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Railway applications - Wheelsets and bogies - Axles - Product requirements

Applications ferroviaires - Essieux montés et bogies -
Essieux-axes - Prescription pour le produit

Bahnanwendungen - Radsätze und Drehgestelle -
Radsatzwellen - Produktanforderungen

This European Standard was approved by CEN on 5 July 2020.

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 CEN-CENELEC Management Centre or to any CEN member.

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EN 13261:2020 (E)**European foreword**

This document (EN 13261:2020) was prepared by the CEN/TC 256 "Railway Applications" Technical Committee, the secretariat of which is held by the DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, by March 2021 at the latest, and all conflicting national standards shall be withdrawn no later than March 2021.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights or similar rights. CEN and/or CENELEC shall not be held responsible for identifying all or some of these patent rights.

This document supersedes EN 13261:2009+A1:2010.

This document has been prepared within the framework of a mandate given to CEN by the European Commission and the European Free Trade Association and supports the essential requirements of Directive 2016/797/EC.

For the relationship with Directive 2016/797/EC, see informative Annex ZA, which forms an integral part of this document.

For a description of the technical changes made in this new edition, see the Introduction.

The informative annexes to this document provide additional guidance that is not mandatory but that helps to understand or use the document.

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NOTE The informative annexes may contain optional requirements. For example, a test method that is optional, or presented as an example, may contain requirements, but it is not necessary to meet these requirements to be in compliance with the document.

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, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, the Republic of North Macedonia, the Republic of Serbia, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

After several years of using the first two editions of this document (EN 13261: 2003 and EN 13261:2009), this new edition incorporates further improvements and data, such as the results of European projects.

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

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

Also, the “freight wagon” and “locomotive and passenger vehicle” TSIs require the existence of a production verification process.

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EN 13261:2020 (E)**1 Scope**

This document specifies the characteristics of the axles for all track gauges.

This document applies to heavy railway vehicles but may also apply to other vehicles such as light railway vehicles, trams or undergrounds.

It defines the characteristics of axles manufactured by forging or rolling, in vacuum-degassed steel, grade EA1N¹, EA1T¹ and EA4T¹. For hollow axles, this document only applies to those obtained by machining the hole in a solid forged or rolled axle.

The requirements defined in this standard apply to cylindrical wheel seats. Most of the requirements also apply to wheelsets with conical wheel seats. Specific requirements for conical wheel seats (e.g. geometric dimensions) are defined in the technical specification.

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

This document applies to axles whose design complies with the rules defined in EN 13103-1.

This document also allows variations in material characteristics in relation to alternative manufacturing processes (e.g. cold forging, shot peening, thermal spraying, steel cleanliness, reduction ratio, improvement of material properties through fusion or heat treatment processes, etc.).

2 Normative references

The following documents referred to in the text constitute, for all or part of their content, 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, *Railway applications – Wheelsets and bogies – Non-powered axles – Part 1: Design method for axles with external journals*

EN 22768-1, *General tolerances – Part 1: Tolerances for linear and angular dimensions without individual tolerance indications (ISO 2768-1)*

EN 22768-2, *General tolerances – Part 2: Geometrical tolerances for features without individual tolerance indications (ISO 2768-2)*

EN ISO 148-1, *Metallic materials – Charpy pendulum impact test – Part 1: Test method (ISO 148-1)*

EN ISO 643:2012, *Steels - Micrographic determination of the apparent grain size (ISO 643:2012)*

EN ISO 11997-1:2006, *Paints and varnishes - Determination of resistance to cyclic corrosion conditions - Part 1: Wet (salt fog)/dry/humid (ISO 11997-1:2006)*

EN ISO 2409:2013, *Paints and varnishes – Cross-cut test (ISO 2409:2013)*

EN ISO 2808, *Paints and varnishes – Determination of film thickness (ISO 2808)*

EN ISO 4624:2016, *Paints and varnishes - Pull-off test for adhesion (ISO 4624:2016)*

¹ N for a standardised metallurgical state;

T for a quenched and tempered metallurgical state.

