



BSI Standards Publication

**Railway applications — 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**

National foreword

This British Standard is the UK implementation of EN 16235:2023. It supersedes BS EN 16235:2013, which is withdrawn.

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

A list of organizations represented on this committee can be obtained on request to its committee manager.

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English Version

**Railway applications - 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**

Applications ferroviaires - Essais en vue de
l'homologation du comportement dynamique des
véhicules ferroviaires - Wagons - Conditions pour la
dispense des wagons avec caractéristiques définies
concernant les essais en ligne selon l'EN 14363

Bahnanwendungen - Prüfung für die fahrtechnische
Zulassung von Eisenbahnfahrzeugen - Güterwagen -
Bedingungen für Güterwagen mit definierten
Eigenschaften zur Befreiung von
Streckenfahrversuchen nach EN 14363

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COMITÉ EUROPÉEN DE NORMALISATION
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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Contents	Page
European foreword	4
Introduction	5
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions	6
4 Deviations from requirements	9
5 Acceptance process to achieve a standardized running gear status.....	9
5.1 General.....	9
5.2 Test requirements	10
5.2.1 Extent of tests	10
5.2.2 Certification	10
5.3 Range of running gear parameters for dispensation from on-track tests	11
5.4 Description of the interface between running gear and vehicle body	13
5.5 Range of vehicle body parameters for dispensation from on-track tests	13
6 Established running gear	15
6.1 General.....	15
6.2 Wagons with single axle running gear	15
6.2.1 General.....	15
6.2.2 Double link suspension	15
6.2.3 Long link suspension “Niesky 2”	19
6.2.4 Suspension “S 2000”	21
6.2.5 Permanently coupled units consisting of 2-axle elements	24
6.3 Wagons equipped with 2-axle bogies	24
6.3.1 General.....	24
6.3.2 Running gear of the family Y25.....	24
6.3.3 2-axle steering axle bogie family.....	30
6.3.4 Permanently coupled unit consisting of 2-axle bogie wagons	34
6.3.5 Articulated wagons equipped with three 2-axle bogies Y25.....	34
6.4 Wagons equipped with 3-axle steering axle bogies	34
6.4.1 General.....	34
6.4.2 3-axle steering axle bogie	34
Annex A (informative) Symbols	39
Annex B (normative) Approval process for freight wagons related to running behaviour.....	41
Annex C (normative) Definition of frequency range for suspensions — Definition of spring characteristic.....	43
Annex D (normative) Established component double link assembly for 2-axle wagons	45
Annex E (informative) Standardized leaf springs for double link suspension and “Niesky 2” suspension.....	51
Annex F (informative) Standardized axle guards for double link suspension	53
Annex G (normative) Established components long link assembly “Niesky 2”	54
Annex H (informative) Standardized components for Y25 family of bogies	59

H.1	Springs.....	59
H.2	Side bearer spring for bogies Y21, Y25 and Y33	60
Annex I	(normative) Assembly links for steering axle bogies.....	62
I.1	General	62
I.2	Assembly rectangle link.....	62
I.3	Assembly trapezoidal link.....	65
I.4	Assembly long link	68
Annex J	(normative) Inner couplings of a permanent coupled unit.....	71
J.1	Inner coupling close coupling	71
J.2	Inner coupling bar.....	72
Annex K	(informative) Standardized leaf springs for 2 axle and 3-axle steering axle bogies	74
Annex L	(normative) Articulation for articulated wagons equipped with bogies of Y25 family	76
Bibliography		81

European foreword

This document (EN 16235:2023) 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 May 2024, and conflicting national standards shall be withdrawn at the latest by May 2024.

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 supersedes EN 16235:2013.

In comparison with the previous edition EN 16235:2013, the following technical modifications have been made:

- Scope adapted to the terminology given in EN 17343:2020 and extended to non-powered special vehicles with operating conditions of freight trains;
- normative references updated;
- references to withdrawn EN 15687:2010 replaced by references to EN 14363:2016+A2:2022 in the whole document;
- in Table 12 and Table 15 the parameter “mass of the wagon” was replaced by a requirement for “axle load” in tare condition;
- modification of the test procedure for a new standardized running gear: requirements for the length of the tested wagons were deleted and replaced by an application range for the wagons based on the lengths of the tested wagons (Table 1 deleted);
- clarification that the use of simulations according to EN 14363:2016+A2:2022 can replace physical testing;
- clarification that the minimum and maximum axle load specified for the application range are the limits for the load conditions for the operation and not necessarily for the design of the wagon;
- Annex ZA deleted.

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 organisations 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, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

Introduction

EN 14363:2016+A2:2022 defines the requirements for railway vehicles with respect to running behaviour. The approval process in accordance with EN 14363:2016+A2:2022 including the dispensation defined in this document, is illustrated in normative Annex B, Figure B.1 (flow chart).

It is recognized that experience has demonstrated that running gear fitted to wagons that operate safely can also be fitted to other wagons which are within certain design limits. These other wagons will also operate safely without the need to undergo on-track testing. This experience is based on the characteristics of track design, track maintenance and vehicle maintenance in the European network since 1998. This document defines the process to determine the conditions under which such dispensation from testing can be given for a vehicle defined by the running gear and its relevant parameters together with the associated parameter limits of wagon bodies.

Vehicles for the transport of freight on the railway have historically been subject to standardization. Very early common items like wheels, buffers, draw gear, etc. were developed as standardized components to fulfil safety requirements, for achieving ease of repair and maintenance for international traffic and low cost. Freight wagons have a wide range of applications and consequently the parameters will vary. In the UIC work for the standardization and interchange of freight wagons certain processes for acceptance with respect to running characteristics evolved and these were formalized in UIC 432:2008 and UIC 572:2009 among others. The principles of this document are similar to the intention of these two leaflets.

NOTE Vehicles accepted through the UIC process were also accepted for RIV (Regolamento Internazionale Veicoli) service, i.e. international interchange between the RIV railways. This was replaced by the General Contract of Use for Wagons (GCU) agreement on 1st July 2006. Following the Directive 2008/57/EC the Conventional Rail Technical Specification for Interoperability for Freight Wagons (CR TSI WAG) was elaborated, which contains interoperability requirements for freight wagons.

The following principles apply to the use of this document:

- 1) the railway system requires comprehensive technical rules in order to ensure an acceptable interaction of vehicle and track;
- 2) new railway vehicles are approved before being placed into service in accordance with numerous national and international regulations. In addition, existing approval is checked when operating conditions are extended. The approval is based on test results, calculations and/or comparisons with existing vehicles in order to achieve a safety level according to the recognized standards and regulations;
- 3) 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.

