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EUROPEAN STANDARD
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EN 13749

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English version

Railway applications - Methods of specifying structural requirements of bogie frames

Applications ferroviaires - Essieux montés et bogies -
Méthode pour spécifier les exigences en matière de
résistance des structures de châssis de bogie

Bahnanwendungen - Radsätze und Drehgestelle -
Spezifikationsverfahren für Festigkeitsanforderungen an
Drehgestellrahmen

This European Standard was approved by CEN on 3 November 2003.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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

Management Centre: rue de Stassart, 36 B-1050 Brussels

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Foreword

This document (EN 13749:2005) 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of an identical text or by endorsement, at the latest by October 2005, and conflicting national standards shall be withdrawn at the latest by October 2005.

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

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EN 13749:2005 (E)**1 Scope**

This document specifies the method to be followed to achieve a satisfactory design of bogie frames and includes design procedures, assessment methods, verification and manufacturing quality requirements. It is limited to the structural requirements of bogie frames including bolsters and axlebox housings. For the purpose of the document, these terms are taken to include all functional attachments, e.g. damper brackets.

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 12082:1998, *Railway applications — Axleboxes — Performance testing*.

3 Terms and definitions

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

3.1 Commercial terms**3.1.1****customer**

organisation which has the responsibility for defining the technical requirements for the bogie which are necessary for it to perform its intended operation

3.1.2**supplier**

organisation which supplies bogies or bogie components

3.2 Technical terms**3.2.1****bogie frame**

load-bearing structure generally located between primary and secondary suspension

3.2.2**bolster**

transverse load-bearing structure between vehicle body and bogie frame

3.2.3**sideframe**

longitudinal structural member of the bogie frame

3.2.4**headstock**

transverse member joining the longitudinal extremities of the bogie sideframes

3.2.5**transom**

central transverse structural member(s) of the bogie frame

3.2.6**axlebox**

assembly comprising the box housing, rolling bearings, sealing and grease

3.2.7**box housing**

load-bearing structure housing the bearings, grease, sealing and accessories

NOTE Earthing, tachogenerator and wheel-slide sensors are typical accessories.

3.2.8**primary suspension**

suspension system consisting of the resilient elements generally located between the axlebox and bogie frame

3.2.9**secondary suspension**

suspension system consisting of the resilient elements generally located between the bogie frame and vehicle body or bolster

3.2.10**static force F_s**

force which is constant with time

NOTE Force due to gravity is an example of static force.

3.2.11**quasi-static force F_{qs}**

force, which changes with time at a rate which does not cause dynamic excitation

NOTE Quasi-static force can remain constant for limited periods.

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3.2.12

dynamic force $F_{dtransient}$, impulsive or continuous force, uniform or random, that changes with time at a rate that causes dynamic excitation

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3.3 Symbols and units

Table 1 — Forces

Force (N)	Position	Symbol		
		Static	Quasi-Static	Dynamic
Vertical	Load applied to bogie	F_z		
	Force on sideframe 1 or sidebearer 1	F_{z1}	F_{z1qs}	F_{z1d}
	Force on sideframe 2 or sidebearer 2	F_{z2}	F_{z2qs}	F_{z2d}
	Force on centre pivot	F_{zp}	F_{zpq}	F_{zpd}
	Force at (body) C of G	F_{zc}		
Transverse	Load applied to bogie	F_y		
	Force on axle 1	F_{y1}	F_{y1qs}	F_{y1d}
	Force on axle 2	F_{y2}	F_{y2qs}	F_{y2d}
	Force at (body) C of G	F_{yc}		
	Force due to wind	F_{w1}		
Longitudinal	Force at each wheel	F_{x1}		
	Force at (body) C of G	F_{xc}		
	Force at (bogie) C of G	F_x		

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Table 2 — Accelerations

Acceleration (m/s ²)	Symbol	
	Body	Bogie (primary sprung)
Vertical	a_{zc}	a_{zb}
Transverse (dynamic)	a_{yc}	a_{yb}
Centrifugal (quasi-static)	a_{ycc}	a_{ycb}
Longitudinal	a_{xc}	a_{xb}

