extent of on-track tests can be found in Annex A. It depends on the modifications, the test methods of the initial and the new acceptance as well as on the results achieved during the initial acceptance.

NOTE The required test extent for an extension of an acceptance state is slightly different from EN14363. It is based on the process described in UIC 518:2009 with the deviation that possible restrictions for contact geometry conditions are stated based on the modified parameters. WG 10 intends to modify EN 14363 accordingly during its revision.

5.5 Test evaluation

The test evaluation follows the requirements of EN 14363. For an on-track test according to the normal method the ratio "limit value according to this document / estimated value" of the track loading parameters Q_{qst} and Q shall be calculated for all test zones and test conditions and its lowest value λ' determined.

5.6 Documentation of results

In addition to the documentation of results according to EN 14363 the λ'-value for the track loading shall be reported as well as the new parameter χ (see 1).

Annex A
(normative)

Conditions for extension of an acceptance

Table A.1 and Table A.2 define the conditions for an extension of an acceptance.

Table A.1 — Definition of test method and extent depending on initial acceptance

<table>
<tr><th colspan="9">Extension of acceptance
Definition of test method and test extent</th></tr>
<tr><td>Performance of tests for initial approval</td><td colspan="4">Normal method</td><td colspan="4">One of the simplified methods</td></tr>
<tr><td>General conditions for application of a simplified method</td><td colspan="4">Not to be considered</td><td colspan="3">Fulfilled after modification of parameters</td><td>Not fulfilled after modification of parameters</td></tr>
<tr><td>λ
(and λ' if relevant)</td><td colspan="3">λ ≥ 1,1
(and λ’ ≥ 1,0 if relevant)</td><td>λ < 1,1
(and/or λ’ < 1,0 if relevant)</td><td colspan="2">λ ≥ 1,1</td><td>λ < 1,1</td><td>Not considered</td></tr>
<tr><td>Modified parameters</td><td>All inside the range defined in column 2a</td><td>All inside the range defined in column 2b</td><td>Some outside the range defined in column 2b</td><td>Not considered for the definition of the test method</td><td>All inside the range defined in column 2a</td><td>All inside the range defined in column 2b</td><td>Some outside the range defined in column 2b</td><td colspan="2">Not considered</td></tr>
<tr><td>Test method and extent</td><td>Test dispensation</td><td>Simplified method with extent defined in columns 3a-e depending on the modified parameters</td><td>Normal method with extent defined in columns 3a-e depending on the modified parameters</td><td>Test dispensation</td><td colspan="3">Simplified method with extent defined in columns 3a-e depending on the modified parameters</td><td>Normal method with extent defined in columns 3a-e depending on the modified parameters</td></tr>
</table>

Table A.1 *(continued)*

<table>
<tr><th colspan="8">Extension of acceptance
Definition of test method and test extent</th></tr>
<tr><th>Performance of tests for initial approval</th><th colspan="4">Normal method</th><th colspan="3">One of the simplified methods</th></tr>
<tr><td>H-forces to be measured if required for the modified parameters</td><td></td><td>– in col. 2b</td><td></td><td></td><td>– in col. 2b or - by the general conditions for application of a simplified method</td><td colspan="2">– by the general conditions for application of a simplified method only</td></tr>
<tr><td>Special requirements</td><td></td><td>When using simplified method without H-forces: New limits to be applied for y..+s and y..*s depending on test results of initially accepted vehicle (see EN 14363:2005, §5.3.2.2 d, e)</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Table A.2 — Definition of test methods and extent depending on the modification

Required test conditions for an extension of acceptance							
1	2a	2b	2c	3a	3b	3c	3d
Modified parameter	**Applicable range of parameter change**			**Test extent** defined for changed parameters outside the range of dispensation (column 2a)			
	for test dispensation	**for a reduced test extent according to Column 3a-3d when testing with a simplified measuring method (required H-force measurement is indicated)**	**for a reduced test extent according to Column 3a-3d when testing with the normal measuring method**	**Straight track 4**	**Large-radius curves 3**	**Small and very small-radius curves 1,2**	**Conicity range to be tested [f]**
Operational parameters							
Increase of permissible maximum speed	Dispensation not allowed	0 to +20 km/h (H-forces required above +10 km/h)	0 to +A [a] km/h	Empty Loaded	Empty Loaded	-	2)
Increase of permissible cant deficiency	Full test required						1)
Vehicle parameters							
Distance between bogie centres for $2a^* > 9$ m [b]	-15 % to A [a]	-30 % to A [a]	-100 % to +A [a]	Empty	-	-	1)
Distance between bogie centres for $2a^* < 9$ m [b]	-5 % to A [a]	-10 % to A [a]	-100 % to +A [a]	Empty	-	-	1)
Vehicle wheel base (non bogie vehicle) for $2a^* \geq 8$ m [b]	-15 % to A [a]	-30 % to A [a]	-100 % to +A [a]	Empty	-	-	1)
Vehicle wheel base (non bogie vehicle) for $2a^* < 8$ m [b]	-5 % to A [a]	-10 % to A [a]	-100 % to +A [a]	Empty	-	-	1)

Table A.2 *(continued)*

Required test conditions for an extension of acceptance							
1	2a	2b	2c	3a	3b	3c	3d
Centre of gravity height - empty vehicle	-100 % to +20 %	-100 % to +A [a]	-100 % to +A [a]	Empty	Empty	Empty	4)
χ - loaded vehicle [d] [e]	-100 % to $0{,}8(\lambda'-1)\cdot 100$ %	-100 % to $0{,}8(\lambda'-1)\cdot 100$ %	-100 % to +A [a]	Loaded	Loaded	Loaded	4)
Moment of inertia around z-axis of vehicle body (non bogie vehicle)	-100 % to +10 %	-100 % to +10 %	-100 % to +A [a]	Empty	-	-	3)
Torsional stiffness coefficient $c_t^* \leq 3 \times 10^{10}$ kNm²/rad [b]	-66 % to +200 %	-66 % to +200 %	-100 % to +A [a]	Empty Loaded			2)
Torsional stiffness coefficient $c_t^* > 3 \times 10^{10}$ kNm²/rad [b]	-50 % to A [a]	-50 % to A [a]	-100% to +A [a]	Empty Loaded			4)
Vehicle tare for vehicles with tare mass ≥ 12 t (non-bogie wagons) or ≥ 16 t (bogie wagons) [c]	-15 % to A [a]	-30 % to A [a]	-100 % to +A [a]	Empty	-	-	2)
Maximum axle load, vehicles with $2Q_0 \leq 250$ kN [c]	-100 % to +5 %	-100 % to +10 % (H-Forces required above +5 %)	-100 % to +A [a]	-	Loaded	Loaded	4)
Running gear parameters							
Bogie wheel base (bogie vehicles)	0 % to +10 %	0 % to +20 % (H-Forces required above +10 %)	0 % to +100 %	-	-	Empty Loaded	4)
		-10 % to +10 %	-100 % to 0 %	Empty	Empty	-	2)
Nominal wheel diameter	-10 % to +15 %	-10 % to +15 %	-100 % to +A [a]	Empty Loaded			2)

Table A.2 *(continued)*

Required test conditions for an extension of acceptance							
1	2a	2b	2c	3a	3b	3c	3d
Stiffness of primary vertical suspension (vehicles with two suspension levels)	0 to +25 %	0 to +25 %	-100 % to +A [a]				4)
Stiffness of secondary vertical suspension (total stiffness at vehicles with one suspension level)	-10 % to +10 %	-10 % to +40 %	-100 % to +A [a]		Empty Loaded		4)
Transition loads	-5 % to +0 %	-5 % to +0 %	-100 % to +A [a]		Empty Loaded		4)
Axle guiding stiffness	-10 % to +10 %	-10 % to +10 %	-100 % to +A [a]		Empty Loaded		2) if <-10 %
Axle guiding damping, clearances etc.	no dispensation	no simplified method	-100 % to +A [a]		Empty Loaded		4)
Rotational torque of bogie	-20 % to +20 %	-20 % to +20 %	-100 % to +A [a]		Empty Loaded		2) if <-20 %, else 4)
Moment of inertia of whole bogie (around z-axis)	-100 % to +10 %	-100 % to +20 %	-100 % to +A [a]	Empty	-	-	2) if >+10 %
Secondary lateral suspension stiffness	no dispensation	no simplified method	-100 % to +A [a]		Empty Loaded		4)
Secondary lateral suspension: Damping, clearances, etc.	no dispensation	no simplified method	-100 % to +A [a]		Empty Loaded		4)

