



SLOVENSKI STANDARD
SIST EN 12663-1:2010+A2:2024

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**Železniške naprave - Konstrukcijske zahteve za grode železniških vozil - 1. del:
Lokomotive in potniška železniška vozila (tudi alternativna metoda za tovarne
vagone) (vključno z dopnilom A2)**

Railway applications - Structural requirements of railway vehicle bodies - Part 1:
Locomotives and passenger rolling stock (and alternative method for freight wagons)

Bahnanwendungen - Festigkeitsanforderungen an Wagenkästen von
Schienenfahrzeugen - Teil 1: Lokomotiven und Personenfahrzeuge (und alternatives
Verfahren für Güterwagen)

Applications ferroviaires - Prescriptions de dimensionnement des structures de véhicules
ferroviaires - Partie 1 : Locomotives et matériels roulants voyageurs (et méthode
alternative pour wagons)

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Bahnwendungen - Festigkeitsanforderungen an Wagenkästen von Schienenfahrzeugen - Teil 1: Lokomotiven und Personenzüge (und alternatives Verfahren für Güterwagen)

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EN 12663-1:2010+A2:2023 (E)**European foreword**

This document (EN 12663-1:2010+A2:2023) 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of an identical text or by endorsement, at the latest by May 2024, and conflicting national standards shall be withdrawn at the latest by May 2024.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 [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document includes Amendment 1 approved by CEN on 2014-09-23.

This document includes Amendment 2 approved by CEN on 2023-08-14.

A2 This document supersedes EN 12663-1:2010+A1:2014. **A2**

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A2** **A2**.

This European Standard is part of the series EN 12663, *Railway applications — Structural requirements of railway vehicle bodies*, which consists of the following parts:

- *Part 1: Locomotives and passenger rolling stock (and alternative method for freight wagons)*
- *Part 2: Freight wagons*

A1 *deleted text* **A1**

A2 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. **A2**

Introduction

The structural design of railway vehicle bodies depends on the loads they are subject to and the characteristics of the materials they are manufactured from. Within the scope of this European Standard, it is intended to provide a uniform basis for the structural design of the vehicle body.

The loading requirements for the vehicle body structural design and testing are based on proven experience supported by the evaluation of experimental data and published information. The aim of this European Standard is to allow the supplier freedom to optimise his design whilst maintaining requisite levels of safety.

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EN 12663-1:2010+A2:2023 (E)**1 Scope**

This European Standard specifies minimum structural requirements for railway vehicle bodies.

This European Standard specifies the loads vehicle bodies should be capable of sustaining, identifies how material data should be used and presents the principles to be used for design validation by analysis and testing. This European Standard applies to locomotives and passenger rolling stock. EN 12663-2 provides the verification procedure for freight wagons and also refers to the methods in this standard as an alternative for freight wagons.

The railway vehicles are divided into categories which are defined only with respect to the structural requirements of the vehicle bodies. Some vehicles may not fit into any of the defined categories; the structural requirements for such railway vehicles should be part of the specification and be based on the principles presented in this European Standard.

The standard applies to all railway vehicles within the EU and EFTA territories. The specified requirements assume operating conditions and circumstances such as are prevalent in these countries.

In addition to the requirements of this European Standard the structure of all vehicles associated with passenger conveyance may generally be required to have features that will protect occupants in the case of collision accidents. These requirements are given in EN 15227.

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.

- Ⓐ₂ EN 13749:2021, *Railway applications - Wheelsets and bogies - Method of specifying the structural requirements of bogie frames*
- EN 15663:2017+A1:2018, *Railway applications - Vehicle reference masses*
- EN 16404:2016, *Railway applications - Re-railing and recovery requirements for railway vehicles*
- EN ISO 6892-1:2019, *Metallic materials - Tensile testing - Part 1: Method of test at room temperature (ISO 6892-1:2019)*

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3 Terms and definitions

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

3.1**railway vehicle body**

main load carrying structure above the suspension units including all components which are affixed to this structure which contribute directly to its strength, stiffness and stability

NOTE Mechanical equipment and other mounted parts are not considered to be part of the vehicle body though their attachments to it are.

