SLOVENSKI STANDARD
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Nadomešča:
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Železniške naprave - Kolesne dvojice in podstavni vozički - Kolesne dvojice - Zahtevane lastnosti proizvoda

Railway applications - Wheelsets and bogies - Wheelsets - Product requirements

Bahnanwendungen - Radsätze und Drehgestelle - Radsätze - Produktanforderungen

Applications ferroviaires - Essieux montés et bogies - Essieux montés - Prescriptions pour le produit

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

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English Version

Railway applications - Wheelsets and bogies - Wheelsets - Product requirements

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Bahnanwendungen - Radsätze und Drehgestelle - Radsätze - Produktanforderungen

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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European foreword

This document (prEN 13260:2023) was prepared by the CEN/TC 256 “Railway Applications” Technical Committee, the secretariat of which is held by the DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 13260:2020.

In comparison with the previous edition EN 13260:2020, the following technical modifications have been made:

— correction of several editing mistakes leading to technical misunderstandings;

— a clearer definition of the requirements for dynamic imbalance (4.2.4) and fatigue tests (4.2.2);

— a clarification of the product qualification conditions (Annex D);

— a clearer definition of the allowable rectifications of the wheelset after assembly (E.5).

This document has been prepared under a standardization request given to CEN/CENELEC by the European Commission and the European Free Trade Association and supports essential requirements of Directive (EU) 2016/797.

For the relationship with Directive (EU) 2016/797, see informative Annex ZA, which is an integral part of this document.

Introduction

After several years of use of the first editions of this document, this new edition includes improvements and additional data.

The product requirements have been harmonized across all three standards for wheelsets, wheels and axles.

In addition, the annexes concerning product qualification and the conditions of product supply, which were previously informative, were modified taking into account feedback and have become normative.

Due to significant in-service feedback on wheelsets in accordance with European Product Design and Qualification Standards, the fatigue test for the assembly is now limited in this revision to specific assembly designs and processes.

Annex A, with the press-fitting curves, contains much more detail than the previous version.

Annex C contains information for identifying wheelset components on the basis of standard EN 15313:2016. In addition, the “Freight Wagons” and “Locomotive and Passenger Vehicles” Rolling Stock TSIs require that a production verification process exists.

1 Scope

This document specifies the characteristics of wheelsets for all heavy rail track gauges.

This document applies to heavy rail vehicles and applies, in principle, to other vehicles such as urban rail vehicles.

This document applies to wheelsets made from elements defined by the following European standards:

— EN 13262:2020 for wheels;

— EN 13261:2020 for axles.

The requirements defined in this document apply to cylindrical wheel seats. Most of the requirements also apply to wheelsets with conical wheel seats. If needed, specific requirements for conical wheel seats (e.g. press-fitting curves, geometric dimensions...) are defined in the technical specification.

Some characteristics are given according to category 1 or category 2.

2 Normative references

The following documents referred to in the text establish, for all or part of their content, the requirements of this document. For dated references, only the cited edition applies. For undated references, the last edition of the reference document applies (including any amendments).

EN 13103-1:2017, *Railway applications — Wheelsets and bogies — Part 1: Design method for axles with external journals*

EN 13261:2020, *Railway applications — Wheelsets and bogies — Axles — Product requirements*

EN 13262:2020, *Railway applications — Wheelsets and bogies — Wheels — Product requirements*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for standardization, which can be accessed via the following addresses:

— IEC Electromedia: available at https://www.electropedia.org/

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

3.1
technical specification
document describing specific parameters and/or product requirements in addition to the requirements of this document

3.2
axle categories
classification of the component, based on operational aspects, that determines the list of requirements to be applied

Note 1 to entry: Category 1 is generally selected when the operating speed is greater than 200 km/h The wheelset is then composed of wheels and a category 1 axle, according to EN 13262:2020 for wheels and EN 13261:2020 for axles.

Note 2 to entry: Category 2 is divided into sub-categories (2a and 2b) to specify certain characteristics:

— 2a) max. speed ≤ 120 km/h;

— 2b) 120 < max. speed ≤ 200 km/h

Note 3 to entry: These categories can also be defined in accordance with the technical specification.

4 Product definition

4.1 Assembly of components

4.1.1 General

Before assembly, the various components of the wheelset shall fulfil the geometric requirements of the specific documents that define them. In particular, the axle and wheels shall be in the "ready for assembly" state defined in EN 13262:2020 for wheels and EN 13261:2020 for axles.

The components of the wheelset can be shrink-fitted or press-fitted to the axle.

For removal, the press-fitted or shrink fitted components (wheels, brake disc, couplings, gear wheels) shall use an oil injection feature.

The interference fits to be used shall be defined by the technical specification, depending on the characteristics of the material used for this element and the forces and torques to be transmitted through the fit. This interference shall be defined according to the geometric tolerances of the wheel seats and the interference values are specified in 4.1.2.

In the case of shrink-fitting, the wheel shall be heated and its temperature shall not exceed 250 °C. If a different heating method is used, proof shall be provided that it has had no influence on the characteristics of the wheel, as defined in EN 13262:2020.