This document does not prevent the use of the principles laid down applying to other types of rolling stock.

1 Scope

This document defines the process to determine the conditions under which dispensation from on-track testing according to EN 14363:2016+A2:2022 can be given to freight wagons. In its application this document specifies the means by which dispensation from on-track tests is possible.

This document is subordinate to EN 14363:2016+A2:2022.

The dispensation conditions described in this document apply to all freight wagons and non-powered special vehicles with operating conditions of freight trains, which are operated on the heavy rail network with standard gauge (1 435 mm).

NOTE 1 The various rail-inclinations used in Europe (1:20, 1:40 and 1:30) are covered by the conditions for dispensation.

This document is not limited to any type of freight vehicle; however, freight wagons with defined parameters and equipped with certain running gear types, which have been previously accepted, are considered to have a continuing dispensation from on-track testing. The parameters of these freight wagons and running gear are detailed within this document.

NOTE 2 The test procedures described in this document (and in EN 14363:2016+A2:2022) can be applied also to applications with other track gauges e.g. 1 524 mm or 1 668 mm. The limit values could be different. If established running gear are existing in such restricted networks the related ranges of running gear and vehicle parameters for dispensation from on-track tests might be specified together with the operational parameters (speed, cant deficiency, maximum axle load) based on previous tests and operating experiences. These limit values and parameters will be specified on national level.

This document only contains requirements for characteristics related to requirements for on-track tests specified in EN 14363:2016+A2:2022.

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.

EN 13715:2020, *Railway applications — Wheelsets and bogies — Wheels — Tread profile*

EN 14363:2016+A2:2022, *Railway applications — Testing and Simulation for the acceptance of running characteristics of railway vehicles — Running Behaviour and stationary tests*

EN 15313:2016, *Railway applications — In-service wheelset operation requirements — In-service and off-vehicle wheelset maintenance*

EN 15551:2022, *Railway applications — Railway rolling stock — Buffers*

EN 15566:2022, *Railway applications — Railway rolling stock — Draw gear and screw coupling*

3 Terms and definitions

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

NOTE Other terms and definition can be found in EN 14363:2016+A2:2022 and EN 13749:2021.

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

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

Symbols are explained in Annex A.

3.1

'declaration of conformity' with this document

declaration that contains all necessary information for the description of a proven vehicle configuration

3.2

standardised running gear

running gear, bogie or single axle suspension system, which ensures compliance with the requirements related to on-track tests as specified in EN 14363:2016+A2:2022 for a vehicle that has vehicle body parameters in a defined range

Note 1 to entry: Test results achieved under the conditions of previous standards in this field (for example under the conditions of previous versions of EN 14363:2016+A2:2022 or UIC 518:2009) remain valid and can be used as basis for the certification of a running gear according to 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.

3.3

established running gear

running gear previously approved by UIC for which compliance with Clause 6 of this document is in place of the 'declaration of conformity' with this document

3.4

homologation file

file that contains the relevant parameters and their permitted modification range that represents the values of the standardised running gear when assessed according to the requirements of Clause 5 of this document

3.5

bogies of Y25 family

bogies that are defined by:

- a torsional elastic frame, consisting of two side beams with or without head beam;
- spring suspension with two sets of helical suspension springs (a set may also consist of one spring) per axle box;
- a lateral and vertical dry friction damping depending on part of the vertical load supported by the axle box;
- a wheelset guiding with a maximum allowed nominal lateral displacement of ± 10 mm

Note 1 to entry: These bogies are called for example Y21, Y23, Y25, Y27, Y31, Y33 or Y37.

3.6

2-axle steering axle bogie family

steering axle bogie family that is defined by:

- a stiff frame, consisting of two side beams with a head beam;

- a leaf spring mounted in links guiding the axle;
- a nominal longitudinal clearance of the axle guiding of ± 6 mm;
- a nominal lateral clearance of the axle guiding of ± 23 mm

Note 1 to entry: These bogies are called for example DB 65, LHB 82, WU 83, Talbot U.

3.7

3-axle steering axle bogie family

steering axle bogie family that is defined by:

- a stiff frame, consisting of two side beams with a head beam;
- a leaf spring mounted in links guiding the axle;
- a nominal longitudinal clearance of the axle guiding of ± 10 mm;
- a nominal lateral clearance of the axle guiding of ± 25 mm

Note 1 to entry: These bogies are called for example DB 711 to DB 715.

3.8

mass distribution coefficient

Φ

description of the distribution of mass of the vehicle around the vertical axis given by:

$$\Phi = \frac{\sqrt{\frac{I_{zz}^*}{m^*}}}{2a^*} = \frac{i_{zz}^*}{2a^*}$$

where

I_{zz}^*	is the moment of inertia of the vehicle body relative to the vertical axis through the centre of gravity of the vehicle body;
i_{zz}^*	is the radius of inertia of the vehicle body relative to the vertical axis through the centre of gravity of the vehicle body;
m^*	is the mass of the vehicle body;
$2a^*$	is the distance between running gear centres

3.9

coefficient of height of centre of gravity

χ

coefficient which is used to define the maximum height of centre of gravity depending on margin of wheel force on outer rail in curves during on-track testing:

$$\chi = Q_0 \left[1 + 2,3 h_{cg} \frac{I_{adm}}{(2b_A)^2} \right]$$

where

Q_0	is the static wheel load;
h_{cg}	is the height of the centre of gravity of the vehicle relative to the centre of the wheelset;
l_{adm}	is the admissible cant deficiency;
$2b_A$	is the lateral distance between the contact points of the wheels (approximately 1 500 mm for standard gauge)

3.10

factor for track loading parameters

lowest ratio between limit values and estimated values for maximum and quasi-static wheel load:

$$\lambda' = \min \left(\frac{x_{\lim}}{X(PA)_{\max}}, \frac{y_{\lim}}{Y(PA)_{\max}}, \dots \right)$$

where

$x_{\lim}, y_{\lim}$	are the limit values of the assessment quantities of EN 14363:2016+A2:2022;
$X(PA)_{\max}, Y(PA)_{\max}$	are the estimated values of assessment quantities evaluated from on-track tests performed for the assessment quantities Q_{qst} and $Q_{\max}$ for normal measuring method (only applicable for vehicles with static axle loads higher than 225 kN up to 250 kN)

4 Deviations from requirements

If deviating from some points of the requirements of this document for a particular assessment, these deviations shall be reported and explained. Then the influence on the assessment of the vehicle in terms of the acceptance criteria shall be evaluated and recorded. The outcome of this study shall be considered as an integral part of the requirements of this document when applied to the assessment process of the vehicle.