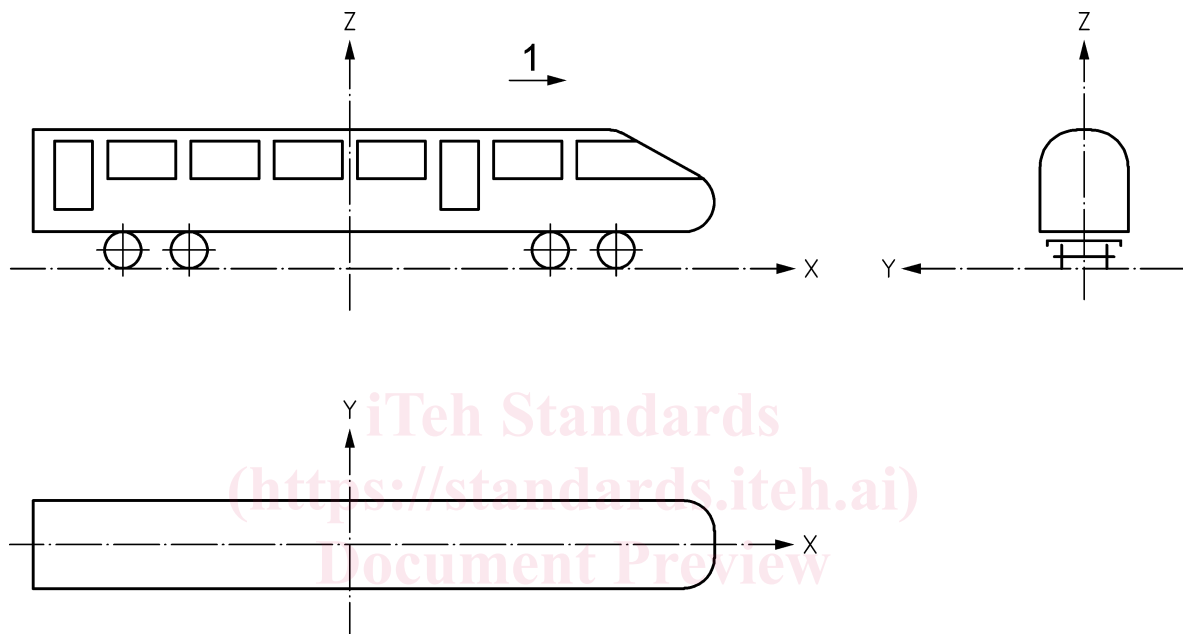
3.2

equipment attachment

fastener and any associated local load carrying substructure or frame which connect equipment to the vehicle body

4 Coordinate system

The coordinate system is shown in Figure 1. The positive direction of the x-axis (corresponding to vehicle body longitudinal axis) is in the direction of movement. The positive direction of the z-axis (corresponding to vehicle body vertical axis) points upwards. The y-axis (corresponding to vehicle body transverse axis) is in the horizontal plane completing a right hand coordinate system.



Key

- 1 driving direction
- X longitudinal direction
- Y lateral direction
- Z vertical direction

Figure 1 — Vehicle body coordinate system

5 Structural requirements

5.1 General

Railway vehicle bodies shall withstand the maximum loads consistent with their operational requirements and achieve the required service life under normal operating conditions with an adequate probability of survival.

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The capability of the railway vehicle body to sustain required loads without permanent deformation and fracture shall be demonstrated by calculation and/or testing as described by the validation programme in Clause 9.

The assessment shall be based on the following criteria:

- a) exceptional loading defining the maximum loading which shall be sustained and a full operational condition maintained;
- b) margin of safety as defined in 5.4.3 and 5.4.4, such that the exceptional load can be considerably exceeded before catastrophic fracture or collapse will occur;
- c) service or cyclic loads being sustained for the specified life without detriment to the structural safety;

A1

- d) loads due to re-railing and recovery operations without catastrophic failure. **A1**

The data defining the expected service conditions shall be part of the specification. From this data all significant load cases shall be defined in a manner that is consistent with the acceptance criteria.

NOTE Where appropriate, stiffness criteria as defined in 5.5 should be part of the specification.

The requirements of this European Standard are based on the use of metallic materials and requirements defined in 5.4.2, 5.4.3 and 5.6 and Clause 7 and Clause 8 are specifically applicable only to such materials. If different (non-metallic) materials are being used, then the basic principles of this standard shall still be applied and suitable data to represent the performance of these materials shall be used.

The load cases used as the basis of vehicle body design shall comprise the relevant cases listed in Clause 6.

