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Railway applications - Wheelsets and bogies - Wheels - Product requirements

Bahnanwendungen - Radsätze und Drehgestelle - Räder, Produktanforderungen

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

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45.040

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ICS 45.040

English version

Railway applications - Wheelsets and bogies - Wheels - Product requirement

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Roues - Prescription pour le produit

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Produktanforderungen

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 13262:2004) 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of an identical text or by endorsement, at the latest by September 2004, and conflicting national standards shall be withdrawn at the latest by September 2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document

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

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Introduction

Normative documents which have been used until now in Europe for the wheel delivery (UIC leaflets, national standards) had for the main purpose, a complete definition of the delivery procedures and the wheel 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 requirements by:

- a) definition of all the wheel characteristics. These are either verified during the qualification or delivery of the product (see clause 3);
- b) definition of the qualification procedures (see informative annex E);
- c) definition of the delivery conditions (see informative annex F). Here, a choice is given to the supplier of either:
 - a traditional delivery procedure with a control by batch sampling as in existing documents (see F.4), or
 - a delivery procedure using quality assurance concepts (see F.5)

The standard defines the wheel product qualification, the technical approval procedure is not within the scope of this standard.

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1 Scope

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

Four steel grades, ER6, ER7, ER8 and ER9 are defined in this standard.

Some characteristics are defined according to a category 1 or a category 2. Category 1 is generally chosen when the train speed is higher than 200 km/h.

These categories can sometimes be subdivided, depending upon the characteristics.

This standard is applicable to solid forged and rolled wheels which are made from vacuum degassed steel and have a chilled rim. They are to have already been used in commercial conditions on a European network in a significant quantity, or to have satisfied a technical approval procedure according to EN 13979-1 for their design.

NOTE 1 The definition of other wheels may be found in other documents, such as UIC leaflets or ISO standards.

NOTE 2 The technical approval procedure is not within the scope of this standard.

NOTE 3 "Rim-chilled" describes heat treatment of the rim, the aim of which is to harden the rim and to create compressive residual stresses in the rim.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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 ISO 6506-1, *Metallic materials - Brinell hardness test - Part 1: Test method (ISO 6506-1:1999)*

ISO 377-2:1989¹⁾ *Selection and preparation of samples and test pieces of wrought steels - Part 2 : Samples for the determination of the chemical composition*

ISO 1101, *Technical drawings - Geometrical tolerancing - Tolerancing of form, orientation, location and run-out - Generalities, definitions, symbols, indications on drawings*

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 9769²⁾, *Steel and iron; review of available methods of analysis*

ASTM E 399.90, *Standard test method for plane-strain fracture toughness of metallic materials*

1) Replaced by ISO 14284:1996 "Steel and iron. Sampling and preparation of samples for the determination of chemical composition"

2) See also CR 10261:1995

3 Product definition

3.1 Chemical composition

3.1.1 Values to be achieved

The maximum percentages of the various specified elements are given in Table 1.

Table 1 — Maximum percentages of the various specified elements

Steel grade	Maximum content in % ^a										
	C	Si	Mn	P ^b	S ^{bc}	Cr	Cu	Mo	Ni	V	Cr + Mo + Ni
ER6	0,48	0,40	0,75	0,020	0,015	0,30	0,30	0,08	0,30	0,06	0,50
ER7	0,52	0,40	0,80	0,020	0,015	0,30	0,30	0,08	0,30	0,06	0,50
ER8	0,56	0,40	0,80	0,020	0,015	0,30	0,30	0,08	0,30	0,06	0,50
ER9	0,60	0,40	0,80	0,020	0,015	0,30	0,30	0,08	0,30	0,06	0,50

^a For special applications, variations within the maximum limit of these values may be agreed.

^b A maximum phosphorus content of 0,025% may be agreed at the time of enquiry and the order.

^c 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 cracking.

3.1.2 Location of the sample

The sample for determining the chemical composition shall be taken 15 mm below the tread at its nominal diameter.

3.1.3 Chemical analysis

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

3.2 Mechanical characteristics

3.2.1 Tensile test characteristics

3.2.1.1 Values to be achieved

Rim and web characteristics are given in Table 2.