5 Acceptance process to achieve a standardized running gear status

5.1 General

Standardized running gear according to this document shall be certified. For this purpose, on-track tests according to EN 14363:2016+A2:2022 shall be carried out with two different vehicles. If both vehicles pass the tests described in 5.2, the running gear shall be certified as standardized running gear in a 'declaration of conformity' with this document that contains:

- a description of the standardized running gear; the relevant parameters and their proven range as specified in 5.3 and 5.4;
- the range of applicable parameters of the vehicle body as specified in 5.5;
- the applicable operating conditions.

Vehicles with parameters within the range defined in the 'declaration of conformity' and equipped with a standardized running gear have dispensation from on-track testing according to EN 14363:2016+A2:2022.

The established running gear defined in Clause 6 of this document shall be regarded as fulfilling the requirements of this chapter and the parameters specified in Clause 6 shall be regarded as equivalent to the 'declaration of conformity'.

This procedure applies only to the on-track tests as required in the relevant clauses of EN 14363:2016+A2:2022. It does not give approval for safety against derailment on twisted track and under longitudinal compressive forces in S-shaped curves.

5.2 Test requirements

5.2.1 Extent of tests

On-track tests shall be carried out according to the complete procedure specified in EN 14363:2016+A2:2022.

The tests shall be performed for the same intended operating conditions (V_{adm} and l_{adm}) with two wagons with different body parameters:

- one wagon of short running gear distance;
- one wagon of long running gear distance.

To achieve a wide range of accepted running gear distances for two axle wagons, it is recommended to test one wagon with $2a^* \leq 7$ m and one wagon with $2a^* \geq 9$ m. For bogie wagons it is recommended to test one wagon with $2a^* \leq 7$ m and one wagon with $2a^* \geq 13$ m.

The torsional coefficient of vehicle bodies shall be between $0,5 \cdot 10^{10}$ kNmm²/rad and $8 \cdot 10^{10}$ kNmm²/rad for each tested wagon.

For the purposes of assessment of running behaviour in loaded condition, a typical loading condition shall be tested.

NOTE 1 It is not necessary to test the worst position of centre of gravity (as it is in most cases impossible to have a density of the load, filling the whole loading gauge, that would lead to the maximum axle load).

In addition, 2 axle wagons for speeds ≥ 100 km/h shall be tested in loaded condition also in sections of test zone 2 with clearances given by a gauge $\geq 1\,450$ mm in combination with wheelsets having distances between active faces at the minimum operation limit.

If the design parameters and the operation parameters require the application of the normal measuring method, it is nevertheless acceptable to perform such tests with one of the vehicles based on measurements of lateral acceleration. In that case, it shall be demonstrated that a relationship exists between accelerations and the sum of the guiding forces on the vehicle tested according to the normal measuring method and a related limit value shall be established.

NOTE 2 This requirement is an extension of the application of the simplified measuring method, using information gathered with vehicle tested according to the normal measuring method.

Physical testing according to EN 14363:2016+A2:2022 can be replaced by simulation if EN 14363:2016+A2:2022 allows for that.

5.2.2 Certification

The compliance of new types of bogies or running gear with the requirements of this document shall be documented in the homologation file (declaration of conformity with this document). This declaration shall include:

- an unequivocal and unique name for the running gear;

- range of parameters of the running gear (see 5.3);
- detailed technical description of the interface between vehicle body and running gear (see 5.4);
- range of parameters of car bodies to be used together with the running gear (see 5.5);
- wear limits which are essential to sustain an acceptable running behaviour (maintenance rules are outside the scope of this document).

Examples for such information can be found in Annex C to Annex L, where these are given for already accepted running gear.

5.3 Range of running gear parameters for dispensation from on-track tests

The functional details of the running gear relevant to the running behaviour during on-track tests according to EN 14363:2016+A2:2022 shall be specified in the acceptance process. Table 1 and Table 2 give an indication of which parameter shall be available for acceptance purposes. In addition, the following shall be specified:

- admissible speed V_{adm} ;
- admissible cant deficiency l_{adm} .

Following successful testing according to 5.2 the acceptable parameter variation range for a dispensation from on-track tests for single-axle running gear and bogies is given by the range between the nominal tested parameters of the running gear and the extended range where specified in Table 1 and Table 2 for single-axle running gear and bogies. All parameters given in these tables are nominal values. The upper limit of the acceptable range depends on the maximum tested value of the respective parameter, the lower limit on the minimum tested value.

Successful testing means that on-track tests according to EN 14363:2016+A2:2022 showed compliance with the acceptance criteria given in these standards.

To extend the applicable parameter range of a standardized running gear, test results of a third tested vehicle outside the previously tested range shall be used.

Table 1 — Accepted parameter ranges for a single axle running gear which was tested successfully according to 5.2

Nominal parameter		Minimum	Maximum
Vertical eigenfrequency (see Annex C)	ν_z	$0,9 \cdot \nu_{z,\text{tested}}$ in full range between tare and loaded condition	$1,12 \cdot \nu_{z,\text{tested}}$ in full range between tare and loaded condition
Vertical damping		nominal characteristics of tested running gear	
Lateral and longitudinal suspension characteristics		nominal characteristics of tested running gear	
Distance between centres of axle bearings (suspension base)	$2b_z$	$2b_{z,\text{tested}} - 100 \text{ mm}$	$2b_{z,\text{tested}} + 170 \text{ mm}$
Nominal wheel diameter	D	$D_{\text{tested}} - 90 \text{ mm}$	$D_{\text{tested}} + 90 \text{ mm}$

Table 2 — Accepted parameter ranges for a bogie which was tested successfully according to 5.2

Nominal parameter		Minimum	Maximum
Bogie axle distance (between outer axles of the bogie)	$2a^+$	$2a^+_{\text{tested}}$	$2a^+_{\text{tested}} + 0,2 \text{ m}$
Vertical eigenfrequency (see Annex C)	ν_z	$0,9 \cdot \nu_{z,\text{tested}}$ in full range between tare and loaded condition	$1,12 \cdot \nu_{z,\text{tested}}$ in full range between tare and loaded condition
Vertical damping		nominal characteristics of tested running gear	
Axle guiding longitudinal		nominal characteristics of tested running gear	
Axle guiding lateral		nominal characteristics of tested running gear	
Lateral secondary suspension characteristics		nominal characteristics of tested running gear	
Distance between centres of axle bearings (suspension base)	$2b_z$	$2b_{z,\text{tested}} - 100 \text{ mm}$	$2b_{z,\text{tested}} + 170 \text{ mm}$
Yaw moment of bogie ^a	M^*_z	$0,8 \cdot M^*_{z,\text{tested}}$	$1,2 \cdot M^*_{z,\text{tested}}$
Moment of inertia of whole bogie (around z-axis)	I^*_{zz}	-	$1,1 \cdot I^*_{zz,\text{tested}}$
Nominal wheel diameter	D	$D_{\text{tested}} - 90 \text{ mm}$	$D_{\text{tested}} + 90 \text{ mm}$
Nominal height of centre pivot relative to centre of wheelset	h_{cp}	$h_{cp,\text{tested}} - 150 \text{ mm}$	$h_{cp,\text{tested}} + 50 \text{ mm}$
^a For a friction based yaw resistance torque measured at two specified loads typical for tare and loaded condition. For other systems, appropriate parameters shall be used to control stability and safety against derailment in tare condition and maximum guiding force in loaded conditions.			

