SLOVENSKI STANDARD
oSIST prEN 13749:2026

01-junij-2026

Železniške naprave - Kolesni pari in podstavni vozički - Konstrukcijske zahteve za tekalne sestave

Railway applications - Wheelsets and bogies - Running gear structural requirements

Bahnanwendungen - Radsätze und Drehgestelle - Festigkeitsanforderungen an Drehgestellrahmen

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

Ta slovenski standard je istoveten z: **prEN 13749**

ICS:

45.040	Materiali in deli za železniško tehniko	Materials and components for railway engineering

oSIST prEN 13749:2026 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 13749

April 2026

ICS 45.040

Will supersede EN 13749:2021+A1:2023

English Version

Railway applications - Wheelsets and bogies - Running gear structural requirements

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

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

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

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Ref. No. prEN 13749:2026 E

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European foreword

This document (prEN 13749:2026) 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 will supersede EN 13749:2021+A1:2023.

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

— non-structural requirements have been moved to EN 15827, including most of the description of the technical specification;

— the scope has been generalised to running gear structural components;

— new Clause 4 on requirements and interface management, outlining the structural design and validation process, primary load paths and the process of deriving loads and load cases;

— addition of scenarios for determining design loads, and the process for deriving loads from operation;

— Clause 5, verification of design data, rewritten;

— Clause 6, validation and acceptance of the design, renamed "structural integrity validation" and rewritten with reference to the EN 17149 series of standards;

— new Annex F added - code of practice for track testing.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

1 Scope

This document specifies the requirements for the validation of the structural integrity for the following running gear structural components:

— components in the load path between the track and the car body (e.g. bogie frame, axlebox, or other equivalent components) and

— components without secondary load paths that are in the traction and braking load paths.

The following components are excluded from the scope of this document:

— structural components that are rigidly attached to the car body (e.g. bolsters directly attached to the car body or connected via slewing rings, centre pivots, etc.);

— equipment structures (e.g. traction motor housings, gearbox housings, and brake units), including components that are rigidly attached to them, that are not in the load path between the track and the car body;

— components for which the structural integrity validation requirements are regulated by other specific European standards (e.g. wheels, axles, brake discs, bearings, coil springs etc.);

— suspension components including springs, dampers, elastic elements and their connecting elements;

— revolving components (e.g. drive train components etc.).

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 14033-1:2017, *Railway applications - Track - Railbound construction and maintenance machines - Part 1: Technical requirements for running*

EN 15085-1:2023, *Railway applications - Welding of railway vehicles and components - Part 1: General*

EN 15085-2:2020+A2:2025, *Railway applications - Welding of railway vehicles and components - Part 2: Requirements for welding manufacturer*

EN 15085-3:2022+A1:2023, *Railway applications - Welding of railway vehicles and components - Part 3: Design requirements*

EN 15085-4:2023, *Railway applications - Welding of railway vehicles and components - Part 4: Production requirements*

EN 15085-5:2023, *Railway applications - Welding of railway vehicles and components - Part 5: Inspection, testing and documentation*

EN 15227:2020, *Railway applications - Crashworthiness requirements for rail vehicles*

EN 15663:2017+A2:2024, *Railway applications - Vehicle reference masses*

EN 15827:2025, *Railway applications - System Engineering requirements for bogies and running gear*

EN 17149-2:2024, *Railway applications - Strength assessment of rail vehicle structures - Part 2: Static strength assessment*

EN 17343:2023, *Railway applications - General terms and definitions*

3 Terms and definitions

For the purposes of this document, the terms and definitions in EN 17343:2023 and the following apply.

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

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
secondary load path
load path that is engaged in case the function of a component is infringed or fully lost

EXAMPLE Safety retention for a torque reaction link, or where the centre pivot contacts the frame on both sides in case of missing traction links.

3.2
axlebox
assembly comprising the box housing, rolling bearings, sealing and grease

3.3
bogie frame
load-bearing structure generally located between primary and *secondary suspension* (3.23)

3.4
bolster
transverse load-bearing structure between vehicle body and *bogie frame* (3.3)

3.5
static force
force which is constant with time

Note 1 to entry: Force due to gravity is an example of static force.

