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Railway applications - Wheelsets and bogies - Part 1:
Design method for axles with external journals

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 13103-1:2017+A1:2022 sisaldab Euroopa standardi EN 13103-1:2017+A1:2022 ingliskeelset teksti.	This Estonian standard EVS-EN 13103-1:2017+A1:2022 consists of the English text of the European standard EN 13103-1:2017+A1:2022.
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English Version

Railway applications - Wheelsets and bogies - Part 1:
Design method for axles with external journals

Applications ferroviaires - Essieux montés et bogies -
Partie 1: Méthode de conception des essieux-axes avec
fusées extérieures

Bahnanwendungen - Radsätze und Drehgestelle - Teil
1: Konstruktionsleitfaden für außengelagerte
Radsatzwellen

This European Standard was approved by CEN on 11 September 2017 and includes Amendment 1 approved by CEN on 29 August 2022.

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

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Foreword

This document (EN 13103-1:2017+A1:2022) 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of an identical text or by endorsement, by June 2023 at the latest, and all conflicting national standards shall be withdrawn no later than June 2023.

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This document includes Amendment 1 approved by the CEN on 29 August 2022.

This document will supersede !EN 13103-1:2017".

The start and end of the text added or modified by the amendment are indicated in the text with ! and " respectively.

This document has been prepared in the context of a standardization request given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of Directive 2008/57/EC.

For the relationship with Directive 2008/57/EC, see informative Annex ZA, which forms an integral part of this document.

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

Introduction

Railway axles were among the first train components to give rise to fatigue problems.

Many years ago, specific methods were developed in order to design these axles. They were based on a feedback process from the service behaviour of axles combined with the examination of failures and on fatigue tests conducted in the laboratory, so as to characterize and optimize the design and materials used for axles.

A European working group under the aegis of UIC¹ started to harmonize these methods at the beginning of the 1970s. This led to an ORE² document applicable to the design of trailer stock axles, subsequently incorporated into national standards (French, German, Italian). It was consequently converted into a UIC leaflet.

The method for this standard is based on the calculation of nominal stresses using beam theory. It was developed at a time when the calculation method per finished item had yet to be established. Fatigue limit values were obtained from tests, and the level of stress on the test pieces was calculated using beam theory. In addition, fatigue correlation coefficients were determined in the same way, using the experimental results from test pieces of different diameters and transition radii.

The following three elements:

- calculation method;
- correction coefficient values;
- fatigue limit values;

are closely linked, with the values of the two latter parameters being dependent on the calculation method.

The bibliography lists the relevant documents used for reference purposes. The method described therein is largely based on conventional loadings (now deduced from the definition of the masses declined in EN 15663). The outcome is validated by many years of operations on the various railway systems.

This standard is based largely on this method which has been improved and its scope enlarged.

In order to simplify the maintenance of axle design standardization, it was decided to merge two previous documents EN 13103 and EN 13104 into a single standard, in the form of this document.

Furthermore, this standard makes reference to mass standard EN 15663 to define the loads used in the calculations.

¹ UIC: Union Internationale des Chemins de fer.

² ORE: Office de Recherches et d'Essais de l'UIC.

1 European scope

This European standard:

- defines the forces and moments to be taken into account with reference to masses, traction and braking conditions;
- gives the stress calculation method for axles with outside axle journals;
- specifies the maximum permissible stresses to be assumed in calculations for steel grades EA1N, EA1T and EA4T defined in EN 13261:2020³;
- describes the method for determination of the maximum permissible stresses for other steel grades;
- determines the diameters for the various sections of the axle and recommends the preferred shapes and transitions to ensure adequate service performance.

This European Standard applies to:

- axles defined in EN 13261:2020³;
- powered and non-powered axles;
- all track gauges³.

The design method for powered axles described in this European Standard applies to:

- solid or hollow powered axles for railway vehicles;
- solid or hollow non-powered axles for motor bogies;
- solid or hollow non-powered axles for locomotives.

The design method for non-powered axles described in this European Standard applies to solid or hollow axles for railway vehicles intended for the transportation of passengers or freight and which do not appear in the preceding list.

This European Standard is applicable to axles fitted to rolling stock intended to run under normal European conditions. Before using this European Standard, if there is any doubt as to whether the railway operating conditions are normal, it is necessary to determine whether an additional design factor has to be applied to the maximum permissible stresses. The calculation of wheelsets for special applications (e.g. tamping/lining/levelling machines) may be made according to this European Standard only for the load cases of free-running and running in train formation. This European Standard does not apply to workload cases. They are calculated separately.

This method may be used for light rail and tramway applications.

³ If the gauge is not standard, certain formulae need to be adapted.

2 Normative references

The following documents are referenced in a normative manner, in part or in full, in this document, and are indispensable for its application. For dated references, only the cited edition applies. For undated references, the last edition of the reference document applies (including any amendments).

!EN 13260:2020", *Railway applications — Wheelsets and bogies — Wheelsets — Product requirements*

!EN 13261:2020", *Railway applications- Wheelsets and bogies - Axles - Product requirements*

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

!EN 15663:2017+A1:2018", *Railway applications - Vehicle reference masses*

3 Terms and definitions

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

3.1

Powered axle

the following axles are considered as powered axles:

- solid or hollow powered axles for railway vehicles;
- solid or hollow non-powered axles for motor bogies;
- solid or hollow non-powered axles for locomotives

3.2

non-powered axle

a solid or hollow axle used for railway vehicles intended for the transportation of passengers or freight and that is not considered as a powered axle as defined in paragraph 3.1

3.3

technical specification

a document describing the specific parameters and/or requirements of the product in addition to the requirements of this standard

3.4

Guiding axle

!axle of the first (i.e. leading) bogie of a coach used at the head of a reversible trainset. If an axle can be used in both positions (guiding or non-guiding), it is to be considered as a guiding axle"