5.4 Description of the interface between running gear and vehicle body

A description of the physical interface between running gear and vehicle body shall include:

- the yaw characteristics of the running gear;
- range of vertical characteristics of side bearers (if applicable);
- range of characteristics of secondary suspension (stiffnesses, hysteresis/damping) (if applicable);
- drawings.

5.5 Range of vehicle body parameters for dispensation from on-track tests

The functional details of the vehicle body relevant to the running behaviour during on-track tests according to EN 14363:2016+A2:2022 shall be specified in the acceptance process. Table 3 gives an indication of which parameter shall be available for acceptance purposes.

Table 3 — Accepted parameter range for vehicles (including articulated wagons and permanently coupled units) equipped with a running gear which was tested successfully according to 5.2

Parameter		Minimum	Maximum
Distance between wheelsets (non bogie vehicles)	$2a^*$	For $2a^*_{\text{tested}} < 6,0$ m: $2a^*_{\text{tested}}^c$ For $2a^*_{\text{tested}} \geq 6,0$ m: Highest value of either 6,0 m or $2a^*_{\text{tested}} - 1,0$ m ^c	Lowest value of either 10,0 m or $2a^*_{\text{tested}} + 1,0$ m
Distance between bogie centres (bogie vehicles)	$2a^*$	For $2a^*_{\text{tested}} < 6,5$ m: $2a^*_{\text{tested}}^c$ For $2a^*_{\text{tested}} \geq 6,5$ m: Highest value of either 6,5 m or $2a^*_{\text{tested}} - 0,5$ m ^c	$2a^*_{\text{tested}} + 3,0$ m
Centre of gravity height of tare wagon	$h_{\text{cg, tare}}$	-	$1,2 \cdot h_{\text{cg, tare, tested, max}}$
Centre of gravity height of loaded wagon	$h_{\text{cg, loaded}}$		$1,2 \cdot h_{\text{cg, loaded, tested, max}}^b$
Coefficient of height of centre of gravity - loaded vehicle ^a	χ	-	$\chi_{\text{loaded, tested, max}} \cdot (1 + 0,8 (\lambda' - 1))$ with λ' - factor for track loading parameters (see 3.10)
Torsional coefficient per vehicle body	c_t^*	$> 0,5 \cdot 10^{10} \text{ kNmm}^2/\text{rad}$	-

Parameter		Minimum	Maximum
Mean axle load of the tare wagon (non-bogie wagon)	$P_{\text{mean,tare}}$	If $P_{\text{mean,tare,tested}} \leq 6,75 \text{ t}$: Lowest value of either 5,75 t or $P_{\text{mean,tare,tested}}$ else $0,85 \cdot P_{\text{mean,tare,tested}}$	-
Mean axle load of the tare wagon (bogie wagon)	$P_{\text{mean,tare}}$	If $P_{\text{mean,tare,tested}} \leq 4,7 \text{ t}$: Lowest value of either 4 t or $P_{\text{mean,tare,tested}}$ else $0,85 \cdot P_{\text{mean,tare,tested}}$	-
Maximum axle load	P	-	$1,05 \cdot P_{\text{tested}}$
Mass distribution coefficient (tare and loaded vehicle)	Φ	-	$1,2 \cdot \Phi_{\text{tested}}$
a For evaluation of χ (see Clause 3) use: and $l_{\text{adm}} = 130 \text{ mm}$ for axle loads $\leq 225 \text{ kN}$ $l_{\text{adm}} = 100 \text{ mm}$ for axle loads $> 225 \text{ kN}$ and up to 250 kN. b It was originally intended to replace this requirement by the requirement for χ. As this is not reasonable for high λ' values or low axle loads, it is intended to develop a less restrictive requirement for the future when more information is available. c If the application of the process of extension of acceptance in EN 14363:2016+A2:2022 on the tested wagon with the lower value $2a^*_{\text{tested}}$ results under consideration of the achieved safety factor λ in a lower acceptable minimum value of $2a^*$, then this lower value shall be chosen for the accepted parameter range.			

Following successful testing according to 5.2, the acceptable parameter variation range for a dispensation from on-track tests for a vehicle body is given by the nominal tested parameters of the vehicle bodies and, where specified in Table 3, by the extended range. All parameters given in this table are nominal values. The upper limit of the acceptable range depends on the maximum tested value of the respective parameter, the lower limit on the minimum tested value.

The minimum axle load and maximum axle load during operation of a wagon equipped with a certified running gear shall be compliant with the loading conditions between tare and loaded achieved according to Table 3 for the investigated standardized running gear.

This is, for example, fulfilled, if operational rules applied to the wagon require to operate it always with a minimum payload or a ballast (for example with an empty loading device) to be compliant with the parameters specified for a tare wagon in Table 3.

To extend the applicable vehicle parameter range of a standardized running gear, test results of a third tested vehicle outside the previously tested range shall be used.

6 Established running gear

6.1 General

This clause specifies certain parameters of suspensions and running gear that shall be known as established running gear. The requirements for the components, operational and design requirements from the point of view of running dynamics are defined in this clause and in normative Annexes D, G, I, J and L. Several existing versions of accepted components fulfilling the normative requirements are given in informative Annexes E, F, H and K.

The details in this chapter shall replace the 'declaration of conformity' required in Clause 5. As a result, vehicles with parameters within the defined ranges and equipped with Established Running Gear shall have dispensation from on-track testing according to EN 14363:2016+A2:2022.

NOTE Established Running Gear according to this document was previously approved under the auspices of UIC.

The minimum axle load and maximum axle load during operation of a wagon equipped with an established running gear shall be compliant with the loading conditions between tare and loaded specified for the established running gear.

This is, for example, fulfilled, if operational rules applied to the wagon require to operate it always with a minimum payload or a ballast (for example with an empty loading device) to be compliant with the parameters specified for a tare wagon in Table 6, Table 7, Table 9, Table 12, Table 15, and Table 18.

6.2 Wagons with single axle running gear

6.2.1 General

Three different types of single axle running gear are established:

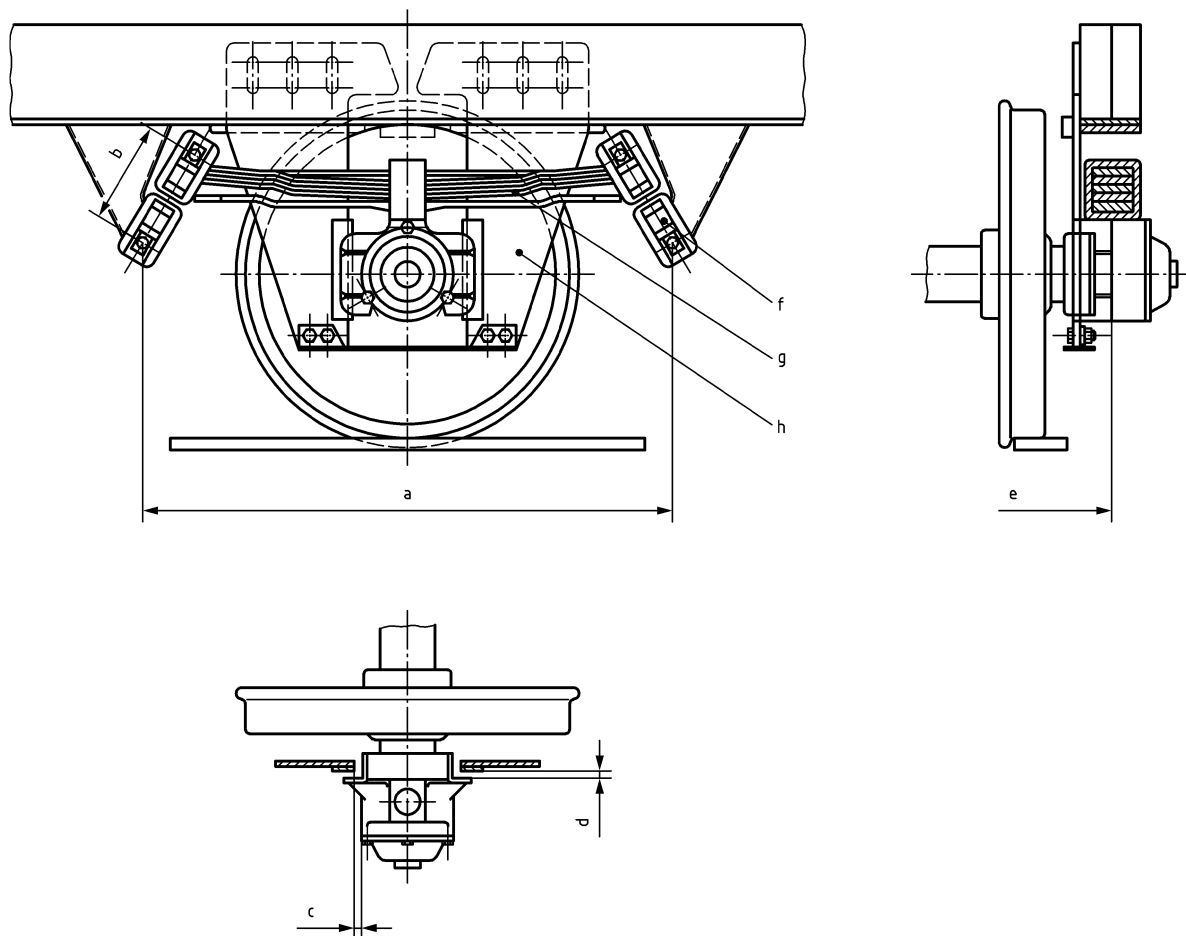
- double link suspension;
- long link suspension "Niesky 2";
- suspension "S 2000".

Requirements for permanently coupled units consisting of 2-axle elements are given in 6.2.5.

6.2.2 Double link suspension

6.2.2.1 General

An example for a double link suspension according to this document is shown in Figure 1 and described by characteristics relevant to running dynamics in 6.2.2.2 to 6.2.2.4 and the operational and design limitations in 6.2.2.5. The existing and accepted components are given in Annex D to Annex F.



Key

- a distance between suspension brackets; the distance between suspension brackets shall be the length of the spring + 300 mm
- b distance between centres of the link pins
- c longitudinal clearance
- d lateral clearance
- e distance between centres of axle bearings (suspension base) between 1 900 mm and 2 170 mm
- f double link
- g leaf spring
- h axle guard

Figure 1 — Double link suspension, overview

The clearance between axle box and axle guard shall be:

- laterally ≥ 20 mm;
- longitudinally = $\min (3 \cdot 2a^*/1\,000; 22,5 \text{ mm})$.

6.2.2.2 Assembly double link

The link assembly as described in Annex D is the key part of the double link suspension according to this document.

6.2.2.3 Component spring

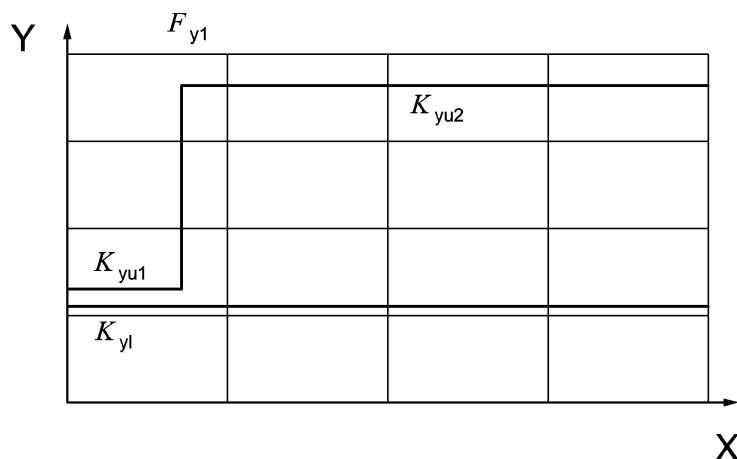
The springs of the established double link suspension according to this document shall comply with a range of characteristics defined by Table 4. Annex C gives details about the definition of the describing parameters. The existing springs which fulfil these requirements are given in Annex E.