3.6
quasi-static force
force which changes with time at a rate which does not cause dynamic excitation

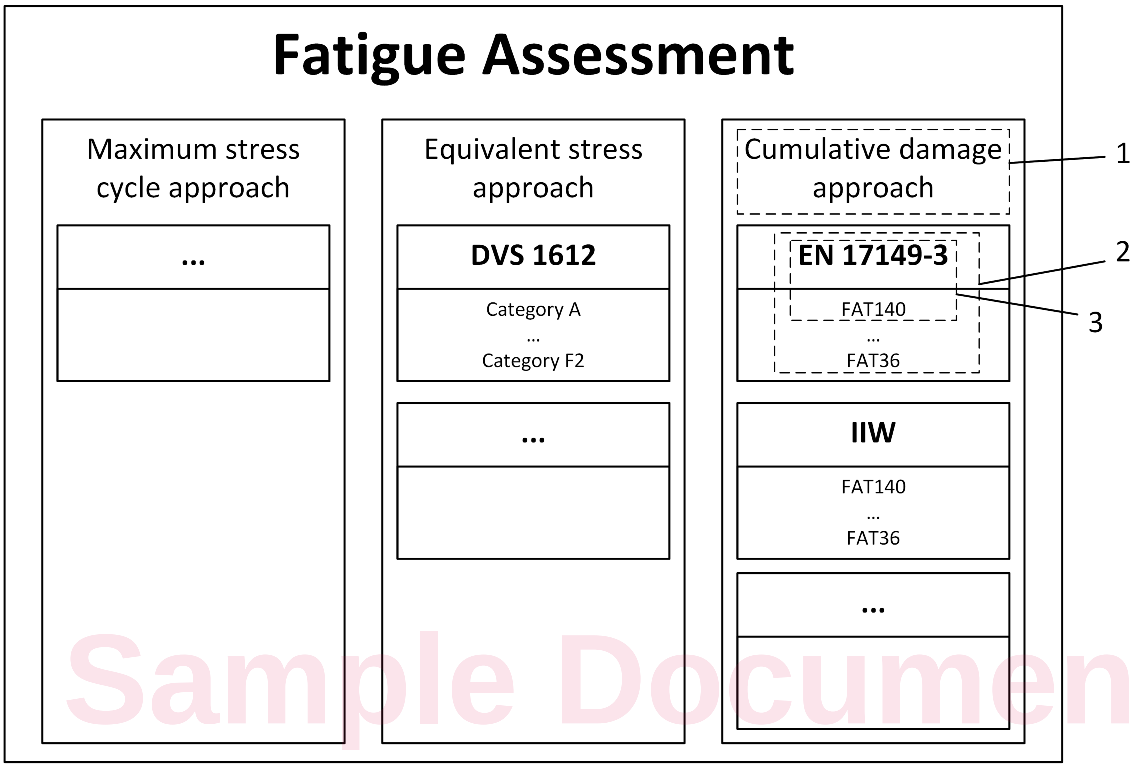
Note 1 to entry: A quasi-static force might remain constant for limited periods

3.7
dynamic force
transient, impulsive or continuous force, uniform or random, that changes with time at a rate that causes dynamic excitation

3.8
load case
set of loads or combinations of loads that represents a loading condition to which the structure or component is subjected

3.9
exceptional load case
extreme *load case* (3.8) representing the maximum load at which full serviceability is to be maintained and used for assessment against static material properties

3.10
fatigue assessment
assessment of the fatigue behaviour based on stress data determined by simulation or measurement subjected to a theoretical *fatigue life model* (3.13) and resulting in a fatigue utilization



Key

1 *fatigue assessment approach* (3.11)

2 *fatigue assessment method* (3.12)

3 *fatigue life model* (3.13)

Figure 1 — Illustration of term hierarchy in fatigue assessment

Note 1 to entry: Laboratory fatigue testing is not addressed by the term fatigue assessment.

Note 2 to entry: Simulation includes finite element analysis, multi-body simulation, analytical models, hand calculations.

3.11
fatigue assessment approach
fundamental principle of the *fatigue life model* (3.13) describing the nature of the stress data being assessed (e.g. maximum stress cycle, damage equivalent stress or stress spectrum) and the assessment strategy being applied (e.g. comparison of a maximum value to a threshold or damage cumulation); see Figure 1

Note 1 to entry: For each fatigue assessment approach various fatigue assessment methods can be applied.

3.12
fatigue assessment method
detailed specification of the fatigue assessment algorithm, see Figure 1

Note 1 to entry: A fatigue assessment method is typically formulated in a standard (e.g. EN 17149-3:2025 [1]).

