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01-december-2010

Železniške naprave - Kolesne dvojice in podstavni vozički - Osi - Zahtevane lastnosti proizvoda

Railway applications - Wheelsets and bogies - Axles - Product requirements

Bahnanwendungen - Radsätze und Drehgestelle - Radsatzwellen - Produktanforderungen

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Ta slovenski standard je istoveten z: **EN 13261:2009+A1:2010**

ICS:

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

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 13261:2009+A1

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ICS 45.040

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English Version

Railway applications - Wheelsets and bogies - Axles - Product requirements

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Foreword

This document (EN 13261:2009+A1:2010) 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of an identical text or by endorsement, at the latest by April 2011, and conflicting national standards shall be withdrawn at the latest by April 2011.

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 comprises amendment 1 adopted by CEN on 2010-09-14.

This document supersedes EN 13261:2009.

The start and end of the text added or modified by the amendment is indicated in the text by the !" marks.

〈A1〉 This document has been prepared under a mandate given to CEN/CENELEC/ETSI by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2008/57/EC. 〈A1〉

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〈A1〉 For relationship with EU Directive 2008/57/EC, see informative Annex ZA, which is an integral part of this document. 〈A1〉

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Introduction

Normative documents which have been used until now in Europe for axle delivery (UIC leaflets, national standards) had, for the main purpose, a complete definition of delivery procedures and axle characteristics that were to be measured.

Product qualification was sometimes mentioned, but the procedures and the characteristics that had to be verified for the qualification were not given.

This standard addresses these issues by:

a) definition of all axle characteristics; these are verified either during qualification or delivery of the product (see clause 3);

b) definition of qualification procedures (see Annex I);

c) definition of delivery conditions (see Annex J); here, a choice is given to the supplier of either:

   1) a traditional delivery procedure with a control by batch sampling as in existing documents (see J.5), or;

   2) a delivery procedure using quality assurance concepts (see J.6).

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1 Scope

This European Standard specifies the characteristics of axles for use on European networks.

It defines characteristics of forged or rolled solid and hollow axles, made from vacuum-degassed steel grade EA1N[1] that is the most commonly used grade on European networks. For hollow axles, this standard applies only to those that are manufactured by machining of a hole in a forged or rolled solid axle

In addition, the particular characteristics for axles in grade EA1T[1] and EA4T[1] are given in Annex A.

Two categories of axle are defined, category 1 and category 2. Generally, category 1 is chosen when the operational speed is higher than 200 km/h.

This standard is applicable to axles that are designed in accordance with the requirements of EN 13103 and EN 13104.

NOTE Different values for some characteristics may be agreed if a particular process of fabrication (e.g. cold rolling, shot peening, shot peening, steel cleanliness, reduction ratio, improved material properties from melting and heat treatment processes, etc.) has an influence on them.

2 Normative references

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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.

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EN 10002-1, *Metallic materials — Tensile testing — Part 1: Method of test at ambient temperature*

EN 10045-1, *Metallic materials — Charpy impact test — Part 1: Test method*

EN 13103, *Railway applications — Wheelsets and bogies — Non-powered axles — Design method*

EN 13104, *Railway applications — Wheelsets and bogies — Powered axles — Design method*

EN 13260, *Railway applications — Wheelsets and bogies — Wheelsets — Product requirements*

EN 20898-2:1993, *Mechanical properties of fasteners — Part 2: Nuts with specified proof load values — Coarse thread (ISO 898-2:1992)*

EN 22768-1, *General tolerances — Part 1: Tolerances for linear and angular dimensions without individual tolerance indications (ISO 2768-1:1989)*

EN 22768-2, *General tolerances — Part 2: Geometrical tolerances for features without individual tolerance indications (ISO 2768-2:1989)*

EN ISO 643:2003, *Steels — Micrographic determination of the apparent grain size (ISO 643:2003)*

EN ISO 2409:2007, *Paints and varnishes — Cross-cut test (ISO 2409:2007)*

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[1] N for a normalized metallurgical condition
T for a quenched and tempered metallurgical condition

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EN ISO 2808:2007, *Paints and varnishes — Determination of film thickness (ISO 2808:2007)*

EN ISO 9227:2006, *Corrosion tests in artificial atmospheres — Salt spray tests (ISO 9227:2006)*

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

ISO 4967:1998, *Steel — Determination of content of non-metallic inclusions — Micrographic method using standard diagrams*

ISO 5948:1994, *Railway rolling stock material — Ultrasonic acceptance testing*

ISO 6933:1986, *Railway rolling stock material — Magnetic particle acceptance testing*
.
ISO/TR 9769[2] *Steel and iron — Review of available methods of analysis*.

3 Product definition

3.1 Chemical composition

3.1.1 Values to be achieved

The maximum percentage contents of the various elements are given in Table 1.

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Table 1 — Limit values by product analysis (%)

C	Si	Mn	P [a]	S [ab]	Cr	Cu	Mo	Ni	V
0,40	0,50	1,20	0,020	0,020	0,30	0,30	0,08	0,30	0,06

[a] A maximum content of 0,025 % may be agreed at the time of enquiry and the order.
[b] A minimum sulfur content may be agreed at the time of enquiry and the order according to the steelmaking process, in order to safeguard against hydrogen embrittlement.

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3.1.2 Location of sample

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

3.1.3 Chemical analysis

The chemical composition analysis shall be performed according to the methods and definitions described in ISO/TR 9769.

[2] See also CEN/TR 10261.

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3.2 Mechanical characteristics

3.2.1 Characteristics from tensile test

3.2.1.1 Values to be achieved

The values to be achieved at mid-radius of solid axles or at mid-distance between external and internal surfaces of hollow axles are given in Table 2.

The values to be achieved near the external surface shall be greater than or equal to 0,95 times the values measured at mid-radius of solid axles or at the mid-distance between external and internal surfaces of hollow axles.

The values to be achieved in the centre of solid axles or near the internal surface of hollow axles shall be greater than or equal to 0,8 times the values measured at mid-radius or at mid-distance between external and internal surfaces.

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

R_{eH}(N/mm²)[a]	R_m (N/mm²)	A_5%
≥ 320	550-650	≥ 22
[a] If no distinctive yield strength is present, the proof stress $R_{p0,2}$ shall be determined.		

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3.2.1.2 Location of test pieces

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The test pieces shall be taken from three levels in the largest axle section:

1) as near as possible to the external surface for all the axles;

2) at mid-radius and in the centre of solid axles;

3) at mid-distance between external and internal surfaces, and near the internal surface of hollow axles

as shown in Figure 1 a) and b).

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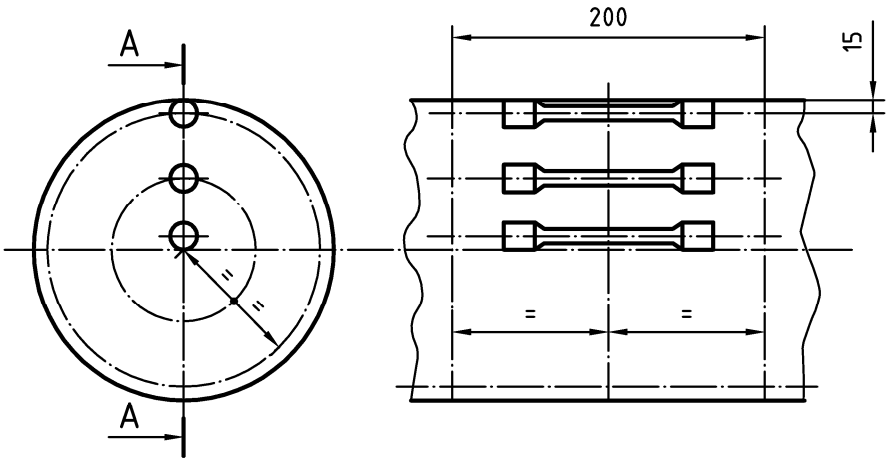
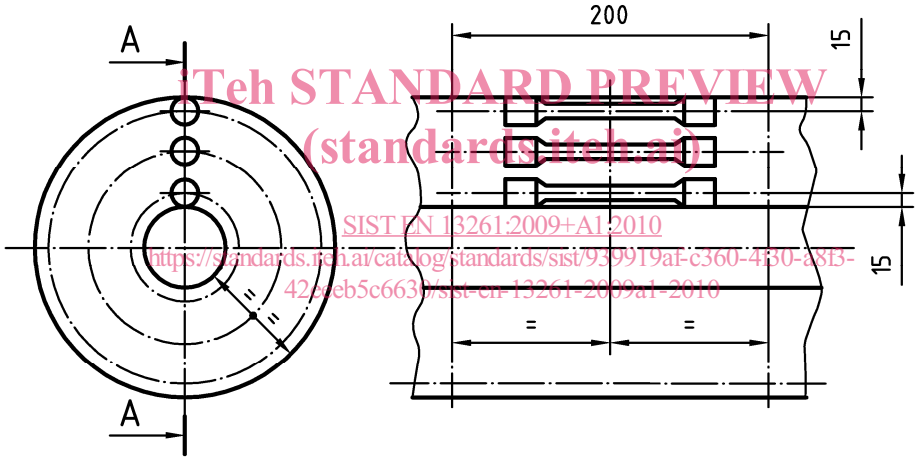
Dimensions in millimetres