Table 4 — Range of vertical spring characteristics for double link suspension for dispensation from on-track tests according to EN 14363:2016+A2:2022

Type		Trapezoidal leaf spring ^{b e}	Parabolic spring ^{c e}
Maximum axle load	$P_{\max}$	20,0 t ^d	22,5 t ^d
Lower limit for vertical eigenfrequency	ν_{zl} ^a	1,5 Hz ^b	1,85 Hz ^c
Upper limit for vertical eigenfrequency	ν_{zu} ^a	4,0 Hz ^b	3,4 Hz ^c
Range of damping	Λ	12 % to 15 %	7 % to 10 % ^f
Range of diameter of spring eye	d_i	36 mm	36 mm to 41 mm
^a Calculated with nominal stiffness according to the definition in Annex C. ^b A maximum manufacturing tolerance of 8 % for the stiffness is required. ^c A maximum manufacturing tolerance of 7 % for the stiffness is required. ^d The strength of the springs and the maximum vertical deflection is not in the scope of this document. ^e Existing springs which fulfil these requirements are given in Annex E. ^f For operation in UK clamping is required in order to increase damping to $12 \% < \Lambda < 17 \%$.			

6.2.2.4 Component axle guard

The axle guard of the established double link suspension according to this document shall comply with a range of characteristics defined by Figure 2 and Table 5. Characteristics of existing solutions which fulfil these requirements are given in Annex F.

**Key**

- X force F_y in kN
Y stiffness K_y in kN/mm

Figure 2 — Definition of values describing the range for lateral stiffness of axle guards for dispensation from on-track tests according to EN 14363:2016+A2:2022

Table 5 — Range of lateral characteristic for axle guards of double link suspension for dispensation from on-track tests according to EN 14363:2016+A2:2022

Type		Axle guard
Lower limit for nominal lateral stiffness ^b	K_{yl} ^a	1,20 kN/mm ^c
Upper limit for nominal lateral stiffness in first stage ^b	K_{yu1}	2,50 kN/mm ^c
Upper limit for nominal lateral stiffness in second stage ^b	K_{yu2} ^a	3,70 kN/mm ^c
Minimum force at break point between stages ^b	F_{y1} ^a	16,8 kN ^c
^a Measured at a height of 70 mm above the centre line of the axle, the wagon being tare and new condition (i.e. approx. 380 mm below the bottom edge of the side beam in the case of wheel diameters between 920 mm and 1 000 mm). ^b For an axle guard with a linear characteristic the stiffness of first and second stage is the same and the break point is not relevant. ^c The strength of the axle guards as well as the minimum and maximum lateral deflection are not in the scope of this document.		

6.2.2.5 Operational and design limitations for double link suspension

Vehicles with bodies according to Table 6 and equipped with double link suspensions according to this document have dispensation from on-track tests according to EN 14363:2016+A2:2022 for axle loads up

to 22,5 t with speeds up to 120 km/h and a cant deficiency up to 130 mm, when the spring design is appropriate (see 6.2.2.3).

For axle loads above 20 t in combination with speeds greater than 100 km/h, a minimum distance between active wheel faces of 1 418 mm is required for the dispensation (see also EN 15313:2022).

NOTE This restriction is related to high lateral forces, which occurred during test runs with a maximum lateral clearance between wheelset and rails greater than 37 mm. Therefore, according to UIC 700:2004, 3.2.2, also the track gauge is restricted to 1 455 mm on D-lines according to EN 15528:2021.

The wheel profile to be used is EN 13715:2020 – S1002.

Table 6 — Parameters of vehicle body which may be equipped with a double link suspension according to this document

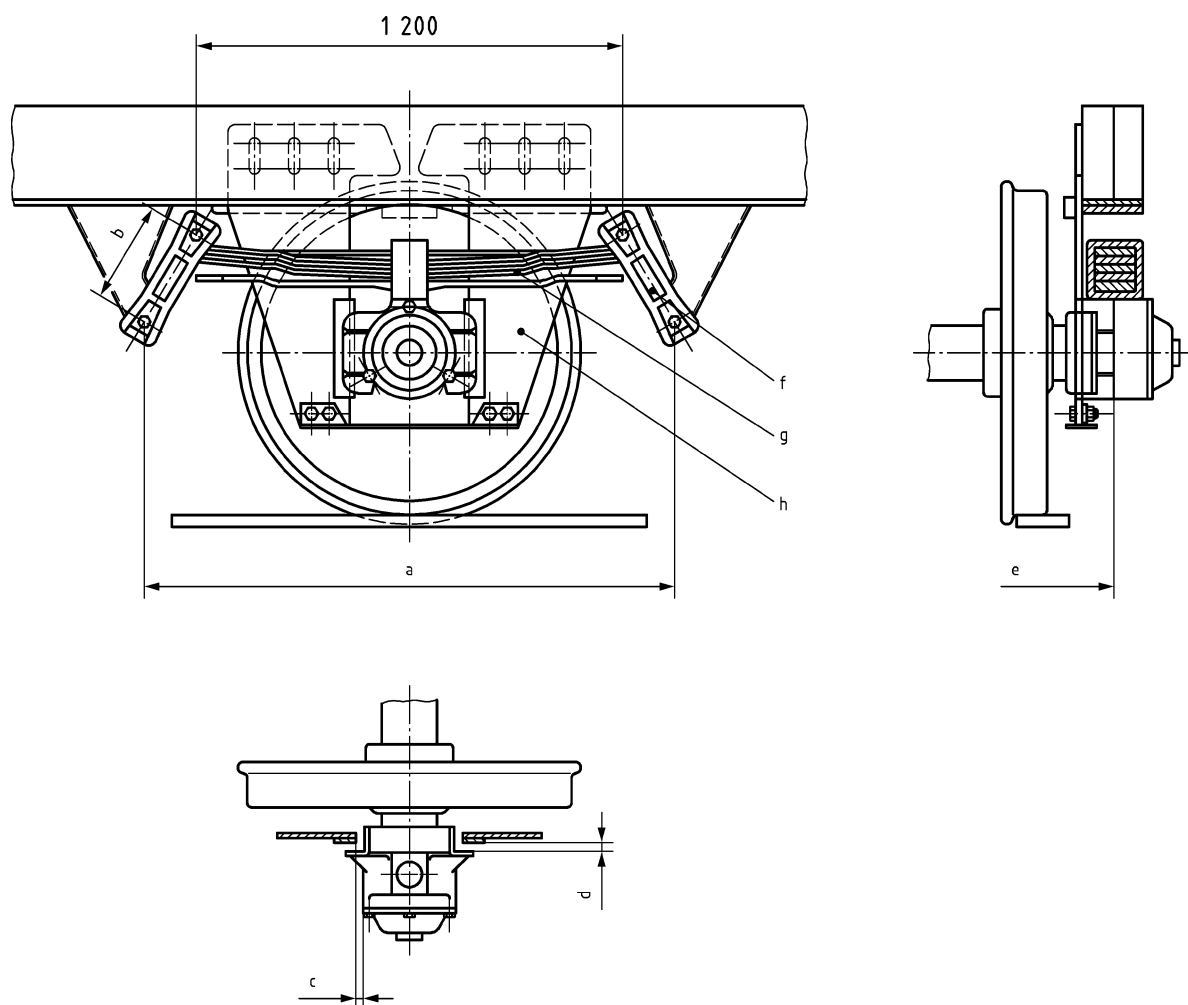
Max. axle load	Min. wheelbase ($2a^*$)	Max. wheelbase ($2a^*$)	Max. mass distribution coefficient Φ for tare wagons	Nominal wheel diameter	Max. height of centre of gravity of laden wagon	Min. torsional coefficient of wagon body (c_t^*)	Min. mass of wagon in tare condition
t	m	m	-	mm	mm	10^{10} kNmm ² /rad	t
20	8,0	10,0	0,55	920 or 840	2 500	0,5	11,5
22,5	8,0	10,0	0,55	920	2 380	0,5	11,5