EN ISO 6507-1, *Metallic materials – Vickers hardness test – Part 1: Test method (ISO 6507-1)*

EN ISO 6892-1, *Metallic materials – Tensile testing – Part 1: Method of test at room temperature (ISO 6892-1)*

EN ISO 9227, *Corrosion tests in artificial atmospheres – Salt spray tests (ISO 9227)*

EN ISO 14284:2002, *Steel and iron - Sampling and preparation of samples for the determination of chemical composition (ISO 14284:1996)*

EN ISO 16276-2, *Corrosion protection of steel structures by protective paint systems – Assessment of, and acceptance criteria for, the adhesion/cohesion (fracture strength) of a coating – Part 2: Cross-cut testing and X-cut testing*

ISO 4967:2013, *Steel - Determination of content of non-metallic inclusions - Micrographic method using standard diagrams*

ISO 5948:2018, *Railway rolling stock material - Ultrasonic acceptance testing*

ISO 6933:1986, *Railway rolling stock material - Magnetic particle acceptance testing*

ISO/TR 9769²⁾, *Steel and iron – Review of available methods of analysis*

3 Terms and definitions **ITh STANDARD PREVIEW** (standards.iteh.ai)

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

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

- IEC Electropedia: available at <https://standards.iteh.ai/catalog/standards/sist/08ba0ed9-6547-4c22-bf16-676118c79072/iec-60383-1-2020>
- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

Technical specification

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

²⁾ See also CEN/TR 10261.

EN 13261:2020 (E)**3.2****Batch**

A batch is composed of axles assumed to have the same characteristics

Note 1 to clause: A batch consists of axles of the same design obtained by forging or rolling a raw material from a single cast and having undergone the same hot deformation process and having been heat treated at the same time with the same procedure. If the raw material is obtained from several casts with the expected chemical composition, the resulting axles can be combined in a batch. In this case, it is necessary to prove during product qualification that the axles from the different casts meet the product qualification requirements.

3.3**Axle categories**

Classification of the component, based on operational aspects, which determines the list of requirements to be applied

Note 1 to clause: Category 1 is generally selected when the traffic speed is greater than 200 km/h.

Note 2 to clause: Vehicles travelling at speeds of 200 km/h or less typically use Category 2 axles.

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

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4 Product definition

4.1 Chemical composition

4.1.1 Values to be obtained

The percentage limit values of the various elements must meet the indications in Table 1.

Table 1 — Limit levels by product analysis

Grade	C %	Si %	Min %	P ^a %	S ^{a b} %	Cr %	Cu %	Mb %	Ni %	\tab V %
EA1N	≤ 0.40	≤ 0.50	≤ 1.20	≤ 0.020	≤ 0.015 ^{a b}	≤ 0.30	≤ 0.30	≤ 0.08	≤ 0.30	≤ 0.06
EA1T	≤ 0.40	≤ 0.50	≤ 1.20	≤ 0.020	≤ 0.015 ^{a b}	≤ 0.30	≤ 0.30	≤ 0.08	≤ 0.30	≤ 0.06
EA4T	≥ 0.22 ≤ 0.29	≥ 0.15 ≤ 0.40	≥ 0.50 ≤ 0.80	≤ 0.020	≤ 0.015 ^b	≥ 0.90 ≤ 1.20	≤ 0.30	≥ 0.15 ≤ 0.30	≤ 0.30	≤ 0.06

^a A maximum content of 0.025% may be agreed in the technical specification.

^b A minimum sulphur content may be agreed in the technical specification based on the steel development process to protect against hydrogen embrittlement.

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4.1.2 Sampling methods

The sample must be taken at the mid-radius of solid axles, or at the mid-distance between external and internal surfaces of hollow axles.

The chemical composition can alternatively be determined by analysing a sample from the cast.

For forged axles, if the method is included in the technical specification, a sample can be extracted from an overlength of the axle journals as specified in Annex A.

4.1.3 Analysis method

The chemical composition analysis must be performed in accordance with the methods and instructions described in ISO/TR 9769 unless another standard is defined in the technical specification.

NOTE ASTM E415-14 or ASTM E1019-11 may be used.

4.2 Mechanical characteristics

4.2.1 Characteristics from the tensile testing

4.2.1.1 Values to be obtained

Values to be obtained at the mid-radius of solid axles, or at the mid-distance between external and internal surfaces of hollow axles, are specified in Table 2.

Values to be obtained near the external surface of the axles must be ≥ 0.95 times the values measured at mid-radius of the solid axles or at mid-distance between the internal and external surfaces of hollow axles.

Values to be obtained at the centre of the solid axles, or near the internal surface of the hollow axles, must be ≥ 0.8 times the values measured at mid-radius or mid-distance between internal and external surfaces.

Table 2 — Values to be obtained at mid-radius of solid axles or mid-distance between internal and external surfaces of hollow axles

Grade	R_{eH}^a MPa	R_m MPa	A_5 %
EA1N	≥ 320	550 - 650	≥ 22
EA1T	≥ 350	550-700	≥ 24
EA4T	≥ 420	650-800	≥ 18

^a If there is no apparent yield strength, the conventional $R_{p0.2}$ limit must be determined.