Table 3 — Masses

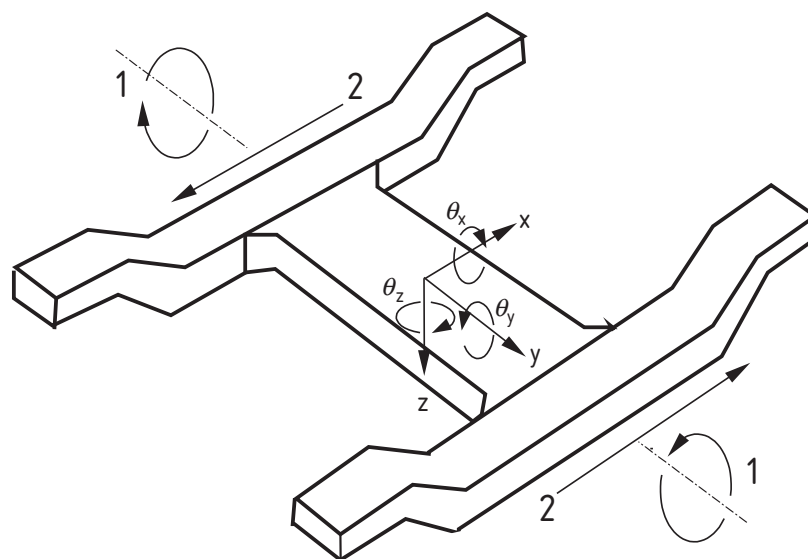
Mass (kg)	Symbol
Vehicle in running order	M_v
Vehicle body	m_1
Bogie (primary sprung)	m_2
Bogie complete	m^+
Exceptional payload	P_1
Normal service payload	P_2

Table 4 — Other symbols and units

Other	Symbol	Unit
Wind pressure	q	N/m^2
Stress	σ	N/mm^2
Maximum stress	σ_{max}	N/mm^2
Minimum stress	σ_{min}	N/mm^2
Mean value of stress	$\sigma_m = (\sigma_{max} + \sigma_{min})/2$	N/mm^2
Amplitude of stress cycle	$\sigma_a = (\sigma_{max} - \sigma_{min})/2$	N/mm^2
Car body surface area	A_w	m^2
Roll coefficient	α	
Bounce coefficient	β	
Adhesion or friction coefficient	μ	
Uncertainty factor or Factor of safety	S_1	

4 Co-ordinate system

Figure 1 shows the co-ordinate system adopted in this document.

**Key**

- 1 Twist
- 2 Lozenge (shear)

Figure 1 — Co-ordinate system

Table 5 defines movements and deformations and their directions.

Table 5 — Movements and deformations in railway bogie assemblies

Direction	Symbol	Description
Longitudinal	x	Linear in the direction of travel
Transverse	y	Linear parallel to the plane of the track, perpendicular to the direction of travel
Vertical	z	Linear perpendicular to the plane of the track
Roll	θ_x	Rotation about the longitudinal axis
Pitch	θ_y	Rotation about the transverse axis
Yaw	θ_z	Rotation about the vertical axis
Twist	—	Out-of-plane (x-y) movement resulting in relative rotation of the sideframes
Lozenging	—	Shear due to relative longitudinal movement of sideframes

5 Classification

This document covers a wide variety of different bogie types. For reference purposes it is convenient to assign them to different categories. Although identified generally in terms of vehicle types, the selection of the category for a bogie should also take into account the structural requirements of the bogie frame. The structural requirements for bogies in a particular category are not unique and shall always be specified by the customer according to the operating requirements, using the principles presented in this document. It is the responsibility of the customer to decide to which category a bogie shall be allocated. There will be differences in choice between customers. This is to be expected and

should not be considered as conflicting with this document. Some bogies may not fit into any of the defined categories.

- category B-I** bogies for main line and inter-city passenger carrying rolling stock including high speed and very high speed vehicles, powered and un-powered;
- category B-II** bogies for inner and outer suburban passenger carrying vehicles, powered and un-powered;
- category B-III** bogies for metro and rapid transit rolling stock, powered and un-powered;
- category B-IV** bogies for light rail vehicles and trams;
- category B-V** bogies for freight rolling stock with single-stage suspensions;
- category B-VI** bogies for freight rolling stock with two-stage suspensions;
- category B-VII** bogies for locomotives.

NOTE The classifications are similar to (but not wholly consistent with) those adopted for vehicle bodies in EN 12663 [9]. They are not exclusive and more may be added as information becomes available.

6 Responsibilities

The customer shall provide the supplier with a detailed description of the requirements of the bogie design in the form of a technical specification incorporating all appropriate mandatory regulations. The customer shall also define the parts of the acceptance procedure (clause 9) and the quality requirements (clause 10), which he specifically requires.

The customer shall specify the way in which the supplier is to provide evidence to show that the requirements have been met.

NOTE If the customer is unable to define the specification completely the supplier may propose a specification and submit it to the customer for approval. It is the supplier's responsibility to design the bogie frame in accordance with the specification.

7 Contents of technical specification

7.1 Scope

The technical specification shall consist of all the information describing the functional requirements of the bogie frame and the interfaces with associated components and assemblies. It shall also comprise, as a minimum, the general requirements of use, the conditions associated with the vehicle equipped with the bogies, the operating characteristics, the conditions associated with maintenance and any other particular requirements of the customer.

7.2 General requirements

The customer shall indicate the type of bogie required in terms of its use in accordance with the categories in clause 5. The customer shall also indicate in the technical specification the intended life of the bogie, its average annual distance run and its total distance run.

7.3 Vehicle conditions and interfaces

The specification shall include, but not be limited to, information on: