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EUROPEAN STANDARD

**EN 13262:2004+A2**

NORME EUROPÉENNE

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English Version

## Railway applications - Wheelsets and bogies - Wheels - Product requirements

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

Bahnanwendungen - Radsätze und Drehgestelle - Räder -  
Produktanforderungen

This European Standard was approved by CEN on 18 March 2003 and includes Amendment 1 approved by CEN on 23 September 2008 and Amendment 2 approved by CEN on 24 January 2011.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

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**EN 13262:2004+A2:2011 (E)****Foreword**

This document (EN 13262:2004+A1:2008) 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of an identical text or by endorsement, at the latest by 30 September 2011 and conflicting national standards shall be withdrawn at the latest by 30 September 2011.

This document includes Amendment 1 approved by CEN on 2008-09-23.

This document supersedes EN 13262:2004.

The start and finish of text introduced or altered by amendment is indicated in the text by tags  $\square_{A1}$   $\square_{A1}$ .

$\square_{A2}$  This document has been created under a mandate granted to CEN/CENELEC/ETSI by the European Commission and the European Free Trade Association and supports the essential requirements of Directive 2008/57/EC.  $\square_{A2}$

$\square_{A2}$  For the relationship with Directive 2008/57/EC, see informative Annex ZA, which is an integral part of this document.  $\square_{A2}$

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

<https://standards.iteh.ai/catalog/standards/sist/d6e92f58-4d86-4588-bc5f-6a805c7d807d/sist-en-13262-2004a2-2011>

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

**A1** Four steel grades, ER6, ER7, ER8 and ER9 are defined in this standard; for European freight wagon interoperability purposes only grades ER6, ER7 and ER8 are applicable.

NOTE 1 Grade ER6 is not normally fit for the duty of application to freight wagons; it is normally applied in low axleload situations. **A1**

**A1** Certain 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. Freight vehicles running at speeds lower than 200 km/h generally use wheels of Category 2. **A1**

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.

**A1** NOTE 2 **A1** The definition of other wheels may be found in other documents, such as UIC leaflets or ISO standards.

**A1** NOTE 3 **A1** The technical approval procedure is not within the scope of this standard.

**A1** NOTE 4 **A1** 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.

## EN 13262:2004+A2:2011 (E)

## 2 Normative references

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.

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, <sup>A1</sup> *Metallic materials - Brinell hardness test - Part 1: Test method (ISO 6506-1:2005)* <sup>A1</sup>

<sup>A1</sup> Deleted text <sup>A1</sup>

ISO 1101, <sup>A1</sup> *Geometrical Product Specifications (GPS) - Geometrical tolerancing - Tolerances of form, orientation, location and run-out* <sup>A1</sup>

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<sup>1)</sup>, *Steel and iron - Review of available methods of analysis*

ISO 14284:1996, <sup>A1</sup> *Steel and iron - Sampling and preparation of samples for the determination of chemical composition* <sup>A1</sup>

<sup>A1</sup> ASTM E399.90:1997 <sup>A1</sup>, *Standard test method for plane-strain fracture toughness of metallic materials*

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1) 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 % <sup>a</sup>										
	C	Si	Mn	P <sup>b</sup>	S <sup>bc</sup>	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

<sup>a</sup> For special applications, variations within the maximum limit of these values may be agreed.

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

<sup>c</sup> 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.