Table 2 — Rim and web characteristics of the wheels

Steel grade	Rim			Web	
	R_{eH} (N/mm ²) ^a	R_m (N/mm ²)	$A_5\%$	R_m reduction (N/mm ²) ^b	$A_5\%$
ER6	≥ 500	780/900	≥ 15	≥ 100	≥ 16
ER7	≥ 520	820/940	≥ 14	≥ 110	≥ 16
ER8	≥ 540	860/980	≥ 13	≥ 120	≥ 16
ER9	≥ 580	900/1050	≥ 12	≥ 130	≥ 14

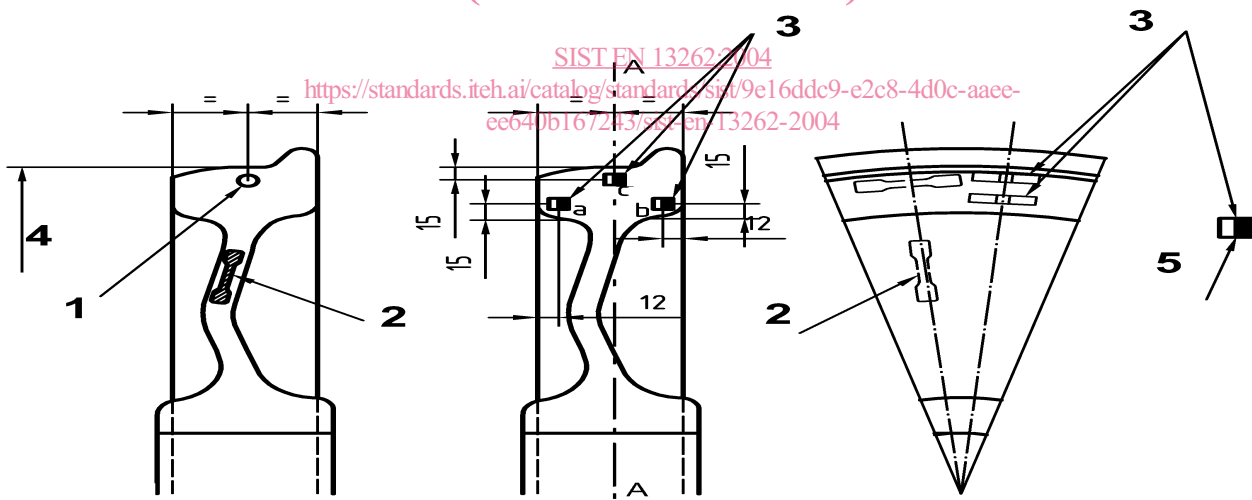
^a If no distinctive yield strength is present, the proof stress $R_{p0,2}$ shall be determined.

^b Reduction of tensile strength as compared to tensile strength of the rim on the same wheel

3.2.1.2 Location of test pieces

The test pieces shall be taken from the rim and the web of the wheel. Their positions are indicated in figure 1.

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Key

- 1 Tensile test piece
- 2 Tensile test piece
- 3 Impact test piece
- 4 Nominal diameter
- 5 Notch

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 parallel length and the gauge length shall be 5 times the diameter. If the test piece cannot be taken from the web, a smaller diameter shall be agreed between the customer and the supplier.

3.2.2 Hardness characteristics in the rim

3.2.2.1 Values to be achieved

The minimum Brinell hardness values applicable to the whole wear zone of the rim shall be equal to or greater than the values given in Table 3. These values are to be achieved up to a maximum depth of 35 mm under the tread, even if the wear depth is greater than 35 mm.

In the rim-web transition (point A in Figure 2), hardness values should be at least 10 points less than the wear limit values.