If another fitting method is used, it shall be defined in the technical specification. It shall at least demonstrate that the characteristics of the axle and wheel as defined in EN 13261:2020 and EN 13262:2020 are not affected by the fitting. Then the mechanical resistance of the assembly (see 4.2.1) shall be demonstrated and the traceability documents for each fitting shall be defined to give the same type of information as specified in E.6.

The static imbalance of the two wheels on each wheelset shall be within the same diametric plane and on the same side of the axle. The static imbalance of the brake discs shall be in the same plane as the wheels but on the opposite side of the axle.

4.1.2 Interference between wheel seat and wheel hub bore

If no other requirement is given in the technical specification, the interference values "*j*" to fulfil are, in millimetres:

— for shrink-fitting: 0,000 9 $dm \leq j \leq$ 0,001 5 dm;

— for press-fitting: 0,001 0 $dm \leq j \leq$ 0,001 5 dm + 0,06;

where *dm* is the wheel seat nominal diameter in millimetres.

4.1.3 Press-fitting diagram

4.1.3.1 Results to be achieved

For press-fitting, the force-displacement curve ensures that the fitting has not damaged the contact surfaces and that the specified interference is effective.

The shape of the curve to be achieved is defined in Annex A.

The final fitting force F_f is a function of the force F defined in 4.2.1 and shall be within the range:

$$0{,}85\ F \leq F_f \leq 1{,}45\ F$$

This range applies to:

— press-fitting of solid wheels;

— with L_f/dm 0,8 to 1,1, where dm is the nominal diameter of the wheel seat, and L_f is the fitting length (in mm);

— molybdenum-based pastes (MoS_2) and tallow.

If other lubricants are used, they shall be defined in the technical specification and verified during the product qualification in accordance with Annex D, including the counter-press test in accordance with 4.2.1.

4.1.3.2 Measurement method

The press used for assembling shall have a calibrated system to plot the diagram representing the force value at each position of the element to be fitted, obtained during the displacement of the element on the axle. The x-axis scale of the displacement shall be at least 0,5 times the actual displacement of the element to be fitted. The y-axis scale of force shall allow the force to be read at each point of the curve at an accuracy of 25 kN. The accuracy of the force sensor shall be 10 kN. The x-axis and y-axis can be inverted.

In the case of point recording, at least one point shall be plotted per millimetre of relative displacement of the parts to be fitted and per 25 kN variation in force.

4.2 Wheelset characteristics

4.2.1 Mechanical resistance of assemblies

4.2.1.1 General requirements

Annexes A and E define the need to perform this test.

4.2.1.2 Results to be achieved

In order to transmit moments and forces between the axle and the wheel, the assembly shall be able to withstand an axial force *F* for 30 s, without displacement between one element and another.

This force *F* shall be defined in the technical specification.

For wheels, if no specific requirement is given in the technical specification, the value of F is as follows:

$F = 4\ dm$

when

$0{,}8\ dm \leq L_f \leq 1{,}1\ dm$

where

dm is the nominal diameter of the wheel seat in mm, L_f is the length of the fitting in millimetres and F is the force in kN.

4.2.1.3 Test method

The test shall be performed on a press equipped with a device to record forces.

The force is applied gradually up to the value F, between one of the hub faces of the fitted element and the axle.

For press-fitted wheels, the counter-press test is recommended to be carried out no earlier than 48 h after the fitting.

For shrink-fitted wheels, the test shall be carried out when the wheel and axle have returned to the same temperature after the fitting.

4.2.2 Fatigue characteristics

4.2.2.1 General

This subclause defines the rotational bending fatigue limit values for 10^7 cycles. These values are used to calculate the maximum permissible axle seat stresses and are required for the application of EN 13103-1:2017. These values are valid for “conventional” axle designs, wheels and assembly processes (press-fitting or shrink-fitting) and do not need to be verified for product qualification.

NOTE A design is considered “conventional” when the parameters defining the assembled parts fulfil the requirements of European Product and Design Standards for internal and external journals (e.g. roughness, geometry, interference adjustment, overlap, diameter ratios, steel grades, etc.).

For other types of design or assembly processes (e.g. cooling a wheel seat, specific diameter ratio, new materials, specific surface coating of the wheel seat, etc.), the following characteristics shall be verified and tested at least once in the event of a new or modified set of parameters affecting the assembly.

These fatigue characteristics are not the same for a solid axle and a hollow axle. This is the result of the axle bore effect on stress distribution.

For a solid axle, only one fatigue limit (F_3) shall be determined under the fitting surfaces.

For a hollow axle, given that the fitting effect is greater on journals than on other fitting surfaces due to the difference in metal thickness, two fatigue limits shall be considered:

— under the wheel seat, excluding journals, limit F_4;

— under the fitted parts of the journal, limit F_5.

If necessary, the fatigue limit F_3 or F_4 shall be verified by testing during product qualification (see Annex D). The fatigue limit F_5 can be calculated using the ratios F_4/F_5 = 1,17 and F_3/F_5 = 1,28.

NOTE Fatigue characteristics F_1 and F_2 of the axle are defined in EN 13261:2020.