6.2.3 Long link suspension “Niesky 2”

6.2.3.1 General

An example for a long link suspension “Niesky 2” according to this document is shown in Figure 3 and described by characteristics relevant to running dynamics in 6.2.3.2 and 6.2.3.3 and the operational and design limitations in 6.2.3.4. The existing versions of accepted components are given in Annex G.

Dimensions in millimetres

**Key**

- a distance between suspension brackets: the distance between suspension brackets shall be the length of the spring + 300 mm
- b distance between centres of the link pins
- c longitudinal clearance
- d lateral clearance
- e distance between centres of axle bearings (suspension base) = between 1 900 mm and 2 170 mm
- f long link
- g leaf spring
- h axle guard

Figure 3 — Long link suspension “Niesky 2”, overview

The clearance between axle box and axle guard shall be:

- laterally ≥ 20 mm;
- longitudinally = $\min (3 \cdot 2a^*/1\,000; 22,5 \text{ mm})$.

6.2.3.2 Assembly long link

The link assembly as described in normative Annex G is the key part of the long link suspension “Niesky 2” according to this document.

6.2.3.3 Components spring and axle guard

The characteristics of the components spring and axle guard for the “Niesky 2” suspension are the same as for the double link suspension (see 6.2.2.3 and 6.2.2.4).

6.2.3.4 Operational and design limitations for “Niesky 2” suspension

Vehicles with bodies according to Table 7 and equipped with long link suspensions “Niesky 2” according to this document have dispensation from on-track tests according to EN 14363:2016+A2:2022 for axle loads up to 22,5 t with speeds up to 120 km/h and a cant deficiency up to 130 mm, when the spring design is appropriate (see 6.2.2.3).

NOTE On lines classified as “D” according to EN 15528:2021 the track gauge is restricted to 1 455 mm according to UIC 700:2004, 3.2.2.

The wheel profile to be used is EN 13715:2020 – S1002.

Table 7 — Parameters of vehicle body which may be equipped with a long link suspension “Niesky 2” according to this document

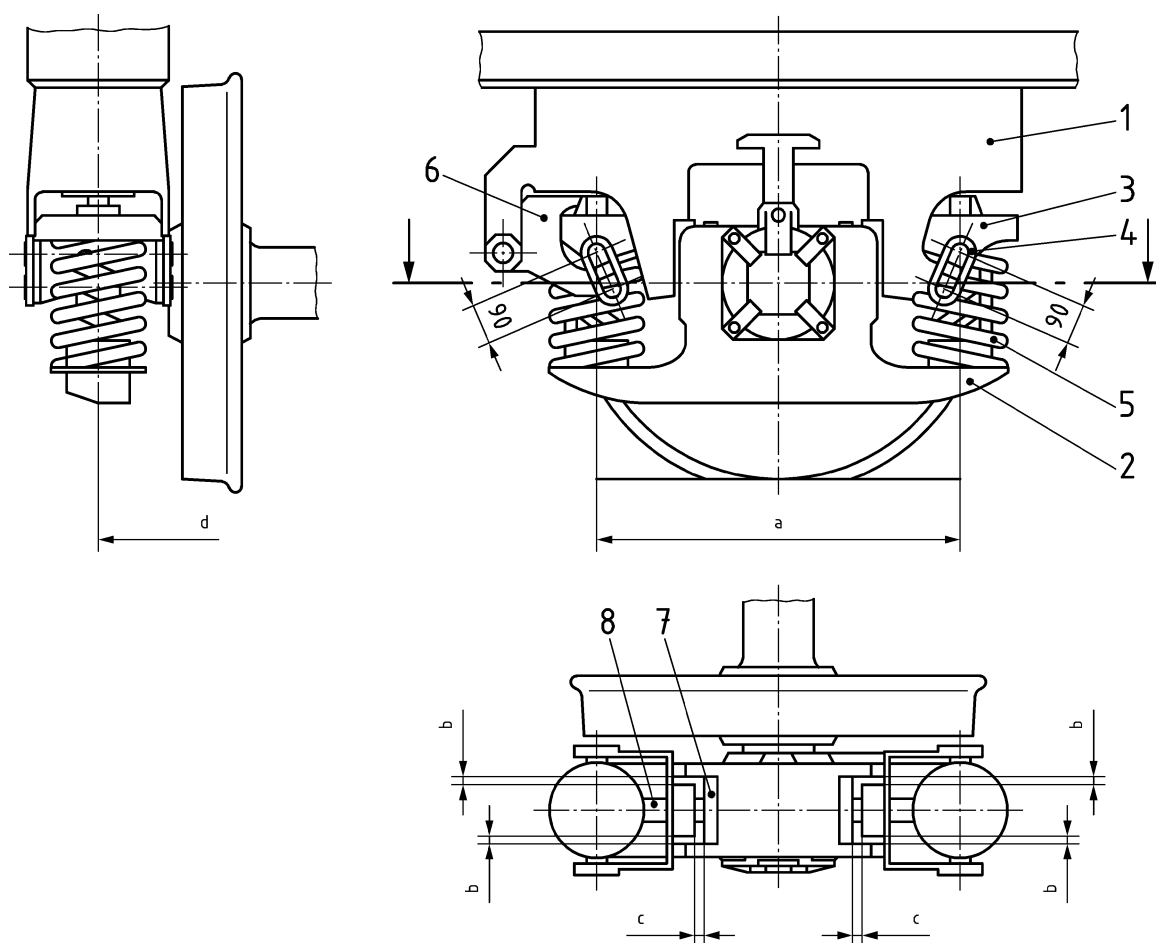
Max. axle load	Min. wheelbase (2a*)	Max. wheelbase (2a*)	Max. mass distribution coefficient Φ for tare wagons	Nominal wheel diameter	Max. height of centre of gravity of laden wagon	Min. torsional coefficient of wagon body (c_t^*)	Min. mass of wagon in tare condition
t	m	m	–	mm	mm	10^{10} kNmm ² /rad	t
20	8,0	10,0	0,55	920 or 840	2 500	0,5	11,5
20	6,0	8,0	0,55	920 or 840	2 500	4,0	11,5
22,5	8,0	10,0	0,55	920	2 380	0,5	11,5
22,5	6,0	8,0	0,55	920	2 380	4,0	11,5