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##### 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

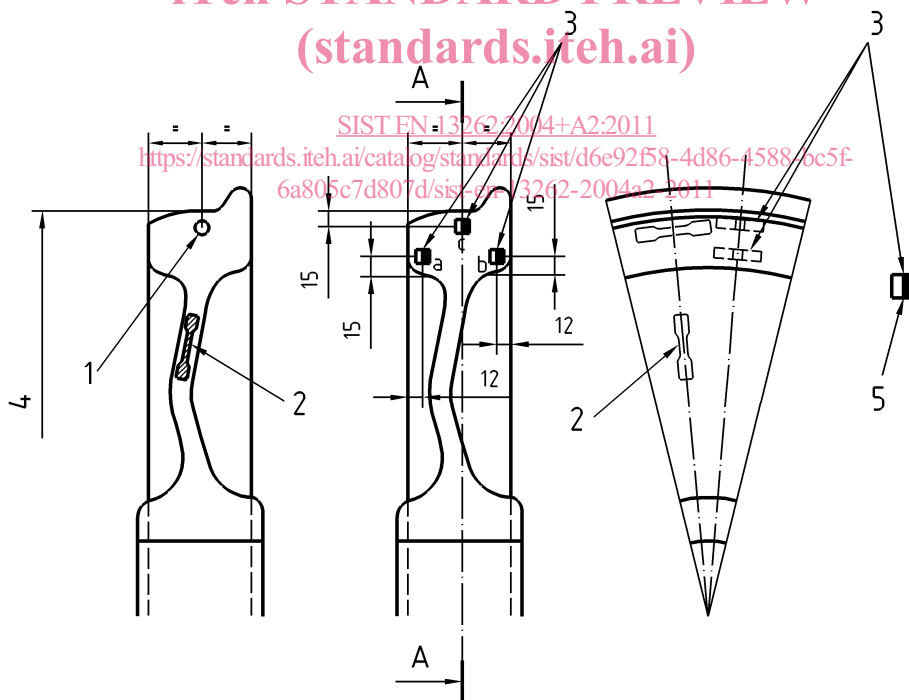
Steel grade	Rim			Web	
	$R_{eH}$ (N/mm <sup>2</sup> ) <sup>a</sup>	$R_m$ (N/mm <sup>2</sup> )	$A_5\%$	$R_m$ reduction (N/mm <sup>2</sup> ) <sup>b</sup>	$A_5\%$
ER6	≥ 500	780/900	≥ 15	≥ 100	≥ 16
ER7	≥ 520	820/940	≥ 14	≥ 110	≥ 16
ER8	≥ 540	860/980	≥ 13	≥ 120	≥ 16
ER9	≥ 580	900/1050	≥ 12	≥ 130	≥ 14

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

<sup>b</sup> 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.



### 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.

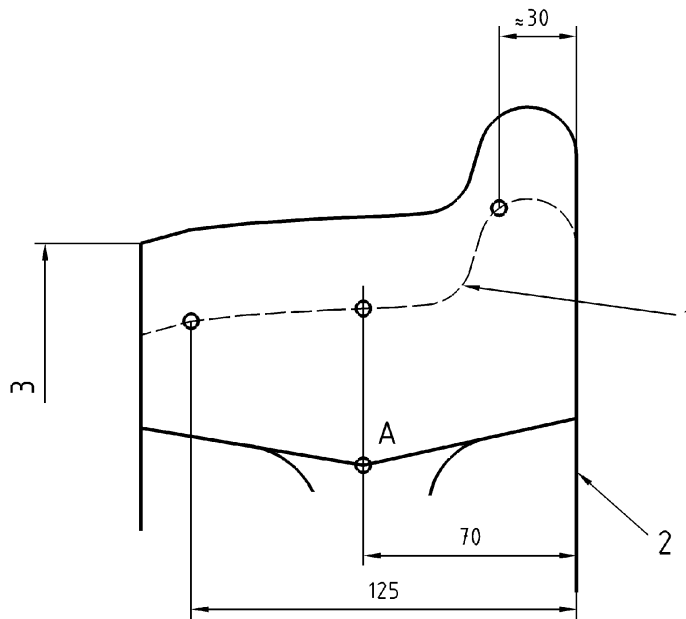
Table 3 — Values to be achieved for hardness characteristics in the rim

Steel grade	Minimum Brinell hardness value	
	Category 1	Category 2
ER6	225	225
ER7	235	235
ER8	245	245
ER9	255	255

#### 3.2.2.2 Location of readings

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

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**Key**

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

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

**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 <sup>2</sup>
Machined	450
As rolled	315

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.