Table A.2 *(continued)*

a	No limitation from this document, there may be restrictions from other regulations
b	Initial value
c	Final value
d	$\chi = Q_0 \left[1 + 2{,}3\, h_g \frac{cd_{\mathrm{adm}}}{(2b_{\mathrm{A}})^2} \right]$ where Q_0 is the static wheel load in kN h_g is the height of centre of gravity relative to top of rail in mm cd_{adm} is the admissible cant deficiency $2b_{\mathrm{A}}$ is the lateral distance between the contact points of wheels (approximately 1 500 mm for standard gauge)
e	for evaluation of χ: 130 mm for axle loads ≤ 225 kN and 100 mm for axle loads > 225 kN and up to 250 kN
f	No specific requirement on equivalent conicity is specified for testing in medium, small and very small radius curves. On tangent track and large radius curves the following applies:
1)	modifications have a possible influence on running gear stability and low frequency body motions: Testing shall include track sections with a contact geometry in a range as defined in EN 14363:2005, 5.4;
2)	modifications have a possible influence only on running gear stability: Testing should be restricted to track sections with known high conicity typical of the intended operational route;
3)	modifications have a possible influence only on low frequency body motions: Testing should be restricted to track sections with known low conicity typical of the intended operational route;
4)	modifications have no influence on running gear stability and low frequency body motions: No specific requirements for contact geometry in straight track apply.

Annex B
(normative)

Operational parameters

Table B.1 contains a supplement to EN 14363:2005, Annex G.

Table B.1 — Supplement to EN 14363:2005, Annex G

Type of train	Vehicles	Infrastructure	Maximum permissible speed of the vehicle v_{adm} in km/h	Permissible cant deficiency cd_{adm} in mm
Freight train	Freight wagons with axle loads higher than 225 kN and up to 250 kN	Conventional infrastructure, class E	≤ 100	100

Annex C
(normative)

Symbols

Relevant symbols for this standard are contained in EN 14363:2005, Annex F. Table C.1 contains the symbols of parameters not included in EN 14363.

Table C.1 — Symbols

Symbol	Significance	Symbol	Significance
Reference system on vehicle			
Other quantities			
χ	— Q-Parameter	$cd_{\text{adm, acceptance}}$	Admissible cant deficiency of an accepted reference vehicle
h_g	— height of centre of gravity relative to top of rails		
Quantities of statistical evaluation			
λ'	— factor for track loading parameters Q_{qst} and Q		

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2008/57/EC

This European Standard has been prepared under a mandate given to CEN/CENELEC/ETSI by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the Directive 2008/57/EC[1)].

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1, confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard, the CR TSI RST Freight Wagon dated July 2006, published in the Official Journal on 8 December 2006 and its intermediate revision published in the Official Journal on 14 February 2009 and Directive 2008/57/EC

Clause/ sub-clauses of this European Standard	Chapter/§of the TSI	Essential Requirements of Directive 2008/57/EC	Comments
The whole standard is applicable	4. Characterisation of the subsystem 4.2.3.4 Functional and technical specifications of the subsystem, Vehicle track interaction and gauging, Vehicle dynamic behaviour Annex 1 Points 1 and 5 of the Intermediate revision	Annex III, Essential requirements 1 General requirements 1.1 Safety Clauses 1.1.1, 1.1.2 1.5 Technical compatibility 2 Requirements specific to each subsystem 2.4 Rolling stock 2.4.3 Technical compatibility §3	This standard is not a self standing standard and shall be used with EN 14363:2005 pending the revision of EN 14363 which should integrate the requirements of this EN 15687.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

[1] This Directive 2008/57/EC adopted on 17th June 2008 is a recast of the previous Directives 96/48/EC 'Interoperability of the trans-European high-speed rail system' and 2001/16/EC 'Interoperability of the trans-European conventional rail system' and revisions thereof by 2004/50/EC 'Corrigendum to Directive 2004/50/EC of the European Parliament and of the Council of 29 April 2004 amending Council Directive 96/48/EC on the interoperability of the trans-European high-speed rail system and Directive 2001/16/EC of the European Parliament and of the Council on the interoperability of the trans-European conventional rail system'

Bibliography

[1] UIC 518-2:2004, *Supplement to UIC leaflet 518: Application to wagons with axleloads more than 22,5 t and up to 25 t*[2)]

[2] UIC 700, *Classification of lines — Resulting load limits for wagons*[2)]

[3] UIC 518:2009, *Testing and approval of railway vehicles from the point of view of their dynamic behaviour — Safety — Track fatigue — Ride quality*

2) Can be purchased from: Railway Technical Publications (ETF), 16 rue Jean Rey, F-75015 Paris.

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