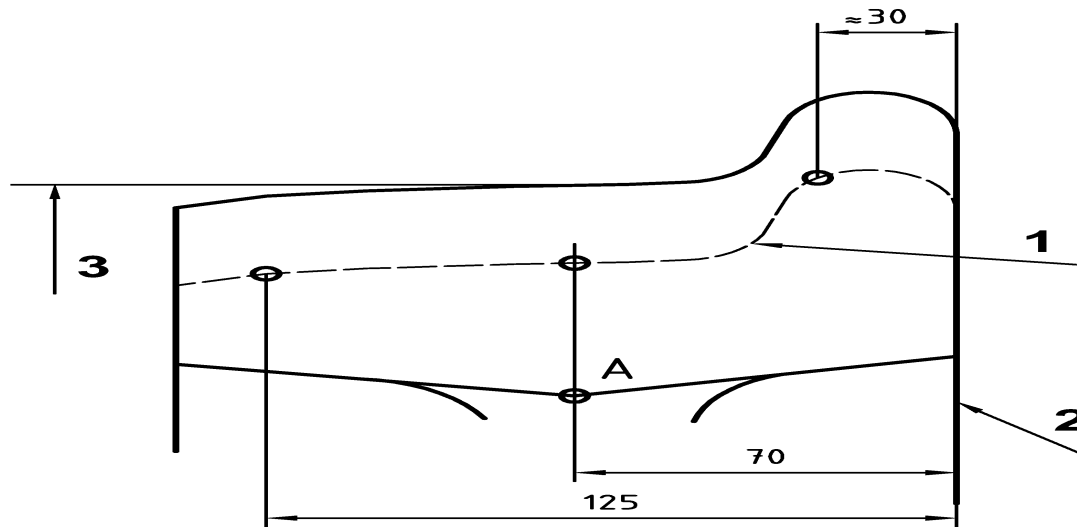
Table 3 — Values to be achieved for hardness characteristics in the rim

Steel grade	Minimum Brinell hardness value	
	Category 1	Category 2
ER6	-	225
ER7	245	235
ER8	245	245
ER9	SIST EN 13262:2004	255

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3.2.2.2 Location of readings

Four readings are carried out on a radial section of the rim as shown in Figure 2.



Key

- 1 Limit of wear or last turning diameter (according to customer's requirements)
- 2 Inside surface of finished wheel
- 3 Nominal diameter

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Figure 2 — Readings taken on a radial section of the rim
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3.2.2.3 Test method

The test shall be performed in accordance with EN ISO 6506-1. The ball diameter is 5 mm.

3.2.3 Impact test characteristics

3.2.3.1 Values to be achieved

They are shown in Table 4. For each temperature, they represent the average value and the minimum value for the three test pieces defined in 3.2.3.2. At +20°C, U-notch specimens shall be used. At -20°C, V-notch specimens shall be used.

Table 4 — Values to be achieved for impact test characteristics

Steel grade	KU (in joules) at + 20°C		KV (in joules) at - 20°C	
	Average values	Minimum values	Average values	Minimum values
ER6	≥17	≥12	≥12	≥ 8
ER7	≥17	≥12	≥10	≥7
ER8	≥17	≥12	≥10	≥ 5
ER9	≥13	≥ 9	≥ 8	≥ 5

3.2.3.2 Location of the test pieces

The positions of the three test pieces are indicated in Figure 1. The bottom notch axis shall be parallel to the A-A axis of Figure 1.

3.2.3.3 Test method

The test shall be performed in accordance with EN 10045-1

3.2.4 Fatigue characteristics

3.2.4.1 Values to be achieved

Independent of the steel grade, the web shall withstand the stress variation $\Delta\sigma$ given by Table 5 during 10^7 cycles without any crack initiation, with a probability of 99,7%.

Table 5 — Values to be achieved for fatigue characteristics

State of delivery of the web	$\Delta\sigma$ N/mm ²
Machined	450
As rolled	315

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NOTE The aim of these characteristics is to guarantee that product characteristics are higher than those used for the definition of permissible stresses for the fatigue design of the web.

As there are many approximations in a fatigue calculation, it is not realistic to distinguish between the four steel grades.

3.2.4.2 Test pieces for fatigue test

Test pieces shall consist of wheels as delivered. Their surface appearances are those defined in 3.6.

3.2.4.3 Test method

The test method shall allow bending stresses to be created in a web section.

The tests to demonstrate the fatigue properties shall be performed in such a manner that statistical evaluation to assess the results can be applied.

The tests are monitored by measuring the radial stresses that exist in the crack initiation area.

An example of the method is given in the informative annex B.

3.2.5 Toughness characteristic of the rim

3.2.5.1 General

This characteristic need only be verified on tread braked wheels (service brake or parking brake), for category 1 or category 2.