3.13
fatigue life model
specific application of a *fatigue assessment method* (3.12), including the applied parameter values for a specific assessment location; see Figure 1

3.14
fatigue resistance
material's or component's ability to withstand cyclic loading

Note 1 to entry: fatigue resistance is a property of a material or component. This term is not intended to address the actual fatigue life. The actual fatigue life results from the actual loads being applied.

Note 2 to entry: In the context of *fatigue assessment* (3.10) the theoretical fatigue resistance is quantified by the *fatigue life model* (3.13)

Note 3 to entry: In the context of fatigue testing the fatigue resistance is the result or validation objective.

3.15
fatigue crack
indication that grows under the influence of fatigue load

3.16
maximum stress cycle approach
fatigue assessment based on the maximum stress cycle
fatigue assessment approach (3.11) evaluating the maximum fatigue stress cycle against a fatigue strength limit

Note 1 to entry: If this fatigue strength limit is associated with $N = \infty$, then the *fatigue assessment* (3.10) results in a theoretical proof of an infinite life. In some technical literature this is also referred to as endurance limit approach.

3.17
fatigue assessment based on equivalent loads
damage-equivalent loads approach
fatigue assessment approach (3.11) evaluating a constant amplitude stress spectrum determined by damage equivalent loads against a corresponding fatigue strength limit

Note 1 to entry: The term *damage equivalent stress* is not used in the name of this approach to avoid misunderstanding with damage equivalent stress spectra which are determined with a *cumulative damage approach* (3.18) by processing variable amplitude stress spectra, e.g. by the application of counting methods and Miner summation.

Note 2 to entry: A key characteristic of the damage-equivalent load approach is that damage calculations are not performed by processing a variable amplitude stress spectrum, such as through the use of cycle counting methods and Miner's rule.
The constant amplitude stress spectrum usually is determined by a set of design load cases that in general are combinations of individual loads. The load amplitudes and combination factors are selected with the objective to obtain a constant amplitude stress spectrum that envelopes the real damage equivalent stress in service. In this approach the damage equivalence is implicitly or explicitly considered by the selection of the values for load amplitudes and combination factors.

Note 3 to entry: This approach has historically been used with design loads from EN 12663-1 [2], EN 12663-2 [3] and this document and *fatigue assessment* (3.10) methods according to e.g. RP60 [4], DVS 1612 [5] or DVS 1608 [6]. In some cases these design loads do not produce the maximum stress cycle. The admissible stress values in some cases are not the actual physical endurance limits.
In the past, this approach has been referred to as endurance limit approach. It has been applied with satisfactory results.
To avoid ambiguity with the *maximum stress cycle approach* (3.16) , the term endurance limit approach is not used in this document.

Note 4 to entry: For fatigue assessments where two or more individual loads are used in combination with load factors to create damage equivalent *load case* (3.8) combinations it may not be possible to prove that the resulting stress from the considered load combinations represents a real constant amplitude damage equivalent stress compared to the real stress spectrum. In such cases the load factors for the *load case* (3.8) combinations should be selected based on experience or based on detailed evaluations to ensure that the resulting stress from the considered load combinations are sufficiently conservative with respect to the real damage equivalent stress in service.

3.18
cumulative damage approach
fatigue assessment based on cumulative damage
fatigue assessment approach (3.11) evaluating a variable amplitude stress spectrum against a corresponding fatigue strength curve

Note 1 to entry: In many assessment methods of the *cumulative damage approach* (3.18) damage equivalent stresses are determined.

3.19
fatigue load case
repetitive *load case* (3.8) used for assessment against fatigue strength

3.20
safety factor
factor applied during the strength assessment which makes an allowance for a combination of the uncertainties and the safety criticality

3.21
sideframe
longitudinal structural member of the *bogie frame* (3.3)

3.22
primary suspension
suspension system consisting of the resilient elements (and associated connecting and locating parts) generally located between the *axlebox* (3.2) and *bogie frame* (3.3)

3.23
secondary suspension
suspension system consisting of the resilient elements (and associated connecting and locating parts) generally located between the *bogie frame* (3.3) and vehicle body or *bolster* (3.4)

3.24
track testing
performing of tests under expected service conditions, on railway infrastructure that represents the actual operating environment, and monitoring and recording the responses

3.25
validation
confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled

[SOURCE: EN ISO 9000:2015 [7], 3.8.13, modified - Notes 1 to 3 to entry have been deleted.]