1a) — Solid axle



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1b) — Hollow axle

Figure 1 — Location of test pieces

3.2.1.3 Test method

The test shall be carried out in accordance with EN 10002-1. The test piece diameter shall be at least 10 mm in the machined-down portion. The gauge length shall be five times the diameter.

3.2.2 Impact test characteristics

3.2.2.1 Values to be achieved

Impact test characteristics shall be determined at 20 °C in the longitudinal and the transverse directions. Values to be achieved at mid-radius of solid axles, or at mid-distance between external and internal surfaces of hollow axles, are given in Table 3.

Near the surface, they shall be greater than or equal to 0,95 times the values measured at mid-radius or at

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mid-distance between external and internal surfaces of hollow axles.

In the centre of solid axles or near the internal surface of hollow axles, they shall be greater than 0,8 times the values measured at mid-radius or at mid-distance between external and internal surfaces.

For each level (surface, mid-radius, centre), the average value of the 3 test pieces (see 3.2.2.2) is defined in Table 3.

No individual value shall be less than 70 % of the values in Table 3.

Table 3 — Values to be achieved at mid-radius or at mid-distance between external and internal surfaces of hollow axles

***KU* longitudinal (J)**	***KU* transverse (J)**
≥ 30	≥ 20

3.2.2.2 Location of test pieces

The test pieces shall be taken from three levels in the largest axle section:

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

as shown in Figure 2a) and 2b).

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3.2.2.3 Test method

The test shall be carried out in accordance with EN 10045-1.