6.2.4 Suspension “S 2000”

6.2.4.1 General

An example of a “S 2000” suspension according to this document is shown in Figure 4 and described by characteristics relevant to running dynamics in 6.2.4.2 and the operational and design limitations in 6.2.4.3.

Dimensions in millimetres

**Key**

- 1 bracket
- 2 axle box
- 3 spring cap
- 4 damping link (dry friction)
- 5 coil spring
- 6 articulation stirrup
- 7 axle damper friction pad
- 8 axle damper plunger
- a distance between suspension brackets = 810 mm
- b lateral clearance
- c longitudinal clearance
- d distance between centres of axle bearings (suspension base) = between 1 900 mm and 2 170 mm

Figure 4 — Suspension “S 2000”, overview

The clearance between axle box and bracket shall be:

- laterally ≥ 20 mm;
- longitudinally = $\min (3 \cdot 2a^*/1\,000; 22,5 \text{ mm})$.

6.2.4.2 Component spring and double Lenoir damping system

The Lenoir damping system provides a load dependent friction damping between axle box and bracket in vertical and lateral direction: Both springs of the suspension are guided by a spring cap on their upper end which has a longitudinal freedom relative to the bogie frame. The frame is partly supported by this spring cap via an inclined link. This link generates – depending on its inclination – a horizontal force which presses the spring cap towards the bogie frame. This longitudinal force is transmitted to the bogie frame via a plunger and produces vertical and lateral friction damping in the friction surfaces.

The friction depends on the load on the first stage of the suspension, the inclination of the link and the friction coefficient of the friction surfaces.

Furthermore, the characteristic of the longitudinal axle guiding is strongly influenced by the Lenoir damper system.

The surfaces of the friction liner shall be smooth and unlubricated and made of manganese steel.

The nominal slope of the rings of the Lenoir damper shall be 20° and the nominal distance between centres of the pivots of ring shall be 90 mm.

The springs of the established suspension S 2000 according to this document shall comply with a range of characteristics defined by Table 8. Annex C gives details about the definition of the describing parameters. The existing spring which fulfils these requirements is given in the Note.

Table 8 — Range of vertical spring characteristics for double link suspension for dispensation from on-track tests according to EN 14363:2016+A2:2022

Type		Helical suspension spring
Maximum axle load	$P_{\max}$	up to 25,0 t ^c
Lower limit for vertical eigenfrequency	ν_{z1} ^a	1,9 Hz ^b
Upper limit for vertical eigenfrequency	ν_{zu} ^a	3,4 Hz ^b
Range of damping	Δ	double Lenoir damper as described in 6.2.4.2
^a Calculated with nominal stiffnesses according to definition in Annex C. ^b A manufacturing tolerance $\leq \pm 5 \%$ for the stiffness is required. ^c The strength of the springs and the maximum vertical deflection are not in the scope of this document.		

NOTE The only standardized solution for the “S 2000” suspension has the following vertical characteristic per axle box:

— Stiffness, 1. stage $c_{z1} = 0,613 \text{ kN/mm}$;

— Stiffness, 2. stage $c_{z2} = 1,817 \text{ kN/mm}$;

— Transition force $F_1 = 40,5 \text{ kN}$.

6.2.4.3 Operational and design limitations for “S 2000” suspension

Vehicles with bodies according to Table 9 and equipped with “S 2000” suspensions according to this document have dispensation from on-track tests according to EN 14363:2016+A2:2022 for axle loads up to 22,5 t with speeds up to 120 km/h and a cant deficiency up to 130 mm, when the spring design is appropriate (see 6.2.4.2).

NOTE On lines classified as “D” according to EN 15528:2021 the track gauge is restricted to 1 455 mm according to UIC 700:2004, 3.2.2.

The wheel profile to be used is EN 13715:2020 – S1002.

Table 9 — Parameters of vehicle body which may be equipped with a “S 2000” suspension according to this document

Max. axle load	Min. wheelbase (2a*)	Max. wheelbase (2a*)	Max. mass distribution coefficient Φ for tare wagons	Nominal wheel diameter	Max. height of centre of gravity of laden wagon	Min. torsional coefficient of wagon body (c_t^*)	Min. mass of wagon in tare condition
t	m	m	–	mm	mm	10^{10} kNmm ² /rad	t
20	8,0	10,0	0,55	920 or 840	2 500	0,5	11,5
20	6,0	8,0	0,55	920 or 840	2 500	4,0	11,5
22,5	8,0	10,0	0,55	920	2 380	0,5	11,5
22,5	6,0	8,0	0,55	920	2 380	4,0	11,5

6.2.5 Permanently coupled units consisting of 2-axle elements

Permanently coupled units consisting of 2-axle elements equipped with one of the single axle running gear described in 6.2.2, 6.2.3 or 6.2.4 have dispensation from on-track tests according to EN 14363:2016+A2:2022 for the operational conditions described in 6.2.2.5, 6.2.3.4 or 6.2.4.3, if each element fulfils the requirements for the vehicle body given in the related Tables 6, Table 7 or Table 9. These units shall be equipped with coupling between the elements either consisting of:

- standard side buffers and screw couplers described in EN 15551:2022 and EN 15566:2022;
- diagonal buffers and screw couplers as described in J.1, Figure J.1 or
- coupler bar described in J.2.

6.3 Wagons equipped with 2-axle bogies

6.3.1 General

Two different families of 2-axle bogies are established:

- Y25 family;
- 2-axle steering axle bogie.

6.3.2 Running gear of the family Y25

6.3.2.1 General

An example for a bogie of the Y25 family according to this document is shown in Figure 5 and described by characteristics relevant to running dynamics in Table 10 and 6.3.2.2 to 6.3.2.4 and the operational and design limitations in 6.3.2.5.