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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.

**3.2.5.2 Values to be achieved**

For wheels of steel grade ER6, the average value obtained from six test pieces shall be greater than or equal to  $100 \text{ N/mm}^2 \sqrt{\text{m}}$ , and no single value shall be less than  $80 \text{ N/mm}^2 \sqrt{\text{m}}$ .

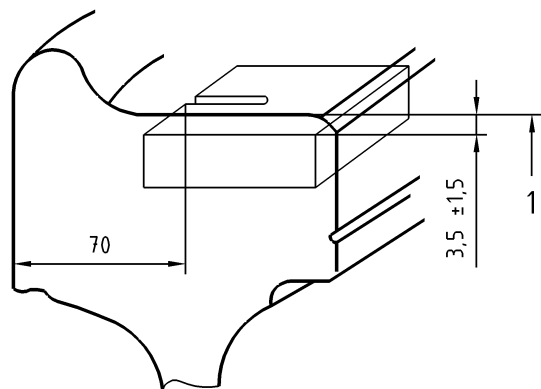
For wheels of steel grade ER7, the average value obtained from six test pieces shall be greater than or equal to  $80 \text{ N/mm}^2 \sqrt{\text{m}}$ , and no single value shall be less than  $70 \text{ N/mm}^2 \sqrt{\text{m}}$ .

For wheels of other steel grades, the values to be achieved are to be agreed between the customer and the supplier.

**3.2.5.3 Location of test pieces**

Six test pieces shall be taken from the rim as indicated in Figure 3.

The test pieces shall be evenly distributed around the rim.

**Key**

1 Nominal diameter

**Figure 3 — Test pieces taken from the rim**

**3.2.5.4 Test method**

The test shall be performed according to ASTM E399.90.

The particular conditions which shall be used are as follows:

- compact tensile test pieces: 30 mm thick (CT 30), with chevron notch with aperture angle of 90° (Figure 4 of [A1](#) ASTM E399.90:1997 [A1](#));
- temperature during the test to be between +15 °C and +25 °C;
- measurement of the crack displacement of the test piece (Figure 3 of [A1](#) ASTM E399.90:1997 [A1](#));
- rate of increase of stress intensity  $\Delta K/s$  should be within the range from 0,55 N/mm<sup>2</sup> √m/s to 1 N/mm<sup>2</sup> √m/s (8.3 of [A1](#) ASTM E399.90:1997 [A1](#)).

The value of the toughness to be considered is the value  $K_Q$  which is calculated from the value of the load  $F_Q$  from the load-displacement record.

### 3.3 Heat treatment homogeneity

#### 3.3.1 Values to be achieved

For category 1 wheels, the hardness values which are measured on the rim shall be no greater than 30 HB.

#### 3.3.2 Test pieces

The hardness measurement shall be undertaken at three points equally distributed on the outside surface of the rim. The impressions shall be made on the same diameter in the area located as defined in Figure 8.

#### 3.3.3 Test method

The test shall be performed according to EN ISO 6506-1. The ball diameter is 10 mm.

### 3.4 Material cleanliness

#### 3.4.1 Micrographic cleanliness

##### 3.4.1.1 Level to be achieved

It shall be measured by micrographic examination as defined in 3.4.1.2. The values to be achieved are given in Table 6.

Table 6 — Level to be achieved for micrographic examination

Type of inclusions	Category 1		Category 2	
	Thick series (maximum)	Thin series (maximum)	Thick series (maximum)	Thin series (maximum)
A (Sulfur)	1,5	1,5	1,5	2
B (Aluminate)	1	1,5	1,5	2
C (Silicate)	1	1,5	1,5	2
D (Globular oxide)	1	1,5	1,5	2
B + C + D	2	3	3	4