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Dimensions in millimetres

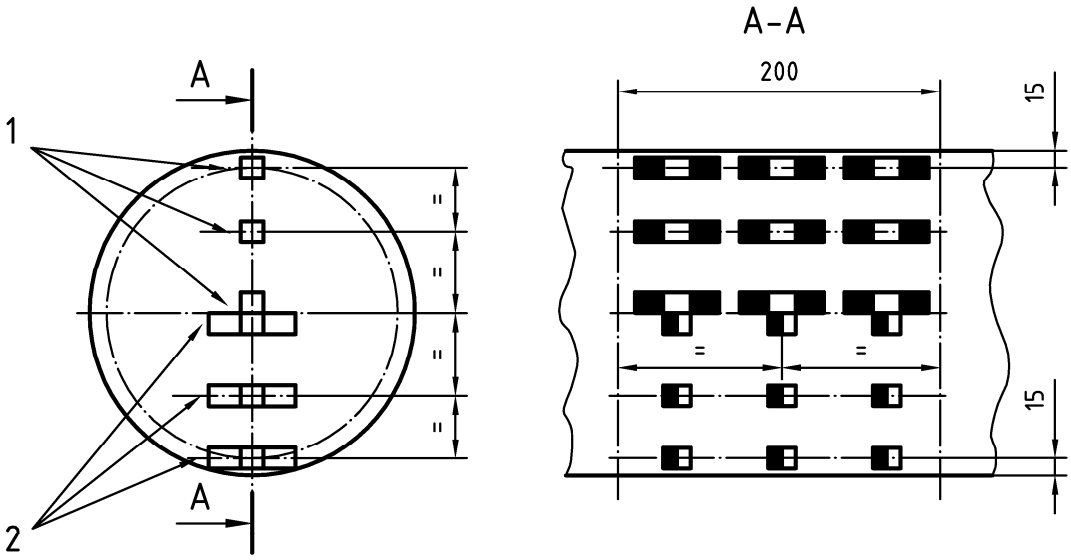

Figure 2a) — Solid axle

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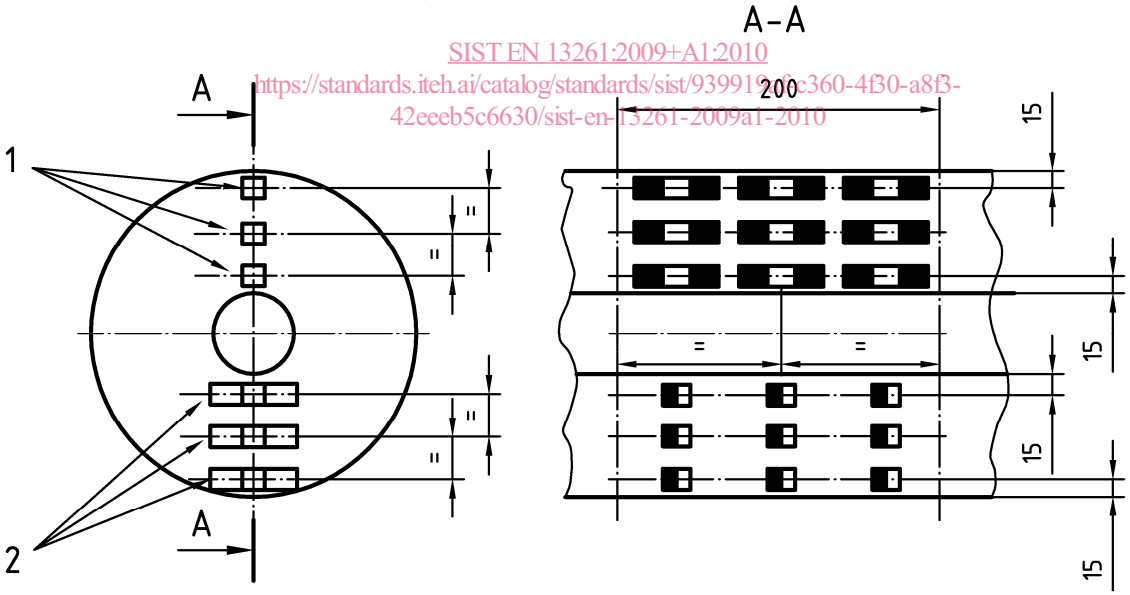

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Figure 2b) — Hollow axle

Key

1 longitudinal test piece

2 transverse test piece

Figure 2 — Location of test pieces

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3.2.3 Fatigue characteristics

3.2.3.1 General

3.2.3.1.1 Introduction

Verification of the fatigue characteristics is essential in order to have a correctly dimensioned axle. The satisfactory performance of an axle in service depends upon these characteristics. The values defined in this subclause are used for the calculation of the maximum permissible stresses that are referred to in the design rules in EN 13103 and EN 13104.

It is necessary to estimate the fatigue limits in the following two areas, in order to predict the behaviour of the axle under in-service stresses:

1) for the material, tests are made on reduced test pieces, for which the shapes do not depend upon the product geometry;

2) for the product, tests are made on full size test pieces, for which the dimensions and manufacture are similar to the final product and its associated permissible fabrication defects.

3.2.3.1.2 Fatigue limits on reduced test pieces

The fatigue limits defined with reduced test pieces are used to verify that the notch effect of the material used for the fabrication of the axle is in accordance with the security coefficient "*S*" defined in design standards EN 13103 and EN 13104. They are determined from:

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— unnotched surface test pieces (fatigue limit R_{fL});

— notched test pieces (fatigue limit R_{fE}).

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3.2.3.1.3 Fatigue limits on full size test pieces

The limits determined on full size test pieces are used to verify that the axle fatigue characteristics are in accordance with those that are used to calculate the maximum permissible stresses referred to in design standards EN 13103 and EN 13104.

These fatigue limits apply to different axle areas. Only the fatigue limits applying to the axle body are taken into account in this standard. The limits applying to the wheelset depend mostly on the assembly and are referred to in EN 13260.

It is necessary to define two fatigue limits:

— on the body surface, limit F_1;

— on the bore surface in the case of a hollow axle, limit F_2.

3.2.3.2 Values to be achieved

The values to be achieved are given in Table 4.

Table 4 — Fatigue limit values

Limit	F_1	F_2	R_{fL}	R_{fE}	$q=R_{fL}/R_{fE}$
Value	≥ 200 N/mm²	≥ 80 N/mm²	≥ 250 N/mm²	≥ 170 N/mm²	≤ 1,47