4.2.1.2 Positions of the test pieces

The test pieces must be collected at three levels from the largest diameter section of the axle:

- 1) as close as possible to the external surface for all axles;
- 2) at mid-radius and in the centre of the solid axles;
- 3) at mid-distance between internal and external surfaces, and near the internal surface, for hollow axles;

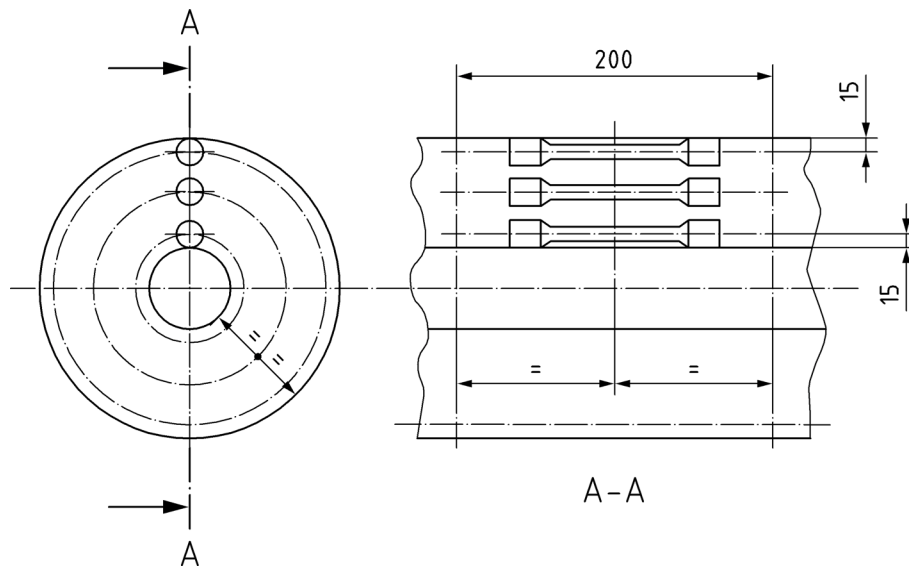
as shown in Figure 1 a) and b).

For forged axles, if the method is included in the technical specification, the test pieces can be extracted from an overlength of the axle journals as specified in Annex A.

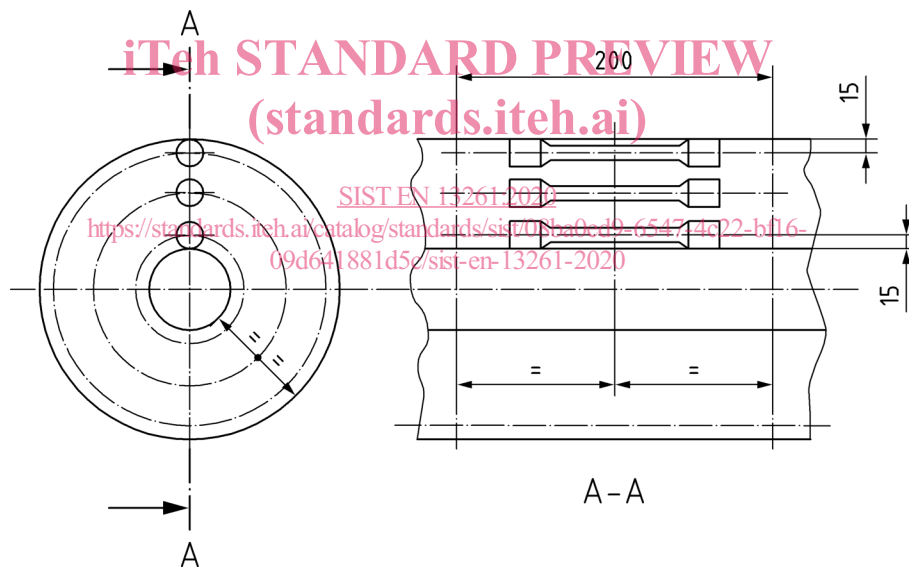
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Dimensions in millimetres



a) Solid axle



b) Hollow axle

Figure 1 — Position of test pieces

4.2.1.3 Test method

The test must be carried out in accordance with the requirements of EN ISO 6892-1. The diameter of the test piece must be at least 10 mm in its calibrated part. The length of the measuring gauge must be 5 times the diameter.