3.26
structural integrity
ability of a structure to maintain performance during operation with respect to structural safety, robustness, serviceability, and durability

[SOURCE: EN ISO 19900:2019 [8], 3.50, modified - removed cross references to other terms; removed "structural component"; "throughout the total service life" changed to "during operation"]

3.27
structural integrity validation by testing
validation (3.25) actions based on physical testing with the focus on *structural integrity* (3.26), performed in a laboratory or as track tests

Note 1 to entry: The typical tests required in the context of structural integrity validation are static and fatigue tests in the laboratory and *track testing* (3.24) with the focus on stress / strain measurement and load related qualities like accelerations or displacements.

3.28
structural integrity validation by simulation
validation (3.25) by analysis, including numerical methods such as finite element analysis, multi-body simulation, analytical models, hand calculations

3.29
significant permanent deformation
plastic deformation of an amount that infringes on the functionality of the structure by exceeding the component geometric tolerances

Note 1 to entry: local yielding, which does not exceed geometric tolerances or infringe on the structure's function is excluded

3.30
verification
confirmation, through the provision of objective evidence, that specified requirements have been fulfilled

Note 1 to entry: Verification is answering whether a specific requirement is met, without questioning this requirement

[SOURCE: EN ISO 9000:2015 [7], 3.8.12, modified - Notes 1, 2 and 3 to entry removed, added new Note 1 to entry]

3.31
running gear
transmits forces between carbody and wheels, for example a bogie

3.32
load-transmitting equipment
component or assembly which transfers or generates inertia loads, equipment loads (such as traction, braking, suspension component forces), including attachment brackets and housings

3.33
technical specification
document defining other or additional requirements not defined in this standard

Note 1 to entry: Usually this is produced by and agreed between the customer and/or the manufacturer (sometimes called the supplier), or a Railway Undertaking, and can be an accompaniment to contractual requirements.

3.34
ultimate load case
extreme *load case* (3.8) used for assessment against static material properties, under which ultimate failure or rupture need to be prevented, but serviceability need not be maintained

3.35
reverse curve
two curves with alternating direction, with minimal distance between them in accordance with track design conditions

Note 1 to entry: Includes S-curves as defined in EN 14363:2016 [9]

3.36
validation plan
includes the *validation* (3.25) strategy and the documentation of the evidence of demonstrating that the *validation objectives* (3.37) are met/satisfied

3.37
validation objectives
specific goals set to confirm that a system, product, or process performs as intended under defined conditions

Note 1 to entry: These guide the *validation* (3.25) activities and serve as criteria for determining whether the requirements, functional performance, and safety standards have been successfully met.

3.38
design scenario
set of circumstances which leads to a combination of loads applied to the *bogie frame* (3.3)

Note 1 to entry: This can be the same as a design *load case* (3.8).

3.39
primary load path
fundamental route of force transmission between wheelset and carbody as well as for traction and braking, excluding damper loads and secondary retention

3.40
fatigue assessment locations
set of locations which define the scope of the fatigue life *validation* (3.25)

3.41
design limit
design limit value
threshold for the value of a parameter used as an acceptance criterion in the design release and *validation* (3.25) process

EXAMPLE The design limit for the fatigue strength utilization as defined in this document is 1,0 or 100 %; see 6.5.2.

3.42
load block
specified loads defined for all actuators including amplitudes, number of cycles and phase relations

3.43
load stage
sequence of one or more load blocks that is repeated with a defined repetition count

3.44
load stage factor
ratio of loads applied during a *load stage* (3.43) with respect to the design *load stage* (3.43)

3.45
test setup
mechanical system of load application and restraints including location, type of load and degree of freedom

Note 1 to entry: The test setup comprises the mechanical system of the test rig including the test specimen, actuators and restraints.

3.46
fatigue test programme
definition of loads being applied during the fatigue test defined by a sequence of load stages

3.47
design documentation
version-controlled definition of manufacturing and quality requirements for a component or assembly (including e.g. the geometry, material properties and acceptance criteria)

Note 1 to entry: Typically the design documentation consists of a combination of drawings, specifications or CAD models

Note 2 to entry: The design documentation should hold all data required to define a manufacturing process and allow predictions of reproducible properties and functionalities, e.g. strength properties, cast or welding quality properties, surface conditions.

3.48
validation domain
collective term for the different *validation* (3.25) methods, in particular simulation, testing in the laboratory and *track testing* (3.24)

4 Requirement and interface management

4.1 General

The structural design and validation (3.25) process shall be consistent with the general principles set out in EN 15827:2025, 6.1.