4.2.2.2 Fatigue limits

The minimum fatigue limits for wheelset axles are given in Table 1.

Table 1 — Minimum fatigue limits for wheelset axle (in MPa)

Steel grade	F_3	F_4	F_5
EA1N/EA1T	120	110	94
EA4T	145	132	113

4.2.2.3 Fatigue test pieces

For fatigue testing of wheelsets, a wheel or dummy test wheel with similar dimensions (especially the hub) shall be press-fitted or shrink-fitted on the wheel seat. The interference shall fulfil the requirements of 4.1.2.

The area of the test piece where the crack is expected to initiate shall have geometry, environment and surface characteristics representative of the axle.

Examples of test pieces are given in Annex B.

4.2.2.4 Test method

Tests shall be carried out on machines that can create rotating bending stresses in the area where it is required to initiate a crack.

For each limit F_3 and F_4, it shall be verified on three test pieces that no cracks have propagated after 10^7 cycles of a load creating a surface stress equal to F_3 or F_4. Indications with a depth of less than 0,5 mm shall not be considered as propagating cracks.

These stress levels shall be calculated on the wheel seat according to the beam theory, without taking into account the interference stresses.

4.2.3 Electrical resistance

The electrical resistance of each wheelset, measured between the treads of the two wheels shall not exceed 0,01 Ω.

The device and method used for this measurement shall be defined in the technical specification.

4.2.4 Dynamic imbalance

4.2.4.1 Maximum permissible values

For a non-powered wheelset of a vehicle capable of running at a speed greater than 120 km/h, the maximum dynamic imbalance values are given in Table 2. They shall be measured in the wheel plane.

For category 1 wheelsets, the dynamic imbalance shall be measured individually.

For category 2 wheelsets (speed greater than 120 km/h), the dynamic imbalance shall be measured individually, unless otherwise specified in the technical specification.

Table 2 — Maximum dynamic imbalance values

Speed km/h	Imbalance g·m
120 < S ≤ 200	75
S > 200	50

For a powered wheelset, balancing shall be achieved by the fulfilment of each component imbalance requirement (wheels, brake discs and other components such as couplings and gears) and placement in the correct orientation in order to ensure minimum imbalance (see 4.1.1 for wheels and brake discs). In this case, dynamic imbalance measurement is not necessary.

4.2.4.2 Test piece

The imbalance is measured on a fully assembled and machined wheelset.

4.2.4.3 Test method

The device and method used for this measurement shall be defined in the technical specification.

4.2.5 Dimensions and tolerances

4.2.5.1 General

The dimensions of the wheelset shall be in accordance with the design drawings, and the dimensional and geometrical tolerances to be applied when assembling the different parts of the wheelset are given in the following subclauses.

Wheelset dimensions and tolerances depend on the category of the wheelset.

The values are given for measurements made without any load on the wheelset.

4.2.5.2 Wheels

Unless otherwise specified in the technical specification, the parameter tolerances defined in Figure 1 shall be those given in Table 3.

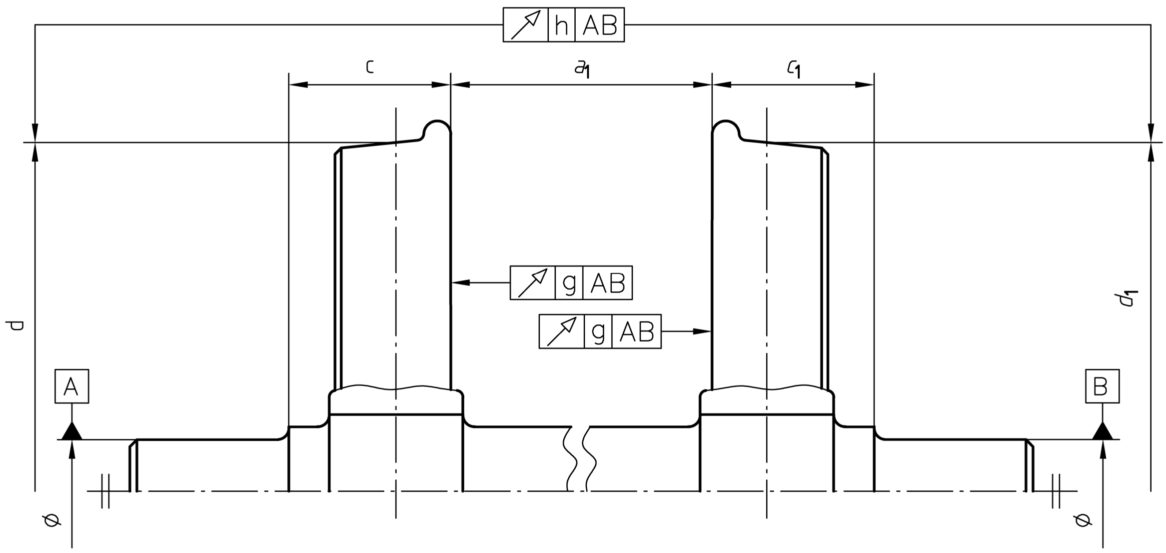

Figure 1 — Wheelset parameters