All formal parameters are expressed as SI basic units and units derived from SI basic units. The acceleration due to gravity g is $-9,81 \text{ m/s}^2$.

5.2 Categories of railway vehicles

5.2.1 Structural categories

For the application of this European Standard, all railway vehicles are classified in categories.

The classification of the different categories of railway vehicles is based only upon the structural requirements of the vehicle bodies.

NOTE It is the responsibility of the customers to decide as to which category railway vehicles should be designed. There will be differences between customers whose choice of the category should take into account the shunting conditions and system safety measures. This is to be expected and should not be considered as conflicting with this European Standard.

Due to the specific nature of their construction and different design objectives there are three main groups, namely locomotives (L), passenger vehicles (P) and freight wagons (F). The three groups may be subdivided further into categories according to their structural requirements.

The categories for freight wagons are extracted from **A2** EN 12663-2:2010+A1:2023 **A2**.

The choice of category from the clauses below shall be based on the structural requirements as defined in the tables in Clause 6.

5.2.2 Locomotives

To this group belong all types of locomotives and power units whose sole purpose is to provide tractive motion and are not intended to carry passengers.

- Category L e.g. locomotives and power units.

5.2.3 Passenger vehicles

To this group belong all types of railway vehicles intended for the transport of passengers, ranging from main line vehicles, suburban and urban transit stock to tramways.

Passenger vehicles are divided into five structural design categories into which all vehicles may be allocated. The five categories are listed below, with an indication of the types of vehicle generally associated with each:

- Category P-I e.g. coaches;
- Category P-II e.g. fixed units and coaches;
- Category P-III e.g. underground, rapid transit vehicles and light railcar;
- Category P-IV e.g. light duty metro and heavy duty tramway vehicles;
- Category P-V e.g. tramway vehicles.

5.2.4 Freight wagons

All freight wagons in this group are used for the transportation of goods. Two categories have been defined:

- Category F-I e.g. vehicles which can be shunted without restriction;
- Category F-II e.g. vehicles excluded in hump and loose shunting.

5.2.5 Other types of vehicles

Some railway vehicles may not fit the descriptions associated with the above mentioned categories (e.g. the standard open bogie van for conveyance of motor vehicles may be treated as a P-I vehicle). The appropriate category for the structural requirements of such railway vehicles should be part of the specification.

5.3 Uncertainties in railway design parameters

5.3.1 Allowance for uncertainties

The uncertainties described in the following clauses may be allowed for by adopting limiting values of parameters or by incorporating a safety factor into the design process. This safety factor, designated *S*, shall then be applied when comparing the calculated stresses to the permissible stress as indicated in 5.4.

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NOTE In the design process the following should be considered with respect to criticality of the component failure: consequence of failure, redundancy, accessibility for inspection, detection of component failure, maintenance interval, etc.

The value of S shall be chosen to include the cumulative effect of all uncertainties not otherwise taken into account.

5.3.2 Loads

All loads used as the basis for vehicle body design shall incorporate any necessary allowance for uncertainties in their values. The loads specified in Clause 6 include this allowance. If the design loads are derived from on-track tests or other sources of information an allowance for uncertainty shall be used.

5.3.3 Material

For design purposes, the minimum material property values as defined by the material specification shall be used. Where the material properties are affected, for example, by:

- rate of loading;
- time (e.g. by material ageing);
- environment (moisture absorption, temperature, etc.);
- welding or other manufacturing processes,

appropriate new minimum values shall be determined.

Similarly, the S-N curve (Woehler curve) used to represent the fatigue behaviour of material shall incorporate the above effects and shall represent the lower bound of data scatter as defined in 7.3.

5.3.4 Dimensional tolerances

It is normally acceptable to base calculations on the nominal component dimensions. It is necessary to consider minimum dimensions only if significant reductions in thickness (due to wear, etc.) are inherent in the function of the component. Adequate protection against corrosion is an integral part of the vehicle specification. The loss of material by this cause can normally be neglected.

5.3.5 Manufacturing process

The performance characteristics exhibited by material in actual components may differ from those derived from test samples. Such differences are due to variations in the manufacturing processes and workmanship, which cannot be detected in any practicable quality control procedure.

5.3.6 Analytical accuracy

Every analytical procedure incorporates approximations and simplifications. The application of analytical procedures to the design shall be consciously conservative.